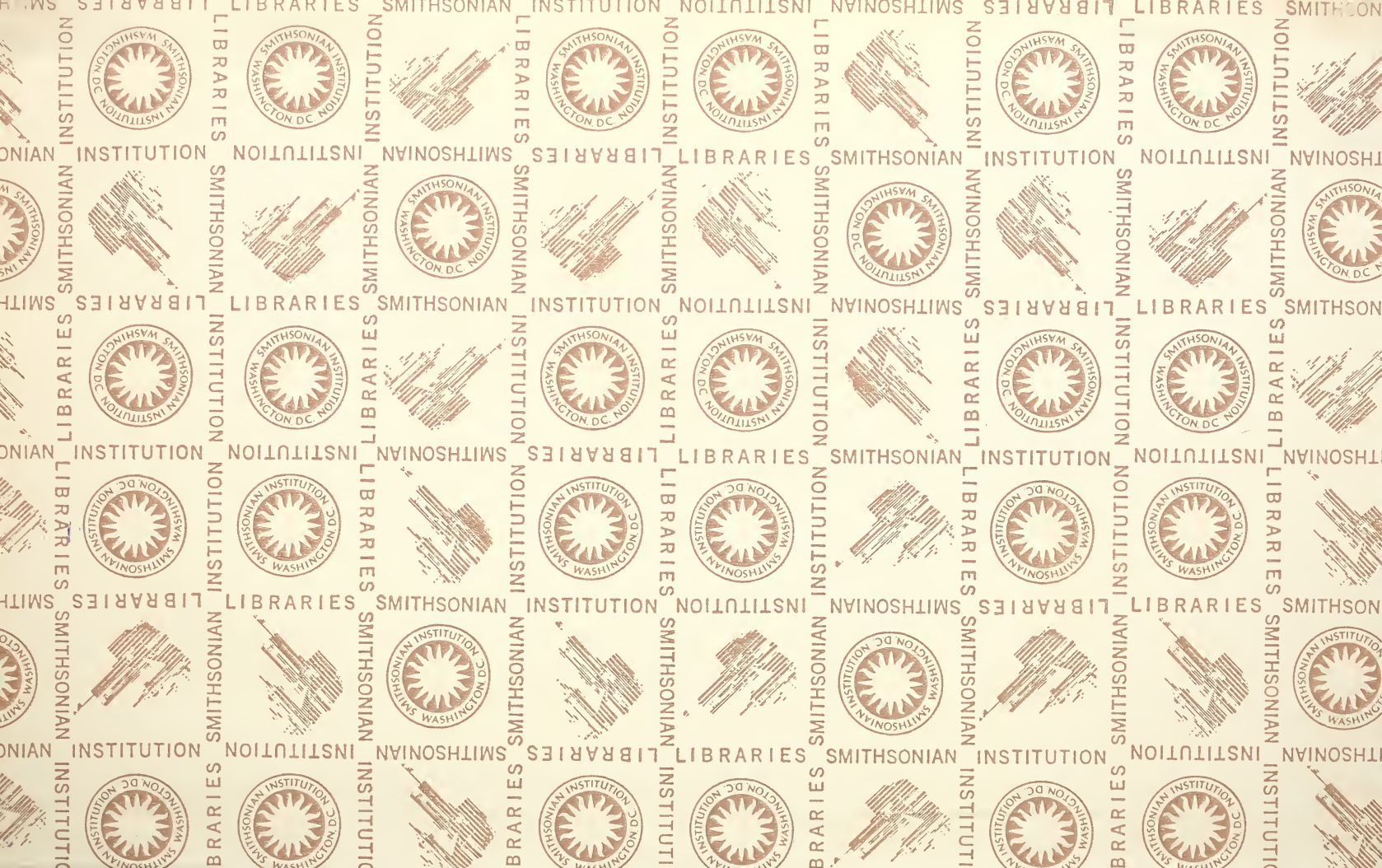

SMITHSONIAN INSTITUTION LIBRARIES

ENTOMOLOGICA AMERICANA

VOLUME 45

CONTENTS

JAMES A. SLATER, EDITOR

PUBLISHED BY THE
NEW YORK ENTOMOLOGICAL SOCIETY
INCORPORATING THE BROOKLYN ENTOMOLOGICAL SOCIETY

With the issuance of Parts 1 and 2 of Volume 45, publication of ENTOMOLOGICA AMERICANA is resumed after a hiatus of several years. Further parts of this volume will be issued early in 1970.

ENTOMOLOGICA AMERICANA was first issued by the Brooklyn Entomological Society in April 1885. Publication was suspended after six volumes but was resumed in 1926.

Volume number 44, the last previous volume was issued in 1964. The combined Societies' purpose in resuming publication is to afford authors an opportunity to get longer papers (72 pages or more) into print, which its quarterly JOURNAL cannot accommodate.

Publication will be by Volume and frequency of publication will depend upon availability and acceptance of worthwhile papers. Your inquiries are solicited and should be directed to the attention of the Publication Committee:

All correspondence concerning the Society or its publications, including subscriptions to ENTOMOLOGICA AMERICANA should be sent to the address shown below.

New York Entomological Society
The American Museum of Natural History
79th Street and Central Park West
New York, N.Y. 10024

Mailed December 29, 1969

Entomologica Americana is published for the Society by Allen Press, Inc., 1041 New Hampshire, Lawrence, Kansas 66044.

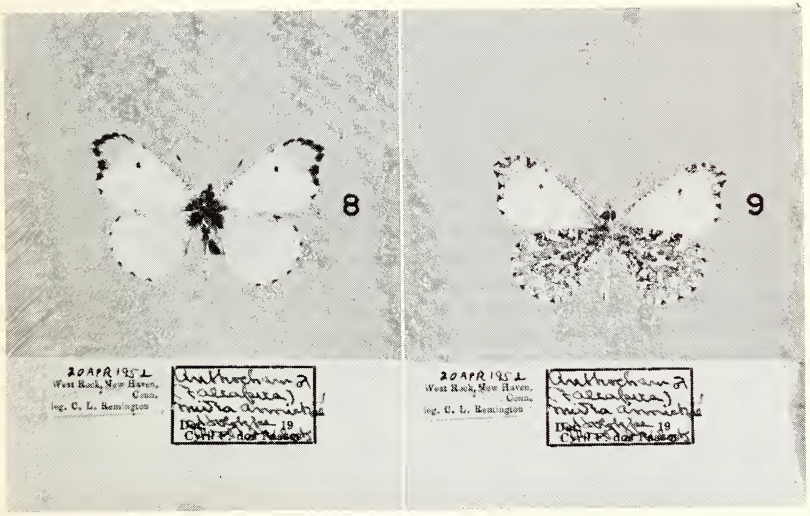
THE SYSTEMATICS OF *ANTHOCHARIS MIDEA* HÜBNER (LEPIDOPTERA: PIERIDAE)

By

Cyril F. dos Passos

and

Alexander B. Klots



Entomologica Americana
Vol. 45, 1969, pp. 1–34

THE SYSTEMATICS OF *ANTHOCHARIS MIDEA* HÜBNER (LEPIDOPTERA: PIERIDAE)

By

Cyril F. dos Passos[1]

and

Alexander B. Klots[2]

Table of Contents

Abstract: The geographic variation and systematics of *Anthocharis midea* (Hübner) of eastern North America are described. The species is placed in the subgenus *A.* (*Falcapica*) Klots, 1930. Neotypes are designated for *Maucipium vorax midea* Hübner, *Pieris lherminieri* Godart and the homonomous *Papilio danaus genutia* Fabricius. The nominate subspecies *A. m. midea* occurs in the southern Coastal Plain. The northeastern subspecies is named as *A. m. annickae* dos Passos and Klots, type locality New Haven, Connecticut. Complete bibliographies are given for the species and subspecies. Some notes on the life history and parasites are included.

Accepted for publication November 19, 1968.

[1] Research Associate, Department of Entomology, The American Museum of Natural History, and Research Associate, Section of Insects and Spiders, the Carnegie Museum.

[2] Professor of Biology, Retired, the City College of New York, and Research Associate, Department of Entomology, The American Museum of Natural History.

INTRODUCTION

For many years the authors have recognized the need for a detailed study of the North American falcate orange-tip butterfly, *Anthocharis midea* Hübner ("1806" [1809]), to clarify its geographic variation and nomenclature and have been accumulating data and specimens for this purpose. They have been materially aided by many persons in Europe and North America and are especially indebted to Lucien Harris, Jr., Bryant Mather, and Richard Heitzman for the loan of important series of specimens from Georgia, Mississippi, and Missouri.

NOMENCLATURE

Generic. This species should be considered (Klots, 1930, pp. 82–83; 1931, p. 254; and "1931" [1933], p. 151) a member of the genus *Anthocharis* Boisduval, Rambur and Graslin [1833], the type-species of which is *Papilio cardamines* Linnaeus (1761, p. 271). Following Hemming (1967, p. 46), we employ the spelling *Anthocharis* instead of *Anthocaris* in this paper because it is the original spelling of the authors Boisduval, Rambur and Graslin [1833], and no reason is apparent for its emendation. Earlier Hemming (1934, p. 132) had used the spelling *Anthocaris* and referred the name to the same authors. This was a *lapsus calami.*

In a subgeneric sense we employ also *Falcapica* Klots, 1930, the type-species of which is *Papilio genutia* Fabricius (*nec* Cramer "1782" [1780], 1793). *Midea* Herrich-Schäffer, 1867, of which *P. genutia* is also the type, is a preoccupied name having been proposed by Bruzelius in 1854 and by Walker in 1863, so that in effect *Falcapica* is a substitute name for *Midea* Herrich-Schäffer although not expressly so stated in the original description.

We are not unmindful of the fact that Kuznezov (1929, p. 58 footnote) proposed the subgeneric name *Paramidea* for a falcate orange-tip butterfly with the type-species *Midea scolymus* Butler, 1866. This is a Palearctic butterfly occurring in West China and Japan. While both *midea* and *scolymus* have falcate forewings, their facies are very distinct so that subjectively we refer each to separate subgenera. It should be noted in passing that Bernardi (1961, p. 111) misspelled "Paramidae" and gave an incorrect page reference "52." It should have been 58. The genitalia are of little use in separating species of *Anthocharis* (*Falcapica*) as will be seen in referring to figures of *genutia* and *scolymus* (Klots, 1930, p. 94, figs. 4 and 5).

Specific. Four species-group names are available for the species:

1. *Papilio danaus genutia* Fabricius (1793, p. 193)
2. *Mancipium vorax midea* Hübner ("1806" [1809], pl. 142)

3. *Pieris lherminieri* Godart (1819, p. 118)
4. *Anthocharis flavida* Skinner (1917, p. 438)

1. *Papilio danaus genutia* Fabricius, although the oldest available name, is a homonym of *Papilio genutia* Cramer ("1782" [1780]) and therefore unavailable. No type of Fabricius' exists at the British Museum (Natural History), London; the Zoologisk Museum, Copenhagen (Zimsen, 1964, p. 560, no. 967); the Zoological Museum of the University, Kiel; or anywhere else insofar as we have been able to ascertain.

In the original description of *genutia*, Fabricius stated that the habitat was "in Indiis" and that the specimen was in the collection of Drury. He also referred to (the unpublished) Jones's Icones (figured picture 3, pl. 26, fig. 2). We have examined the Icones at the Hope Museum, Oxford, and have a photograph of this figure kindly furnished by Miss Audrey Smith which we reproduce here (Fig. 1). Considering the standards of its time, it is a good and recognizable representation of the North American falcate orange tip, although it does not show the black discocellular spot on the upper side of the forewing and has the apical orange patch running down too far along the outer margin. It shows a very extensive orange patch which extends basad to at least the end of the discal cell where the black discocellular spot would be. We are indebted to Prof. G. C. Varley of the Hope Museum for permission to reproduce this photograph which has not been published heretofore.

The oldest published figure of *genutia* is in Donovan's Insects of India (1802, [pl. 27], fig. ⁂).[3] This does not agree very well with the North American insect but resembles even less the Chinese and Japanese *A. scolymus* Butler and not at all anything from India. Since Donovan gives a reference to Fabricius' original description,

---

[3] The pages and plates in this work are not numbered. The title page is followed by two pages entitled "Advertisement" and 16 signatures, some of which are numbered and others lettered, some of the numbers being duplicated. Each signature appears to have been accompanied by one or more colored plates. There is little or no consistency to these numbers and letters.

The copy of this work in the Library of the British Museum (Natural History) contains 57 plates. The one in the Library of The American Museum of Natural History contains 58 plates. That this work should contain 58 plates is evidenced by the index, which lists that many plates. Each plate bears a date between 1 Jan. 1800 and 1 Feb. 1804, but they are not numbered in the index in accordance with their dates of issue, a systematic method of numbering having been adopted. The signatures are not dated, but most likely appeared with the plates. Whether they did or not, the plates bear the scientific names and the dates of their publication. An edition by Westwood (1842) contains 58 plates.

(All figures are approximately natural size)

FIG. 1. Photograph of the figures of upper- and undersides of *Papilio danaus genutia* Fabricius in Jones's Icones.

it is possible that his figure is a poor representation of Drury's specimen or of the Icones figure.

2. *Mancipium vorax midea* Hübner ("1806" [1809]) is the next oldest available name. Hemming (1937, p. 429) states that the specimen figured by Hübner came from either "Georgien" German text or "Brasilia" Latin text. Since Brazil is an impossible locality for the species, we may safely assume that the specimen came from Georgia. No trace of any Hübnerian specimen that might be his type was found in any of the European museums; it is safe to assume that none exists.

3. *Pieris lherminieri* Godart (1819) is the next oldest available name. The locality given in the original description is "Charles-Town." We feel safe in assuming that this meant Charleston, South Carolina, where the species is known to occur. Charlestown, Massachusetts, has been suggested as an alternative, but we regard this as highly improbable. Scudder (1889, p. 1150) mentions Boisduval's reporting the butterfly to be found about Boston, but believes that this was erroneous. The closest records to Boston, then as now, are

from New Haven, Connecticut in the coastal plain, and Holyoke, Massachusetts in the Connecticut River Valley, far inland from Boston and Charlestown. No possible Godart specimen of *lherminieri* was found by us in the Museum d'Histoire Naturelle, Paris, where many of Godart's types are preserved; and we have been assured by Dr. Pierre E. L. Viette of that institution that it is not there. Neither is any Godart specimen in the Edinburgh Museum of Science and Art, Edinburgh, where some of Godart's North American types are preserved or elsewhere so far as we have been able to ascertain. It is safe to assume that the type no longer exists.

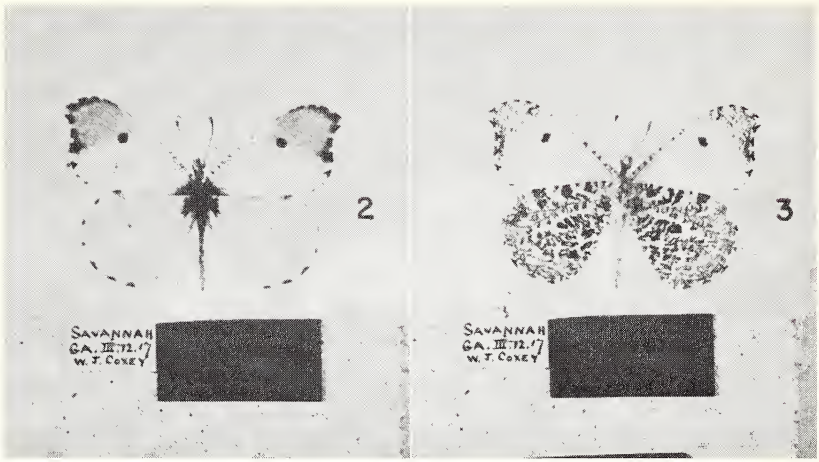
4. *Anthocharis flavida* Skinner (1917) was described from a single male from Savannah, Georgia (March 12, 1917, collected by W. T. Coxey). We figure this type (Figs. 2 & 3) which is in the Academy of Natural Sciences, Philadelphia. Although named as a variety, it is actually a normal specimen of the population about Savannah.

Neotypes and Type Localities

As we show below, there is considerable geographic variation in the populations of the species. In the study and nomenclature of this, however, the lack of types and exact type localities for the nominal species *Papilio genutia* Fabricius, *Mancipium midea* Hübner, and *Pieris lherminieri* Godart is a grave handicap preventing the exact application of specific-subspecific names. We therefore, under Article 75 of the International Code of Zoological Nomenclature, herewith designate neotypes for these nominal species. In doing so we have chosen specimens consistent with the original information and data, and coming as nearly as practicable from the original type localities as discussed above. We do this after consultation with other specialists in North American butterflies, from none of whom was any objection received.

1. *Papilio danaus genutia* Fabricius (1793). The locality ("in Indiis") given in the original description is obviously wrong. Fabricius' specimen may well have come from the coastal plain region of Georgia, whence John Abbot had been sending material to Europe for many years. The specimen figured in Jones's Icones (*loc. cit.*) referred to by Fabricius most closely resembles those from the coastal plain of Georgia. We therefore designate as the **neotype** of this nominal species a male specimen from Wilmington I., near Savannah, Georgia, April 2–11, 1947, which is the property of The American Museum of Natural History (Figs. 4 & 5).

2. *Mancipium vorax midea* Hübner ("1806" [1809]). As noted above, "Georgien" and not "Brasilia" is almost certainly the true



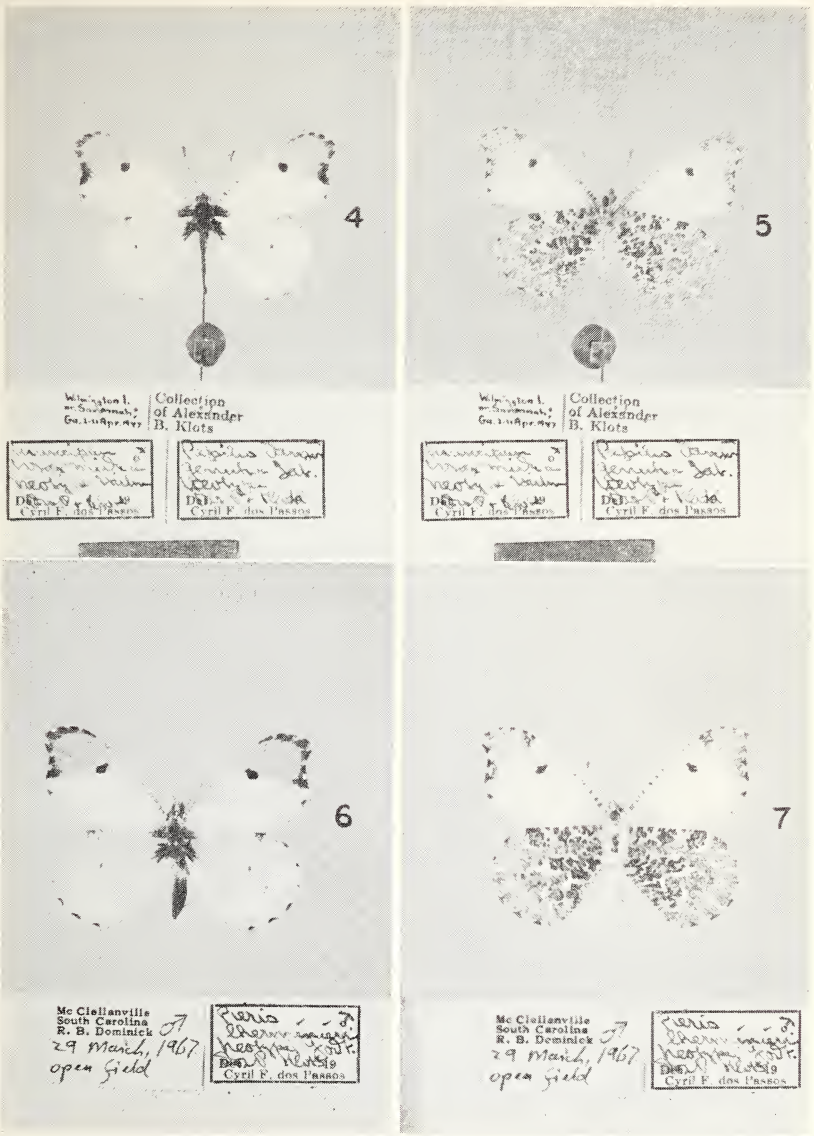
FIGS. 2–3. *Anthocharis flavida* Skinner ♂ type, upper- and undersides, Savannah, Ga., 12 March 1917, W. T. Coxey.

type locality. We therefore designate as the **neotype** of this nominal species the same male specimen designated as the neotype of *Papilio danaus genutia* Fabricius, from Wilmington I., near Savannah, Georgia, April 2–11, 1947, which is the property of The American Museum of Natural History (Figs. 4 & 5).

3. *Pieris lherminieri* Godart (1819). For the reasons stated above we designate as the **neotype** of this nominal species a male specimen from McClellanville (Charleston Co.), South Carolina, 29 March 1967, leg. R. B. Domenick which is the property of The American Museum of Natural History (Figs. 6 & 7). We are indebted to Dr. R. B. Domenick of McClellanville, South Carolina, for this specimen.

4. *Anthocaris genutia flavida* Skinner (1917) although named as a variety is based on a normal specimen characteristic of the Savannah, Georgia population. It must therefore be treated as a species-group name in accordance with Article 10b of the International Code of Zoological Nomenclature. We believe that it was first given this status by Clark and Clark (1951, p. 86) (Figs. 2 & 3).

In accordance with the above, the restricted type localities of both *Papilio danaus genutia* Fabricius and *Mancipium vorax midea* Hübner are Wilmington I., near Savannah, Georgia; and that of *Pieris lherminieri* Godart is Charleston, South Carolina. All three of these names, and *Anthocharis flavida* Skinner also, then apply to the population of the Southern Coastal Plain that is characterized, as discussed



FIGS. 4–5. *Papilio danaus genutia* Fabricius ♂ neotype, upper- and undersides, Wilmington I. near Savannah, Ga., 2–11 April 1947. This specimen is also the neotype of *Mancipium vorax midea* Hübner.

FIGS. 6–7. *Pieris lherminieri* Godart ♂ neotype, upper- and undersides, McClellanville, South Carolina, 29 March 1967, leg. R. B. Domenick.

below, by the great extent basad of the apical orange patch of the forewing of the male. Since *midea* is in effect a substitute name for the homonymous *Papilio genutia*, it should be used for this population, with both *lherminieri* and *flavida* as subjective junior synonyms.

GEOGRAPHIC VARIATION

The chief, if not the only reliable, character in which *A. midea* shows significant geographic variation is the extent of the apical orange patch on the upper side of the forewings of the male. At one extreme this extends basad to enclose the black discal spot. At the opposite extreme it may be separated from the spot by an area of white that is nearly its own width. In an attempt to quantify with some degree of accuracy the extent of this patch, seven arbitrary groups were decided upon and series of specimens from many localities were classified in such groups. Admittedly this was subject to considerable subjective error. The inner margin of the patch is never either even or clear-cut, but considerably diffused (sometimes with varying hues of dilute orange or orange and yellow scales) especially along the veins costad of the cell. The spot varies individually in diameter a great deal independent of the extent of the orange. Counting white and orange scale rows between the end of the cell and the outer margin was tried but abandoned because of the diffuseness of the orange edge and the inaccuracy caused by even the slightest rubbing away of scales. Group counts are recorded in general only when a significant number of specimens was available from a locality, small series of specimens being eliminated because of the possibilities of bias due to edaphic and seasonal variation. Although not included in the group counts, odd specimens have been commented upon when they seemed significant. Unfortunately, little or no material from several important regions was available for study.

Group A—Orange extends basad of discal spot.

Group B—Orange extends basad to touch discal spot.

Group C—Inner border of orange separated from the discal spot by less than the diameter of the spot.

Group D—Inner border of orange separated from the discal spot by 1–1½ × the diameter of the spot.

Group E—Inner border of orange separated from the discal spot by 1½–2½ × the diameter of the spot.

Group F—Inner border of orange separated from the discal spot by 2½–3½ × the diameter of the spot.

Group G—Inner border of orange separated from the discal spot by 3½–4½ × the diameter of the spot.

The following table shows the result of our examination of 320 specimens of *midea* from 12 states and gives the geographic variation of the size of the orange spot on the male forewings:

Table I

Pattern Groups	A	B	C	D	E	F	G	Totals	
Georgia									50
Savannah & vicinity	8	3	2					13	
Savannah, Ft. Pulaski	5	1						6	
Jekyll Island	2	1						3	
St. Simons Island	1							1	
Atlanta & vicinity	2	3	1	2	1			9	
Kennesaw Mt. (Cobb Co.)		3	2	5				10	
Marietta (Cobb Co.)		3	1		1			5	
Chatsworth (Whitefield Co.)		1	1					2	
Trenton (Dade Co.)		1						1	
South Carolina									13
Beaufort (Beaufort Co.)	3		1					4	
McClellanville (Charleston Co.)	8	1						9	
Mississippi									50
Clinton (Hinds Co.)	10	17	11	8	4			50	
Texas			2	2	5	38	2	49	49
Tennessee	1	5	1	1				8	8
Arkansas	4	6	2	2	1			15	15
Missouri									39
Warsaw (Benton Co.)	9	6	3	1	11			30	
St. Louis & vicinity	2	1	3		3			9	
West Virginia					2	3	1	6	6
Virginia				2	11	1		14	14
New Jersey									42
Paterson, Essex Co., etc.		1		2	5	17	1	26	
Other (coastal plain)					3	10	3	16	
New York									19
Ramapo Mts. & vicinity			1	3	8	6	1	19	
Connecticut									15
West Rock, New Haven				1	10	4		15	
All Localities									320

Distribution

As will be seen from our table, the coastal population of southern South Carolina and Georgia is strongly characterized by the great extent of the orange patch (groups A, B, and C), totaling A—27 = 75%, B—6 = 17%, C—3 = 8%, D–G—0, Totals—36. It may be

noted that in this region the males often show tinges, sometimes strong, of yellow about the apex of the hindwing and that females sometimes show a tinge of yellow about the apex of the forewing. This is the population to which the names *A. genutia* (Fabricius), *midea* (Hübner), *lherminieri* (Godart), and *flavida* Skinner must be applied.

The population of inland Georgia above the fall line is also characterized by an extensive orange patch, but this is less extensive and less consistent in this population than in the coastal one as shown by the totals: A—2 = 7%, B—10 = 37%, C—5 = 19%, D—8 = 30%, E—2 = 7%, F–G—0, Totals—27. Only 2/27 specimens have the extremely large patch, while 10/27 have the relatively reduced patch of groups D and E.

A. midea apparently does not occur in Florida, even in the Gulf Coast panhandle, and we have no specimens from Alabama. In Mississippi, however, it is locally common. The population shows a very high incidence of an extensive orange patch (A + B + C—38/50 = 76%) but also contains many individuals with a somewhat reduced patch (D + E—12/50 = 24%).

No material is available from Louisiana.

The material from Texas shows a very different picture. The 49 specimens examined come from a wide range (Dallas, Harris, Harrison, Brazos, Bexar, Kerr, Comal, San Patricio, and Smith counties). Among them there are no specimens with a very extensive patch (groups A & B), and by far the largest group (38/49 = 77%) has the patch greatly reduced. This is all the more surprising because of the dominance of large-patch populations in most of the southern and western range of the species. It would be difficult, in fact, to find any consistent points of difference between the series from Texas and those from the most distant northeastern part of the species' range in New Jersey, New York, and Connecticut.

The populations of Tennessee, Arkansas, and Missouri on the other hand contain a very large proportion of large-patch individuals. In the adequate Missouri series these comprise 62% (A + B + C), while 38% have a somewhat reduced patch (D + E). The latter figure is especially important indicating that the gene pool of this population must be far more mixed than that of those from the southeastern coastal plain.

The concentration of large-patch individuals in coastal South Carolina, Georgia, and Mississippi and also in the northwestern part of the range of the species, presents a special problem. It may very well be, as one of us has postulated (Klots, 1965, p. 462–463) that the southeastern coastal plain large-patch characteristic arose in peninsular Florida during the Pleistocene when, due to changes in

ocean level, this area was an island separated from the mainland; and that the character later spread both northeastward and northwestward, chiefly along the coast, but not into Texas, while the refugium population died out in Florida. The large-patch character of the northwestern population could then be a part of this or could have arisen independently. The small-patch Texas population would then be the descendants of a Pleistocene population in a different refugium, perhaps in Texas itself and Mexico. We are unable to surmise how or where the northwestern (i.e., Missouri) large-patch character arose.

Northward from Georgia and South Carolina in the Coastal Plain and Piedmont the populations show a sharp diminution of the amount of orange. Unfortunately, adequate material from northern South Carolina and North Carolina is lacking. In Virginia, Clark and Clark (1951, p. 86) comment on seasonal changes and state that the latest individuals "agree essentially with the subspecies *flavida* from the coast of Georgia; but we have seen no specimens from Virginia in which the orange patch is extended inward as in *flavida*." Our small Virginia series agrees with this. We have, however, seen one specimen from the District of Columbia with the orange patch extended inward to enclose the discal spot (group A).

Unfortunately, adequate material from Maryland and Delaware has not been available to us. The few specimens we have seen, however, indicate that the populations of these states have decidedly small patches. This is definitely true of New Jersey, New York, and Connecticut populations, of which 74/76 = 97% of the specimens studied fall in Groups D–G. The New Jersey series represent both Coastal Plain and Piedmont (hilly country above the fall line) areas; in New York and Connecticut these distinctions largely break down. These populations, occupying the extreme northeastern parts of the range of the species, are clearly extreme in the reduction of the orange patch.

Conclusion

What to do with this situation nomenclatorially is a moot question. There is obviously something of a north–south cline east of the Appalachians from Connecticut to Georgia, albeit probably a strongly stepped cline with perhaps a major break south of Virginia. Nothing is known about the possibilities of gene exchange between the isolated colonies in which the species occurs, and therefore of rates of gene flow and gene exchange between areas nearly a thousand miles apart. Nor is anything known about the genetics of the character involved. Phenetically the species shows a clinal condition, but we do not know that anything of the sort exists genetically. Needless to say, we can

only guess at the possible evolutionary relationships of the very similar Texas and Connecticut populations located at opposite extremes of the range of the species, or at those of the similarly widely separated large-patch populations of coastal Georgia and Missouri. We believe that at least the major population differences that exist should be indicated nomenclatorially, since this is the chief function of biological nomenclature. We have accordingly chosen to designate the Connecticut population at the northeastern extremity of the range of the species as a subspecies.

The matter of referring populations to one subspecies or another is subjective and can only be done on the basis of material available at the moment. Such decisions are always subject to review as new populations and more specimens come under study. The population of *midea* along the Georgian coast and on the off-shore islands is usually of the form having more extensive orange areas on the forewings that touch the black spot in the cell. Conversely, populations in the north have a more restricted orange patch. The latter are referred to our new subspecies. Strangely isolated colonies of one form or the other sometimes occur in alien territory. One interesting example of this is presented by a series from Warsaw, Barton County, Missouri, kindly loaned to us by Mr. Richard Heitzman. Of this rather large series of 54 males, exactly one half of the specimens, if labeled "Georgia," would pass for the southern subspecies; while the other half, if labeled "New York," would pass for the northern subspecies.

We now present under three headings the complete synonymies of *Anthocharis midea*, *A. midea midea*, and our new subspecies. Of course, it has not been possible to assign all references with certainty to their respective headings. To do so correctly one would have to see the actual specimen referred to by the respective authors. In many cases that is no longer possible. However, with a reasonably good knowledge of the eastern Atlantic states and those bordering them, it is possible to assign most names correctly.

SYNONYMIES

Anthocharis (Falcapica) *midea* (Hübner)

(Figures 4 and 5 neotype)

The citations listed under this heading consist of check lists and general catalogues, not of a revisional nature, together with miscellaneous references where no precise locality for the occurrence of the insect is given, or where the locality given is apparently false. Local catalogues and lists are placed under the respective subspecies

to which they are deemed to refer. Preparatory stages of the insect are also given under this heading.

E[*uchloë*] *Midea* Hübn., "1816" [1819], p. 94, no. 997.

Anth[*ocharis*] *Genutia* Boisd., (= ♀ *Pi*[*eris*] *Lherminieri* Godt. = *Mancipium Vorax Midea* Hübn. = *Euchloë Mi*[*dea*] Hübn.) Doubleday, "1846–50" (1847), vol. 1, p. 57, no. 12 (United States).

Anthocaris Boisd. Dup. *genutia* Fab., (= Fem. *Lherminieri* Godt.) Morris, 1860, p. 4. (N. Am.).

A[*nthocharis*] Boisd. *genutia* Fab., (= *Lherminieri* (fem.) Godt. = *A. Midea*? Hübn.) Morris, 1862, p. 20, no. 1 (southern states).

[*Anthocharis*] (*Anthocaris!*) *genutia*, = (*lHerminieri*) Weidemeyer, 1863, vol. 2, pp. 151, 154 (United States).

Midea genutia, F., (= *l'herminieri*) Herrich-Schäffer, 1867, vol. 21, p. 143 (Nordamerika).

M[*idea*] *Genutia*, Fabr., (= *Mancipium vorax Midea*, Hübn. = *Pieris L'herminieri et Genutia*, Godt.) Kirby, 1871, pp. 508, 509, no. 1 (Unio Amer.).

E[*uchloë*] Hübn. *Genutia* Fabr., (= *Pieris Lherminieri* God. = *Mancipium vor. Midea* Hübn.), Scudder (*partim*), 1872, p. 43, no. 1 (southern New England to Georgia and Texas).

[*Anthocharis*] *Genutia*, Scudder, 1875, vol. 10, p. 113.

Midea Genutia, Scudder, 1875, vol. 10, p. 218.

[*Anthocharis*, Bd.] *Genutia*, Bd., Edwards (*partim*), 1877, vol. 6, p. 15, no. 49 (New York to Virginia; western states, Texas).

[*Anthocharis* Bdv.] *Genutia* Fb., Möschler, 1878, vol. 39, p. 299.

[*Anthocharis*, Bdl.] *Genutia*, Fabr., (= *Mancipium vorax Midea*, Hüb. = *Pieris L'herminieri*, Godt.) Strecker (*partim*), 1878, p. 77, no. 38. (U. S. east of Texas, [?except New England States]).

[*Anthocharis*, Bd.] *Genutia*, F., anonymous [Publication Committee] "1882" [1881], vol. 4, p. 1, no. 45.

[*Anthocharis*, Bd.] *Genutia*, Fab., Edwards, 1884, p. 348, no. 53.

[*Anthocharis* Bdv.] *genutia* Fabr., Smith *et al.*, 1891, p. 14, no. 393.

Anthocharis genutia, Dyar, 1894, p. 100.

A[*nthocharis*] *genutia*, Beutenmüller, 1897, vol. 5, p. 208.

E[*uchloë*] *genutia*, Butler, 1899, vol. 32, p. 2.

M[*idea*] *genutia*, Butler, 1899, vol. 32, p. 3.

Midea genutia, Grote, 1900, vol. 39, p. 41.

[*Synchloë* Hübner] *genutia* Fabricius, (= *midea* Hübner) Dyar (*partim*), "1902" [1903], no. 52, p. 7, no. 48 (southern Atlantic states).

[*Anthocharis* Bdv.] *genutia* Fabr., Smith *et al.*, 1903, p. 9, no. 421.

[*Anthocharis*] *Genutia* Fab., Skinner, [1905], no. 1, p. 22.

Anthocharis Genutia, Fabricius, Wright, 1905, p. 50, no. 61, p. 107,

pl. 7, figs. 61 male, b female (eastern states).

M[*idea*] H.-Schäffer *genutia* F., (= *midea* Hbn., *l'herminieri* Godt.) Röber, (1910), vol. 5, p. 96, fig. 28b (United States).

[*Anthocharis* Bdv.] *genutia* Fabr., (= *Midea* Hbn.) Barnes and McDunnough, 1917, p. 3, no. 43.

Euchloë genutia, Lutz, 1918, p. 137, pl. 34 ♂.

Euchloë genutia, Lutz [1921], pp. 137, 490, pl. 34 ♂.

[*Anthocharis* Bdv.] *midea* (Hbn.) (= *genutia* [Fabr.,] [*nec* Cram.], = *lherminieri* [Godt.]) Barnes & Benjamin, 1926, vol. 25, p. 7, no. 44.

[*Anthocharis* Bdv.] *midea* (Hbn.) *flavida* Skin., Barnes & Benjamin, 1926, vol. 25, p. 7, no. 44a.

[*Anthocharis* Boisduval, Subgenus *Falcapica*] *genutia* Fabricius, Klots, 1930, vol. 25, pp. 83, 93, pl. 6, fig. 4 ♂ (genitalia).

Anthocharis genutia, Rummel, *fide* Siepmann, 1931, vol. 26, p. 268.

[*Euchloë*] Hübner *midea* Hb., Hemming, 1934, vol. 1, p. 131, no. 358.

[*Anthocaris* Boisduval, Rambur and Graslin] *genutia* Fab., Hemming, 1934, vol. 1, p. 132, no. 359.

Synchloë genutia, Fazzini, 1934, p. 48. (In the East).

Euchloë (or *Anthocharis*) *genutia*, Lutz, 1935, p. 136, pl. 26 ♂.

Euchloë genutia, Engelhardt, *fide* Siepmann, 1937, vol. 32, p. 87.

Mancipium vorax Midea Hübner = *Euchloë Midea* Hübner *MS*, Hemming, 1937, vol. 1, p. 429 (*Brasilia* [Latin text]).

Euchloë Midea Hübner *MS* = *Genutia* Fabr., Hemming, 1937, vol. 2, p. 115 (Latin text, *in Brasilia*).

E[*uchloë*] *genutia* (Fabricius), Davenport & Dethier, "1937" [1938], vol. 17, p. 179.

[*Anthocharis* Bdv.] *midea* Hbn., (= *genutia* Fabr.), McDunnough, 1938, vol. 1, p. 7, no. 30.

[*Anthocharis* Bdv.] *midea* Hbn. *lherminieri* (= *flavida* Skin.,) Godt., McDunnough, 1938, p. 7, no. 30a.

Anthocharis Boisduval *midea* (Hübner) (= *genutia* [Fabricius] *nec* [Cramer]), Field, 1938, vol. 39, no. 10, p. 279, no. 74.

Papilio genutia, Zimsen, 1964, p. 560, no. 967.

Scudder (1889, p. 1147) lists two unpublished works in his synonymy of *Anthocharis genutia*. The first is Abbot's drawings of the insect of Georgia in the British Museum (Natural History), volume 20 which figures *genutia* (figs. 79–81). These drawings were prepared about 1800. That work is certainly unpublished, but the second work to which Scudder refers is more doubtful. This is Townend Glover's 1878 Illustrations of North America Lepidoptera, pl. 27, figs. 2, 3. This work was copyrighted by Glover and is to be found in some libraries including that of The American Museum of Natural History. Since whether it is published or not is immaterial to the questions discussed in this paper, we do not feel obliged to take any position on that interesting problem.

Anthocharis (Falcapica) midea midea (Hübner)
(Figures 4 and 5)

The citations listed under this heading consist of references to *A. midea midea* wholly or in part, the latter being included also under the following heading. Some of these citations cannot be pinpointed with certainty because, Georgia and South Carolina being states in which both populations occur, a reference to those states alone may indicate either or both subspecies.

P[*apilio*] *D*[*anaus*] *Genutia* Fabricius (*partim*), 1793, vol. 3, p. 193, [no.] 601 ("India").

Papilio Genutia, Donovan (*partim*), "1800" [1802], sig. F. p. [2], pl. [27], fig. ⁂ (India).

Mancipium vorax Midea Hübner (*partim*), "1806" [1809], vol. 1, pl. [142], figs. 1–4 [*MS* Georgien (German text)].

Pieris Lherminieri Godart, 1819, vol. 9, pp. 118, "197" [167], no. 164 ("Charles-Town" [= Charleston, South Carolina]).

Pieris Genutia, Godart, 1819, vol. 9, pp. 118, 168, no. 165 (les Indes orientales).

Pier.[*is*] *Genutia*, Godart, "1819" [1824], vol. 9, p. 806.

Genutia, Scudder, 1872, vol. 4, p. 74. (Georgia, May 21 in Oak Woods; north as well as south) Abbot *MS* folio 20, figs. 79–81.

[*Anthocharis*, Bdl.] *Genutia*, Fabr., (= *Mancipium vorax Midea*, Hüb., = *Pieris L'herminieri*, Godt.) Strecker (*partim*), 1878, p. 77, no. 38 (U. S. east of Texas [?except New England states]).

Anthocaris, Bd. *Genutia*, Bd., Worthington, 1880, vol. 12, p. 47 (Illinois).

M[*idea*] *Genutia* Fabr., Staudinger (*partim*), 1888, vol. 1, p. 47 (southern states of North America).

Anthocharis genutia, Scudder (*partim*), 1889, vol. 2, pp. 1147–1153; vol. 3, pl. 15, figs. 13, 15, pl. 26, fig. 3, (distribution) pl. 35, fig. 14, pl. 40, fig. 5, pl. 46, fig. 41, pl. 56, fig. 7, (*imago*) pl. 65, fig. 29, (*ova*) pl. 73, fig. 9, pl. 76, fig. 5, pl. 79, fig. 54, (*larva*) pl. 84, fig. 59 (*pupa*) (southern half of Alleghenian, northern half of Carolinian faunas, from Atlantic to southern Mississippi Valley; Pennsylvania, central Texas at Dallas; nearly all Atlantic states from Connecticut to Georgia; Savannah, Ga., Kanawha Co., W. Va.; Mexican border; Illinois; Ohio at Cincinnati; Newburgh, N.Y.; Connecticut at Greenwich, New Haven, New Britain, Farmington and tops of Meriden Hills, vicinity Holyoke, Mass., May to June).

[*Synchloë* Hübner] *genutia* Fabricius, (= *midea* Hübner) Dyar (*partim*), "1902" [1903], no. 52, p. 7, no. 48 (southern Atlantic states).

[*Anthocharis genutia*] *flavida* [new variety] Skinner, 1917, vol. 28, p. 438 (Savannah, Georgia, March 12, 1917).

Anthocharis genutia, Comstock & Comstock (*partim*), 1923, p. 385

(southeastern United States not Florida; north to New Haven, Connecticut).

Synchloë genutia, (*Anthocaris genutia* or *Euchloë genutia*), Weed (*partim*), 1924, pp. 94 (*ova*), 97, 256, pl. [fig. 2.] (east of Rocky Mountains; north to New England; southern states, south to Texas; western portion of North Carolina).

Synchloë genutia, Comstock & Comstock (*partim*), 1929, p. 82, pl. 15, figs. 1–2 (southeast United States, except Florida; north to New Haven, Connecticut).

Euchloë [(*Anthocharis*)] *genutia* (Fabricius), Holland, (*partim*), 1931, p. 287, pl. 4, fig. 6 (*ova*); pl. 32, figs. 37♂ 38♀; pl. 2, fig. 5 (*larva*); pl. 5, fig. 59 (*pupa*) (New England to Texas).

[*Euchloë* (*Anthocharis*) *genutia* (Fabricius)] Var. *flavida* (Skinner), Holland, 1931, p. 287, pl. 71, fig. 15 male "paratype" (Georgia).

Mancipium vorax Midea Hübner = *Euchloë Midea* Hübner *MS*, Hemming, 1937, vol. 1, p. 428 (Georgien [German text]).

Euchloë Midea Hübner *MS*, Hemming, 1937, vol. 2, p. 115 (German text, in Georgien).

Anthocharis midea (Hbn.) = *genutia* Fab., Harris, [1950], p. 3 (uncommon in Georgia, April).

Anthocharis midea (Hbn.) = *genutia* Fab. subspecies *flavida*, Skinner, Harris, 1950, p. 3 (near Savannah [Georgia]).

Anthocharis genutia (Fabricius) subspecies *flavida*, Clark & Clark, 1951, vol. 116, no. 7, p. 86 (coast of Georgia).

Anthocaris genutia Fabricius, Klots (*partim*), 1951, pp. 49, 181, 208, pl. 6, fig. 5 (*pupa*) pl. 25, fig. 7♂ (Ramapo Mts.) (Massachusetts and Connecticut, s. to Georgia, w. to Illinois and Texas [Dallas]).

A[*nthocaris*] *g*[*enutia*] *midea* Huebner, Klots, 1951, p. 182 (Georgia).

Anthocaris midea (Hbn.), Mather, 1952, vol. 6, p. 42 (Hinds County, Mississippi, March and April).

Euchloë Hüb. *genutia* Fab. *l'herminieri* Godt., = *flavida* Skin. Tietz [1952], p. 2, no. 30a (Savannah, Georgia, April and May).

Anthocaris midea Arnhold, "1952" [1953], vol. 6, p. 99 (Missouri).

Anthocharis genutia genutia (Fabricius), Lambremont, 1954, vol. 1, no. 10, pp. 131, 148 (Louisiana, upland regions northern part of state, April).

E[*uchloë*] *genutia* Fabricius, Forbes (*partim*), 1960, pp. 108, 110 (southern Massachusetts to Illinois and Arkansas, south to Georgia and Texas).

Anthocaris genutia Fabricius, Ehrlich & Ehrlich, [1961], p. 73 (New England to Texas, east of Rocky Mountains, Kansas).

Anthocaris midea (Hübner), Klots (*partim*), 1965, p. 463 (shore region [including the sea islands] of Georgia and South Carolina).

Anthocharis (Falcapica) midea annickae, new subspecies
(Figures 8, 9, 10, and 11 holotype ♂ and allotype ♀)

This new subspecies for which, as heretofore pointed out, no name is available, differs from the nominate subspecies in that on the forewing the orange apical area is more restricted and does not touch or closely approach the cell or the black discal spot. The range of this population covers most of North America east of the Appalachian Mountains from southern Massachusetts to Virginia.

The holotype, male from West Rock, New Haven, Connecticut, was taken on 20 April 1952 and the allotype, female from the same locality was taken on 1 May 1964, both by Dr. Charles L. Remington to whom we are indebted for them. They have been deposited in The American Museum of Natural History.

There are also four male and two female paratypes also furnished to us by Dr. Remington from the same locality as follows: males, 30 April 1952, 22 April 1954, 1 May 1954, and 19 April 1954; females, 16 May 1952 and 1 May 1954. These are also in the collection of The American Museum of Natural History.

The great phenetic similarity of the populations in Texas and in the northeast (*annickae*) is by no means evidence that they are genetically so similar that they should be considered subspecifically congruent. To do so would, in fact, contravene everything that is now known about the evolutionary differentiation of populations on the specific and subspecific level during periods of spatial isolation from each other. We have no trustworthy evidence what the *A. midea* are like that inhabit the inland areas between the *A. midea annickae* of the Appalachians and the northern coastal plain and the *A. midea* of Texas. The same applies to the similar populations of the southern coastal plain (*A. midea midea*) and of the far-distant Missouri-Kansas region. Many careful population studies will have to be made in the mid-West before any safe conclusions can be made about the taxonomic status of the western populations.

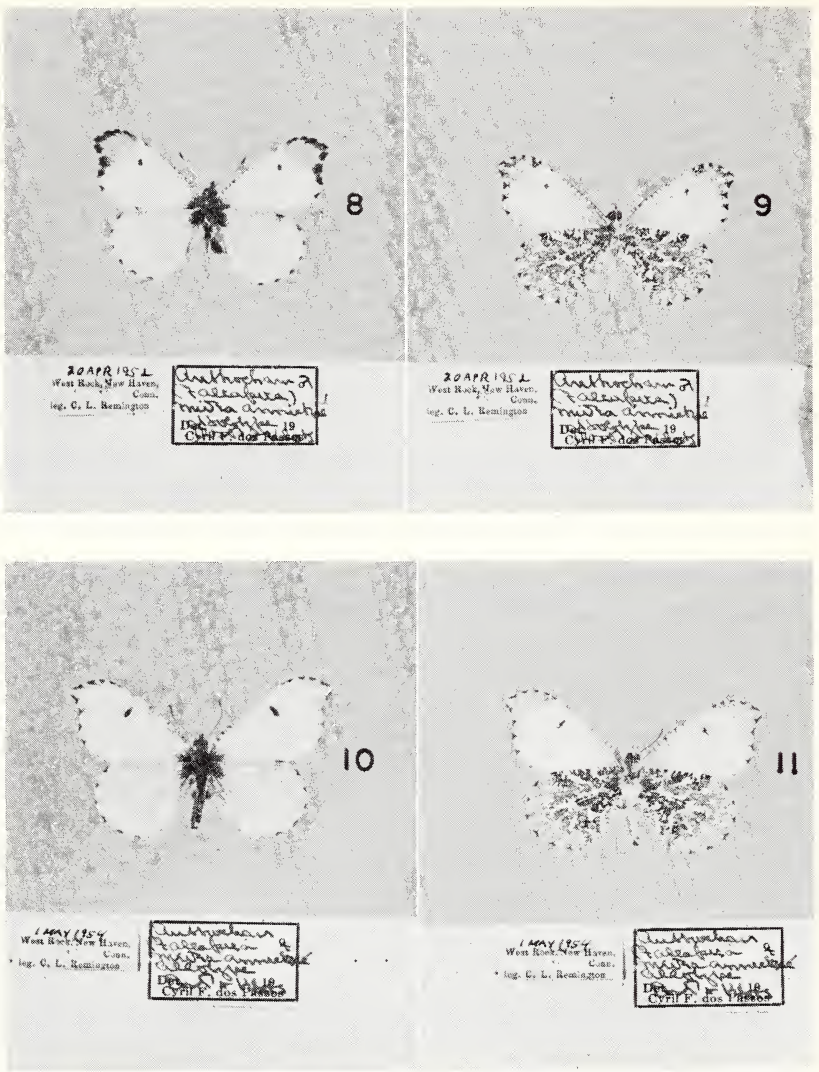
Anthocharis (*Falcapica*) *midea annickae* is named in honor of the former Mlle. Annick de Toulgoët Treanna, elder daughter of our friends the Comte and Comtesse de Toulgoët Treanna of Paris, France, who is now Mme. Michel Mauer.

The synonymy of this subspecies is as follows:

P[*apilio*] *D*[*anaus*] *Genutia* Fabricius (*partim*), 1793, vol. 3, p. 193, [no.] 601 (India).

Papilio Genutia, Donovan (*partim*), "1800" [1802], sig. F., p. [2], pl. [27], fig. ⁂ (India).

Mancipium vorax Midea Hübner, "1806" [1809], vol. 1, pl. [142], figs. 1–4 [*MS*: Georgien (German text)].



FIGS. 8–11. *Anthocharis midea annickae* holotype ♂ and allotype ♀, upper- and undersides, both West Rock, New Haven, Conn., ♂ 22 April 1954, ♀ 16 May 1952, leg. C. L. Remington.
(The specimens of Figs. 4–11 are in The American Museum of Natural History. All photographs except Fig. 1 are by the senior author.)

Anthocharis Genutia, Boisduval (= *Mancipium vorax Midea*, Hübn. = la femelle *Pieris Lherminieri*, God.) 1836, vol. 1, p. 565, no. 10 (Amerique Septentrionale; environs de Boston et de Charlestown).

Anthocaris Genutia Boisd., Scudder, 1868, vol. 11, p. 376, no. 12 (New Haven, Connecticut, May 16).

Anthocaris Genutia Boisd., Scudder, 1868, p. 4, no. 12 (New England).

Anthocaris genutia, Doubleday, 1869, Scudder (ed.), vol. 1, p. 121 (Edwards County, Illinois).

Anthocaris midea, Riley, 1871, p. 158 (Missouri).

[*Anthocharis*, Boisduval] *Genutia* Fabricius, Edwards, "1872" [1869], p. 5, no. 1. (New York to Virginia; middle and western states; Texas).

Euchloë Genutia, Butler, "1869" [1870], p. 214, no. 1 (Illinois, United States).

E[*uchloë*] Hübn. *Genutia* Fabr., (= *Pieris Lherminieri* God. = *Mancipium vor. Midea* Hübn.) Scudder (*partim*), 1872, p. 43, no. 1 (southern New England to Georgia and Texas).

[*Anthocharis*, Bd.] *Genutia*, Bd., Edwards (*partim*), 1877, vol. 6, p. 15, no. 49 (New York to Virginia; western states, Texas).

Anthocharis genutia Bois., Drury, [1878], vol. 1, p. 12, no. 14 (Cincinnati, Ohio).

Anthocharis Genutia Edwards, "1874–1884" [1878], vol. 2, pt. 7, p. [83–84], pl. *Anthocaris* II, figs. ♂ 1–2, ♀ 3–4 (Dallas, Texas; New Jersey; near Philadelphia; near Baltimore, Maryland; Newburgh, New York; Coalburgh, West Virginia, April; Illinois; Boston).

Anthocaris Genutia, Edwards, 1881, vol. 13, p. 211 (Coalburgh, [West Virginia], 17 April–14 May).

Anthocaris midea, Riley, 1881, p. 308 (Missouri).

[*Anthocharis* Boisduval] *Genutia* Fab., Edwards, 1884, vol. 11, p. 261, no. 53 (New York to Virginia; western states).

Anthocaris Genutia Fab., E. M. & S. F. Aaron, 1884, vol. 4, p. 172 (prairies southern Texas, 1st week April).

Anthocaris Genutia Fab., French, 1886, p. 118, no. 17 (New York to Virginia; Western States, Texas).

Anthocaris genutia Maynard, 1886, p. 48, no. 66, pl. 8, figs. 66 ♂, 66a ♂ (New England, Connecticut, western Massachusetts, 2 broods, first [*sic*] in July).

M[*idea*] *Genutia* Fabr., Staudinger (*partim*), 1888, *in* Staudinger & Schatz, vol. 1, p. 47 (southern states of North America).

Anthocharis genutia, Scudder (*partim*), 1889, vol. 2, pp. 1147–1153; vol. 3, pl. 15, figs. 13, 15, pl. 26, fig. 3 (distribution), pl. 35, fig. 14, pl. 40, fig. 5, pl. 46, fig. 41, pl. 56, fig. 7 (*imago*), pl. 65, fig. 29 (*ova*), pl. 73, fig. 9, pl. 76, fig. 5, pl. 79, fig. 54 (*larva*), pl. 84, fig. 59 (*pupa*) (southern half of Alleghenian, northern half of Carolinian faunas, from Atlantic to southern Mississippi valley; Pennsylvania, central Texas at Dallas; nearly all Atlantic states from Connecticut to Georgia; Savannah, Ga.; Kanawha Co., W. Va.; Mexican border; Illinois; Ohio at Cincinnati; Newburgh, N. Y.; Connecticut at Greenwich, New Haven, New

Britain, Farmington and tops of Meriden Hills, vicinity Holyoke, Mass., May to June).

Anthocharis genutia, Skinner and Aaron, 1889, vol. 21, p. 129. (Westville, New Jersey, May 6).

Anthocharis genutia, F., Beutenmüller, "1889–1891" [1890], vol. 5, p. 200 (Delaware Water Gap, Pennsylvania; Nyack, New York).

Anthocharis genutia, Rowley, 1890, vol. 22, p. 123 (Coalburgh, West Virginia, May).

Anthocaris genutia, Maynard, 1891a, p. 48, no. 66, pl. 8, figs. 66♂, 66a♂ (rare in New England, taken in Connecticut and western Massachusetts, 2 broods, first [*sic*] in July).

Anthocharis genutia Fab., Maynard, 1891b, p. 29, no. 52, figs. 14b, 14g, pl. 2, fig. 1 male (New York to Virginia, western states and Texas. Rare in southern New England, February, March, Texas, April further north).

[*Anthocharis*] *Genutia*, Edwards, 1892, vol. 24, pp. 52, 109 [Coalburgh, W. Virginia].

Anthocharis genutia Fab., Blatchley, 1892, *in* Gorby, p. 372, no. 12 (53) (Vanderburgh County, Indiana).

Anthocharis genutia, Skinner, 1892, vol. 3, p. 240 (Arcola, Perkiomen Creek, Pennsylvania, May 9).

Anthocharis genutia (Fabr.) Beutenmüller, 1893, vol. 5, p. 248, pl. 2, fig. 5 (Nyack and Newburgh, New York; Delaware Water Gap, Pennsylvania, May).

Anthocharis Genutia, Scudder (*partim*), 1893, p. 140 (eastern half of southern portion of our district, [eastern United States] even into New England; southern Illinois and Ohio, May to June).

Anthocharis genutia, [Anonymous], 1895, vol. 6, p. 145 (near Westville, New Jersey; Fox Chase, west of Quaker City, [Pennsylvania]).

Anthocharis Genutia, Edwards, "1888" [1897], vol. 3, pt. 6, pp. [57–61], pl. *Anthocharis* 1, figs. 5 male a–h3 (Washington, D. C.).

[*Anthocharis* Boisduval] *Genutia* Fab., (= *midea* Hüb.), Skinner, 1898, p. 65, no. 397 (Connecticut, New York to Virginia, western states).

Euchloë genutia Fabricius, Holland, 1898, p. 284, p. 4, fig. 6 (*ova*); pl. 32, figs. 37♂, 38♀; pl. 2, fig. 5 (*larva*); pl. 5, fig. 59 (*pupa*) (New England to Texas).

Euchloë genutia (Fabr.), Beutenmüller, 1898, vol. 10, p. 246, pl. 14, fig. 7 (Massachusetts to Texas).

Anthocharis Genutia Fabr., Smyth, 1900, vol. 11, p. 465 (Blacksburg, Virginia, summit Alleghenies, April to May).

[*Synchloë* Hübner] *genutia* Fabricius, (= *midea* Hübner) Dyar (*partim*), "1902" [1903], no. 52, p. 7, no. 48 (southern Atlantic states).

Anthocharis genutia, Hornig, 1903, vol. 14, p. 252 (Westville, New Jersey, May).

Anthocharis genutia Fab., Grossbeck, 1905, vol. 16, p. 131 (preparatory stages; Garret Mountain, Paterson, New Jersey).

A[nthocharis Bdv.] *genutia* Fab., Smith, 1910, p. 418 (New Jersey, April and May).

Anthocharis genutia, Skinner, 1917, vol. 28, p. 438 (Illinois).

[*Synchloë* Hübner] *genutia* Fabricius, Britton, 1920, no. 31, p. 159 (Connecticut).

Anthocharis genutia, Comstock & Comstock (*partim*), 1923, p. 385 (southeastern United States not Florida; north to New Haven Connecticut).

Synchloë genutia, (*Anthocaris genutia* or *Euchloë genutia*), Weed (*partim*), 1924, pp. 94, 97, 256, pl. [fig. 2]. (east of Rocky Mountains; north to New England; Southern states south to Texas; western portion North Carolina).

Anthocharis genutia, Clark, 1927, pp. 424, 428, pl. 2, figs. 10, 11 (Washington, D. C.).

A[nthocharis Boisduval] *genutia* Fab., Forbes, "1926" [1928] *in* Leonard, p. 677, no. 43 (highlands of Hudson, Greenwood, Tuxedo, Newburgh, Ramapo Mts., Canarsie, [New York] Apr.–May).

Synchloë genutia, Comstock & Comstock (*partim*), 1929, p. 82, pl. 15, figs. 1–2 (southeast United States, except Florida; north to New Haven, Connecticut).

Euchloë [(*Anthocharis*)] *genutia* (Fabricius) Holland (*partim*), 1931, p. 287, pl. 4, fig. 6 (*ova*); pl. 32, figs. 37♂ 38♀; pl. 2, fig. 5 (*larva*); pl. 5, fig. 59 (*pupa*) (New England to Texas).

Euchloë genutia Fabricius, [anonymous] [Wyss comp.] [1932], p. [24], no. 45 (Cincinnati, Ohio).

Anthocharis genutia (Fabricius), Clark, 1932, pp. 2, 3, 6, 7, 9, 12, 21, 23, 26, 30, 32, 43, 44, 61, 148, 164, 167, 168, 173, 234, 238, 252, pl. 2, figs. 10, 11, pl. 29, figs. 1–4 (Maryland; District of Columbia; Virginia).

(*Anthocharis*) Subgenus *Falcapica* Klots *genutia* Fabr., Talbot, 1934, *in* Strand, pt. 60, p. 321 (United States [New England to Texas]).

E[uchloë Hübner] *genutia* Fab., Brimley, 1938, p. 259 (Raleigh, Chapel Hill, Roanoke Rapids, [North Carolina], March and April).

Anthocaris medea [*sic*] (Hbn.), Leussler, 1938, vol. 49, p. 77 (Crete and Omaha, Nebraska).

Anthocharis (*Falcapica*) *midea* (Hübner), Field, 1938, vol. 39, no. 10, p. 176, no. 74 (New England south to Virginia and west to Texas and Kansas, Douglas, Greenwood and Leavenworth Counties, Kansas).

Anthocharis genutia Fab., Engelhardt, *fide* Tulloch, 1939, vol. 34, p. 227 (Lincoln, New Jersey, April and May).

[*Anthocharis* Boisduval] *midea* Hübner, (= *genutia* Fabricius), W. P. Comstock, 1940, vol. 48, p. 70, no. 30 (locally common throughout state [New Jersey]).

Anthocharis midea (Hübner), Field, 1940, vol. 13, p. 28 (Douglas and Leavenworth counties, Kansas, April).

Anthocharis midea (Hübner), Macy and Shepard, [1941], p. 36, fig. 7; pp. 52, 53, pl. 4, [fig. 4] (New England westward and southward

to Ohio, Illinois, and Texas; common near Washington, D. C.; Oakland, New Jersey; Athens County, Ohio, March to May).

Anthochris [*sic*] *midea*, Cook, 1948, vol. 2, p. 22 (Crailhope, Kentucky).

Anthocaris [(*Falcapica*)] *genutia* [= *midea*], Edwards, dos Passos (ed.) 1951, vol. 59, p. 163 (Washington, D. C.).

Anthocaris genutia midea Hbn., Rawson, 1951, vol. 5, p. 70 (Mt. Peter, Greenwood Lake, New York).

[*Anthocaris*] *midea*, Remington, 1951, (New Haven, Connecticut).

Anthocharis genutia (Fabricius), Clark & Clark, 1951, vol. 116, no. 7, pp. 86, 87, pl. 9, figs. i–j (Maryland and Virginia).

Anthocaris genutia Fabricius, Klots (*partim*), 1951, pp. 49, 181, 208, pl. 6, fig. 5 (*pupa*), pl. 25, fig. 7♂ (Ramapo Mts., N. Y.) (Massachusetts and Connecticut, s. to Georgia, w. to Illinois and Texas [Dallas]).

Anthocaris midea, Muesebeck & Walkley, 1951, p. 128–130.

[*Euchloë* Hüb.] *genutia* Fab. = *midea* Hüb., Tietz, [1952], p. 2, no. 30 (Pennsylvania).

E[*uchloë*] *genutia* Fabricius, Forbes (*partim*), 1960, pp. 108–110 (southern Massachusetts to Illinois and Arkansas, south to Georgia and Texas).

Anthocaris midea (Hübner), Klots (*partim*), 1965, p. 463 (in the Piedmont, westward to Texas and northward into Connecticut and Missouri).

Life History

The life history of *midea* is well known and all stages are beautifully figured and described by Edwards in the third series of the Butterflies of North America, [1888], pt. 6, pl. *Anthocharis* I, figs. a–h3, pp. [57]–[61].

One interesting fact that we have observed concerning the life history of this insect is that the imagines do not always emerge the year following pupation. Among those reared by the senior author in 1933 from specimens taken at Edison, New Jersey, one male did not emerge from the pupa until 26 April 1935. Others reared from specimens taken by us at Harrisville and New Gretna, both in Burlington County, New Jersey, 8–9 May 1953 and reared by the senior author on *Arabidopsis Thaliàna* (Linnaeus) resulted in seven out of thirteen specimens not emerging until the second year, the record being four males and two females the first year, while three males and four females emerged the second year. All of these specimens are in the senior author's collection except for one male, Harrisville, ex pupa, 1 March 1955 and one pupal shell which is in the junior author's collection.

The late Charles E. Rummel of Green Village, New Jersey, ob-

served many years ago (1931, p. 268) a case where an imago did not emerge until the third year, but we have never had that experience.

In the northern part of its range, the species is monogenetic. In Virginia *teste* Clark & Clark (1951, p. 86) there may be a partial second generation influenced by local climatic conditions, and this may well be the case in many parts of its southern range.

Foodplants

The larva of *midea* feeds on various Cruciferae (Mustard Family), among which the following have been reported: *Bursa Bursa-pastòris* (Linnaeus), (1753, p. 647) Britton (Shepherd's purse, -bag, or -pouch); *Arabidopsis Thaliàna* (Linnaeus), (1753, p. 665), (Mouse-ear or Thale-cress, Wall-cress); *Barbarèa Barbarèa* (Linnaeus), (1753, p. 660), MacMillan, (Yellow Rocket or Cress); *Arabis glàbra* (Linnaeus), (1753, p. 666), Bernhardi, (Tower Mustard or Cress); and a species of *Cardamine* ([Tournefort] Linnaeus), (1753, p. 654) the specific name of which does not appear to have been reported but may be the one mentioned below.

We have reared the insect on *A. glàbra* when taken in the mountainous section of New Jersey and on *A. Thaliàna* when taken on the coastal plain. Dr. Charles L. Remington of the Gibbs Research Laboratories, Yale University, reports finding eggs and larvae at New Haven, Connecticut, on *Arabis laevigàta* (Mühlenberg), (1801, p. 543), Poiret (Smooth Rock-cress); *A. lyrata* Linnaeus (1753, p. 665), (Lyre-leaved Rock-cress); and *Cardamine parviflòra* Linnaeus and *C. arenicola* Britton, (1892, p. 220,) (Sand Bitter-cress or Small Flowered Bitter-cress), and rearing the insect on all three. Doubtless there are other foodplants such as *Cardamine rhomboidea* De Candolle (1821, p. 246), (Bulbous Cress) probably a synonym of *Cardamine bulbosa* (Schreber) Britton (1793, p. 174).

According to Smyth (1900, p. 465), eggs of *midea* were laid on *Dentaria laciniata* Mühlenberg (1800, p. 479), (Cut-leaved Toothwort or Pepper-root) which seems to be the only foodplant in Blacksburg, Virginia.

Parasites

From larvae collected on *Arabis glàbra* (see above) were reared some parasitic wasps determined by Miss Luella M. Walkley of the United States National Museum, who stated that it was the first record of that parasite on *midea*, to be *Hyposoter exiguae* (Viereck) (1912, p. 638) (Ichneumonidae). One male wasp and cocoon are in that institution, and others in the collection of the senior author. This wasp has also been recorded on *Heliothis armiger* (Hübner),

([July 1803]–[1808]), *Prodenia ornithogalli praefica* Grote, 1875 (both Noctuidae), and *Colias eurytheme* Boisduval, 1852 (Pieridae).

Also reported on *Anthocharis midea* are *Apanteles flaviconchae* Riley (1881, p. 308) (Braconidae) and *A. limenitidis* (Riley) (1871, p. 158) according to Muesebeck (1951, p. 128).

Another reported parasite is *Apanteles pergandei* Grossbeck (1905, p. 133) *nec* Ashmead (Braconidae). We do not find that this name was ever published by Ashmead. Grossbeck (*supra*) stated in a footnote that, "The species is described only in *MS* and will appear in Dr. Ashmead's monograph of the North American Braconidae now in preparation." Ashmead died a few years later (1908) without however having published any such monograph or described *Apanteles pergandei*. The name is, therefore, a *nomen nudum*.

ACKNOWLEDGMENTS

We again express our thanks to Messrs. Lucien Harris, Jr. of Avondale Estates, Georgia, Bryant Mather of Jackson, Mississippi, and John R. Heitzman of Independence, Missouri, for the loans of their entire collections of *Anthocharis midea* with permission to retain such specimens as might be necessary to enlarge the distribution records of The American Museum of Natural History; and to Professor Charles L. Remington for the gift of specimens to be used as the types of *A. m. annickae* as well as notes on the foodplants of that subspecies in Connecticut; also to Dr. Richard B. Domenick of McClellanville, South Carolina for the loan of 9 male specimens taken at that locality with permission to retain one male to serve as the neotype of *Pieris lherminieri* Godart.

We also wish to thank Miss Luella M. Walkley of the United States National Museum for identifying the parasitic wasp that was reared on *midea* and Dr. Pierre E. L. Viette of the Paris Museum for searching for Godart's type of *Pieris lherminieri* in that institution.

BIBLIOGRAPHY

AARON, E. M. AND S. F. AARON. 1884 [1885]. List of a collection of diurnal Lepidoptera from southern Texas. Papilio 4: 172–182.

ABBOT, J. *ineditus*. ca. 1800. Drawings of the insects of Georgia. British Museum (Natural History) 6: 20, figs. 79–81. See Smith, J. E.

ANONYMOUS. 1882 [1881]. Check list of the North American Macrolepidoptera of America. Publication Committee, Bull. Brooklyn ent. Soc. 4: 45, [2] + 25 pp.

————. 1893–94. List of Pteridophyta and spermatophyta growing without cultivation in northeastern North America. Mem. Torrey Botanical Club 5: 5–9, 172–173.

————. 1895. Popular Entomology A chase for a butterfly. Ent. News 6: 145–147.

————. 1932. See Wyss, A. E.

ARNHOLD, F. R. 1952 [1953]. Notes on collecting *Anthocharis midea* and *Euchloë olympia*. Lep. News 6: 99–100.

ASHMEAD, W. H. Monograph of the North American Braconidae. [Apparently never published.]

BARNES, W. AND J. H. MCDUNNOUGH. 1917. Check list of the diurnal Lepidoptera of Boreal America. Decatur, Ill., Herald Press, viii + [2] + 392 + [4] pp.

BARNES, W. AND F. H. BENJAMIN. 1926. Check list of the diurnal Lepidoptera of Boreal America. Bull. So. Calif. Acad. Sci. 25: 3–27.

BERNARDI, G. 1961. Note synonymique sur les Pieridae. Bull. Soc. ent. Fr. 66: 111–112.

BERNHARDI, J. J. 1800. Systematisches Berzeichniss der Pflanzen, Welch in der Gegend um Erfurt Gefundenwerden. Octavo, Erfurt, Germany. Pt. 1, 28 + 346 pp.

BEUTENMÜLLER, W. 1889–91 [1890]. Catalogue of the lepidoptera found within fifty miles of New York City, with their foodplants. Ann. N. Y. Acad. Sci. 5: 199–229.

————. 1893. Art. XVI Descriptive catalogue of the butterflies found within fifty miles of New York City, together with a brief account of their life histories and habits. Bull. Amer. Mus. Nat. Hist. 5: 241–310, 4 pls.

————. 1897. Meeting of October 16, 1897. N. Y. ent. Soc. 5: 208.

————. 1898. Revision of the species of Euchloë inhabiting America north of Mexico. Bull. Amer. Mus. Nat. Hist. 10: Art. XIII: 235–248, pls. 13–14.

BLATCHLEY, W. S. 1892. A catalog of the butterflies known to occur in Indiana *in* Gorby. Indiana Department of Geology and Natural Resources, 17th Annual Report, pp. 365–408.

BOISDUVAL, J. B. A. D. DE. 1836. Histoire naturelle des insectes. Species général des lépidoptères. Paris, Deroret, pp. 4 + xii + 690 pp. + 24 pls. (colored and partly colored).

BOISDUVAL, J. B. A. D. DE, J. P. RAMBUR, AND A. DE GRASLIN. [1833]. Collection iconographique et historique des chenilles . . . d'Europe. Paris. 128 pls. col. with descriptive letterpress, pts. 1–10, 1832; 11–20, 1833; 21–30, 1834; 31–38, 1835.

BRIMLEY, C. S. 1938. The insects of North Carolina. Raleigh, N. C., North Carolina Department of Agriculture, 560 pp.

BRITTON, N. L. 1892. New or noteworthy North American Phanerogams.—VI. Bull. Torrey Botanical Club 19: 219–226.

BRITTON, W. E. 1920. Check list of the insects of Connecticut. Hartford, Conn. Bull. #31, [8] + 398 pp.

BRUZELIUS, R. M. 1854. Beskrifning "ofwer Hydrachnider, som fore-

kömma inom Skåne" akademisk afhandhing. Lund, 56 pp., 5 pls. Faf.

BUTLER, A. G. 1866. A list of the diurnal lepodoptera recently collected by Mr. Whitley in Hakodadi (north Japan). J. Linn. Soc. (Zool) IX: 50–59.

————. 1869 [1870]. Catalogue of diurnal lepidoptera described by Fabricius in the British Museum. London, Order of the Trustees, pp. vi + 303, 3 pls.

————. 1899. Notes on the genus *Euchloë* Hübner, A genus of the Pierinae. Entomologist, London 32: 1–3.

CLARK, A. H. 1927. Fragrant butterflies. Washington, Smithsonian report for 1926, publication 2901, pp. 421–446 + 13 pls.

————. 1932. The butterflies of the District of Columbia and vicinity. Washington, Smithsonian Institution, Bull. U. S. Nat. Mus. no. 157, x + 338 pp., 64 pls.

CLARK, A. H. AND L. F. CLARK. 1951. Butterflies of Virginia. Washington, Smithsonian Institution Misc. collection 116: 7: publication no. 4050, viii + 240 pp., 30 pls., frontispiece colored.

COMSTOCK, J. H. AND A. B. COMSTOCK. 1923. A manual of the study of insects. Ithaca, N. Y., Comstock Publishing Co., 17th ed., xii + 702 pp., 795 figs.

————. 1929. How to know the butterflies. Ithaca, N. Y., Comstock Publishing Co., xii + 312 pp., 45 pls.

COMSTOCK, W. P. 1940. Butterflies of New Jersey. A list of the lepidoptera suborder Rhopalocera occurring in the state of New Jersey; giving time of flight, foodplants, records of capture with locality and date. Jour. N. Y. ent. Soc. 48: 47–84.

COOK, C. 1948. Early spring collecting in Kentucky. Lep. News 2: 22.

CRAMER, P. AND [in part] C. STOLL. 1779 [1775]–1791. Papillons éxotiques des trois parties du monde l'Asie, l'Afrique, et l'Amerique. [The title and the text in Dutch and French.] Amsterdam, S. J. Baalde; Utrecht, Barthelemy Wild, "1779" [1775–1776], 1: [4] + i–xxx, 1–16, 1–155 + [4], frontispiece and pls. 1–96 colored; "1779" [1777], 2: [4] + 1–152 + [4], frontispiece and pls. 97–192 colored; "1782" [1779–1780], 3: [8] + 1–36, 73 [sic], 38–176 + [2], frontispiece and pls. 193–288 colored; "1782" [1780–1784], 4: [4] + 1–252, 1–30 + [2], pls. 289–400 colored. Supplément a l'ouvrage, intitule les papillons éxotiques, des trois parties du monde l'Asie, l'Afrique, et l'Amerique; par M. Pierre Cramer, contenant les figures exactes des chenilles et des chrysalides de Suriname; comme celles des plusieurs rares et nouvellement découvertes papillons et phalenes. Amsterdam, Nic. Th. Gravius "1791" [1787–1791], 5: [4] + i–viii, 1–67, 60 [sic], 69–181, "382–384" [183–184], pls. 1–42 colored.

DAVENPORT, D. AND V. G. DETHIER. 1937 [1938]. Bibliography of the described life histories of the Rhopalocera of America north of Mexico 1889–1937. Ent. Americana, new ser. 17: 155–194.

Donovan, E. 1800 [1802]. Epitome of the natural history of the insects of India and the islands of the Indian Sea. London, T. Bensley, ii + 68, 58 pls., colored.

dos Passos, C. F., editor. 1951. The entomological reminiscenses of William Henry Edwards. Jour. N. Y. ent. Soc. 59: 129–186.

dos Passos, C. F. 1964. A synonymic list of the Nearctic Rhopalocera. Lep. Soc., Mem. No. 1, vi + 146 pp.

Doubleday, E. and [in part] J. O. Westwood [1850–52, 143–4 p]. 1846–1852. The genera of diurnal lepidoptera: comprising their generic characters, a notice of their habits and transformation, and a catalogue of the species of each genus. London, Longman, Brown, Green and Longman, 1846–1850, vol. 1, containing the families Papilionidae, Pieridae, Ageronidae, Danaidae, Heliconidae, Acracidae, and part of Nymphalidae; by E. Doubleday; illus. with 86 pls., by W. C. Hewitson, xii + 250 pp., pls. A uncolored 1, 1*, 2–4*, 5–18, 18 [sic], 19–30 colored: 1850–1852, vol. 2 containing the remainder of the family Nymphalidae, and the families Morphidae, Brassalidae, Satyridae, Libytheidae, Erycinidae, Lycaenidae, and Hesperidae; with a supplement by J. O. Westwood, pp. [2] + 251–534, pls. 31–54, 54*, 55–66, 66 [*sic*], 68–80, [1] colored.

————. 1869. See Scudder, S. H., Editor.

Drury, C. 1878. Catalogue of the lepidoptera, observed in the vicinity of Cincinnati, Ohio, including diurnals, Sphingidae, Aegeridae, Zygaenidae, Bombycidae, Noctuidae, Phalaenidae, and Pyralidae. J. Cin. Soc. Nat. Hist. 1: 12–23.

Dyar, H. G. 1894. Notes on *Pieris* and *Anthocharis*. Can. Ent. 26: 100.

————. 1902 [1903]. A list of North American lepidoptera and key to the literature of this order of insects. Washington, Bull. U. S. Nat. Mus. no. 52, pp. xx + 724.

Edwards, W. H. [1868–1872]. Synopsis of North American butterflies. Philadelphia, The Amer. Ent. Soc. [1868]: pp. 1–4; [1869]: pp. 5–6; [1870]: pp. 7–14; [1871]: pp. 15–38.

————. 1874–1884 [1878]. The butterflies of North America. Second series, vol. 2, pt. 7. Boston and New York, Houghton, Mifflin & Co. *Anthocaris* II, 4 figs., [83–84] pp.

————. 1877. Catalogue of the diurnal lepidoptera of America north of Mexico. Trans. Amer. ent. Soc. 6: 1–68.

————. 1881. On the length of life of butterflies. Can. Ent. 13: 205–214.

————. 1884. Revised catalogue of the diurnal lepidoptera of America north of Mexico. Trans. Amer. ent. Soc. 11: 245–338.

————. 1884. List of species of the diurnal lepidoptera of America north of Mexico. Boston and New York, Houghton, Mifflin & Co. [16] pp.

————. 1888 [1897]. The butterflies of North America. Third series, vol. 3, pt. 6. Boston and New York, Houghton, Mifflin & Co., *Anthocaris* I, fig. 5♂, figs. a–h3, preparatory stages, [57–61] pp.

————. 1892. Miscellaneous notes on butterflies, larvae, etc. Can. Ent. 24: 49–56, 105–111.

EHRLICH, P. R. AND A. H. EHRLICH. [1961]. How to know the butterflies. Dubuque, Iowa; Wm. C. Brown Co., [8] + 262 pp., 525 figs.

ENGELHARDT, G. P. 1937. See Siepmann, C. G.

————. 1939. *In* Tulloch (see Tulloch).

FABRICIUS, J. C. 1793. Entomologica systematica emendata et aucta . . . adjectis synonymis, locis, observationibus, descriptionibus. Copenhagen, C. G. Proft, vol. 3, Part I, [6] + 488 + 1794 pp.; Part II, 350 pp.

FAZZINI, L. D. 1934. Butterflies and moths of America. Racine, Wisc., Whitman Publishing Co., 96 pp., 47 illus. colored, 1 black and white fig.

FIELD, W. D. 1938. Manual of the butterflies and skippers of Kansas. Vol. 39, no. 10. Bull. Univ. Kans. Biol. Ser., Kansas State Printing Plant, 328 pp., 1 map.

————. 1940. New records of butterflies for Kansas (Lepidoptera: Rhopalocera). J. Kansas ent. Soc. 13: 28–29.

FORBES, W. T. M. 1926 [1928]. Order Lepidoptera *in* Leonard, A list of the insects of New York with a list of the spiders and certain other allied groups. Ithaca, N. Y., Cornell Univ., no. 101, 532–687 pp.

————. 1960. Lepidoptera of New York and neighboring states. Ithaca, N. Y., Cornell Univ. Agric. Exper. Station, State College of Agriculture, Part IV, Mem. 371, 188 pp.

FRENCH, G. H. 1886. The butterflies of the eastern United States. Phila., Pa., J. B. Lippincott Co., 402 pp. + 93 figs.

GLOVER, T. 1878. Illustrations of North American entomology in the order lepidoptera. Washington, D. C., vol. 2, 117 pls., 47 pp. *ms.*

GODART, J. B. See Latrielle, P. A.

GORBY, S. S. 1892. Seventeenth annual report. Indiana Department of Geology and Natural Resources, Indianapolis, William Burford, 706 pp. + expl. of 20 pls.

GROSSBECK, J. A. 1905. Notes on the life history of *Anthocharis genutia* Fab. Ent. News 16: 131–134.

GROTE, A. R. 1900. The descent of the Pieridae. Proc. Amer. Philos. Soc. 39: 4–67.

HARRIS, L., JR. 1931. A list of the butterflies of Georgia. Trans. Georgia Naturalists Club 1: 1–28, 1 pl., 1 fig.

————. [1950]. The butterflies of Georgia revised. Georgia Soc. Naturalists, Bull. no. 5, [6] + vii + 29 + [4] pp.

HARRIS, T. W. See Scudder, S. H.

Hemming, F. A. 1934. The generic names of the Holarctic butterflies. London, The Oxford Univ. Press, viii + 184 pp.

————. 1937. Hübner, a bibliographical and systematic account of the entomological works of Jacob Hübner and of the supplements thereto by Carl Geyer, Gottfried Franz von Frölich and Gottlieb August Wilhelm Herrich-Schaeffer. London. Royal ent. Soc. 1: xxxiv + 606, 1 portrait.

————. 1967. The generic names of the butterflies and their type-species (Lepidoptera: Rhopalocera). Bull. B. M. (N. H.) Ent., Suppl. 9, London, 509 pp.

Herrich-Schaeffer, G. A. W. 1867. Prodromus systematis lepidopterorum. Correspondenz. Blatt. des zoologisch-minerologischen Vereines in Regensburg, vol. 21, pp. 138–144.

Holland, W. J. 1898. The butterfly book. New York, Doubleday, Page & Co., xx + 382 pp., 183 + [1] figs., 48 pls. colored.

————. 1931. The butterfly book, new and thoroughly revised edition. Garden City, N. Y., Doubleday, Doran & Co., Inc., xii + 424 pp., 77 pls. colored (4 black and white), 198 + [1] fig.

Hornig, H. 1903. The feeding habits of the larva of *Anthocharis genutia*. Ent. News 14: 252.

Hübner, J. 1806–[1819]. Sammlung exotischer Schmetterlinge. Vol. 1. Augsburg, II + [4] pp., 213 col. pls.

————. 1816–[1826]. Verzeichniss bekannter Schmettlinge [sic]. Augsburg, 432 + 72 pp.

International Code of Zoological Nomenclature. 1964. [Second ed.] Adopted by the XV International Congress of Zoology, London, International Trust for Zoological Nomenclature, xx + 176 pp.

Jones, William "of Chelsea." 1783–[1791]. Icones [an unpublished collection of drawings in the Hope Department of the Museum at Oxford], 7 volumes.

Kirby, W. F. 1871. A synonymic catalogue of diurnal lepidoptera. London, John van Voorst, viii + 690 pp.

————. 1879. Catalogue of the collection of diurnal lepidoptera formed by the late William Chapman Hewitson of Oatlands, Walton-on-Thames and bequeathed by him to the British Museum. London, John van Voorst, iv + 246 pp.

Klots, A. B. 1930. A generic revision of the Euchloini (Lepidoptera, Pieridae). Bull. Brooklyn Ent. Soc. 25: 80–95, 6 pls., 12 figs.

————. 1931. The generic synonymy of the North American Pieridae (Lepidoptera). Ent. News 42: 253–256.

————. 1931 [1933]. A generic revision of the Pieridae (Lepidoptera). Ent. Amer. 12: (n. ser.): 139–242, 100 figs.

————. 1951. A field guide to the butterflies of North America east of the Great Plains. Boston, Mass., Houghton, Mifflin Co., Riverside Press, Cambridge, xvi + 350 pp., 40 pls. (16 colored), 9 line illus., 1 map.

————. 1965. Some glaciation-isolated populations of North American lepidoptera. Proc. XIIth International Congress of Entomology, London, 841 pp.

KUSNEZOV, N. J. 1929. Faune de l'URSS, et des pays limitrophes Insects Lépidoptères. Vol. 2, pp. 337–599, 1–64, 205–233 figs.

LAMARCK, J. B. A. P. M. AND J. L. M. POIRET. 1810. Encyclopédie méthodique. Botanique, Suppl. vol. 1, Paris, H. Agasse, xviii + 755 pp., Add. pp. 756–761.

LAMBREMONT, E. N. 1954. The butterflies and skippers of Louisiana. Tulane Studies in Zoology, New Orleans, Tulane University 1: 10: 127–164.

LATREILLE, P. A. 1819–[1924]. Encyclopédie méthodique, Histoire naturelle. Entomologie, ou histoire naturelle des crustaces, des arachnides et des insectes. Paris, H. Agasse, vol. 9 and supplement, 828 pp.

LEUSSLER, R. A. 1938. An annotated list of the butterflies of Nebraska (Lepidoptera: Rhopalocera). Ent. News 49: 76–80.

LINNAEUS, C. 1753. Species plantarum, exhibentes plantas rite cognita, ad genera relatas, cum differentiis specificis, nominibus trurali-bus, synonymis selectis, locis natalibus, secundum systeme sexuale digestas. Stockholm, Laurentii Salvii 1: [13] + 560 pp., 2: [2] + 561–1200 pp. + index generum 32 pp.

————. 1761. Fauna Suecica sistens animalia Sueciae regni: Mammalia, Aves, Amphibia, Pisces, Insecta, Vermes. Distributa per classes & ordines, genera & species, cum differentiis specierum, synonymis auctorum, nominibus incolarum, locis natalium, descriptionibus insectorum. Editio altera. Stockholm, Laurentii Salvii, [48] + 578 pp., frontispiece + 2 pls.

LUTZ, F. E. 1918. Fieldbook of the insects with special reference to those of northeastern U.S. aiming to answer common questions. G. P. Putnam's sons, New York and London. The Knickerbocker Press, ix + 510 pp., 145 pls. (44 colored).

————. [1921]. Fieldbook of insects with special reference to those of northeastern U.S. aiming to answer common questions, second edition, revised and enlarged. London, New York, G. P. Putnam's Sons, 562 pp., 101 + [1] pls., (24 colored) + frontispiece.

————. 1935. Fieldbook of insects with special reference to those of northeastern U.S. aiming to answer common questions, third edition, rewritten. New York, G. P. Putnam's Sons, [10] + 510 pp., 100 pls. (23 colored).

MACMILLAN, C. 1892. Metaspermae of the Minnesota Valley, a list of the high seed-producing plants indigenous to the drainage-basin of the Minnesota River. Minneapolis, Minn. Geol. Nat. Hist. Survey, Bot. Series 1: 826 pp.

MACY, R. W. AND H. H. SHEPARD. [1941]. Butterflies—a handbook of the butterflies of the U.S. complete for the region north of the

Potomac and Ohio Rivers and east of the Dakotas. Minneapolis. viii + 248 pp. + 4 colored pls. + 7 figs. + 38 photos.

Mather, B. 1952. *Anthocaris* in Mississippi. Lep. News 6: 42.

Maynard, C. J. 1886. The butterflies of New England. Boston, Mass. Bradlee Whidden, iv + [2] + 66 + [2] pp. + 8 colored pls.

————. 1891a. Butterflies of New England, second edition. Newtonville, Mass., published by author, [4] + iv + 78 + [4] pp. + 10 pls. colored.

————. 1891b. A manual of North American butterflies. Boston, Dewolfe, Fiske and Co., [4] + iv + 226 pp. + 10 pls. colored + [1] + 59 figs.

McDunnough, J. H. 1938. Check list of the lepidoptera of Canada and the U.S. of America, Part I, Macrolepidoptera. Mem. So. Calif. Acad. Sci. 1: [4] + 4 (corrigenda) + 276 pp.

Morris, J. G. 1860. Catalogue of the described lepidoptera of North America. Washington, Smithsonian Inst., viii + 68 pp.

————. 1862. Synopsis of the described lepidoptera of North America, Pt. I, Diurnal and crepuscular lepidoptera. Washington, Smithsonian Inst., xxviii + 358 pp. + 28 figs.

Möschler, H. B. 1878. Catalogue of the lepidoptera of America north of Mexico. Part I, Diurnals by William H. Edwards. Philadelphia, Amer. ent. Soc., Entomologische Zeitung (Stettin) 39: 297–310.

Muesebeck, C. F. W. and L. M. Walkley. 1951. Family Braconidae in Hymenoptera of America north of Mexico, Synoptic Catalogue . . . U.S. Dept. of Agric., Agricultural Monograph No. 2, Washington, D.C., 1420 pp.

Mühlenberg, H. L. 1810. *In* Lamarck, Encyclopédie méthodique. Botanique. Suppl. 1, Paris, H. Agasse, p. 409–415.

Poiret, J. L. M. 1810. See Lamarck.

Rawson, G. W. 1951. Hilltops and *Anthocharis*. Lep. News 5: 70.

Remington, C. L. 1951. Hilltops and *Anthocharis* note. Lep. News 5: 70.

Riley, C. V. 1871. Third annual report on the . . . insects of the state of Missouri . . . Jefferson City, Missouri, 176 + 8 pp., 70 figs.

————. 1878–1886 [1881]. Notes on North American microgasters with descriptions of new species. Trans. St. Louis Acad. Nat. Sci. 4: 296–324.

Röber, J. See Seitz, A.

Rowley, R. R. 1890. Cases of long pupal periods among lepidoptera. Can. Ent. 11: 375–384.

Rummel, C. E. See Siepmann, C. G.

Scudder, S. H. 1868. Check list of the butterflies of New England. Boston, 8 pp.

————. 1868. Supplement to a list of the butterflies of New England. Proc. Boston Soc. Nat. Hist 11: 375–385.

————. 1872. A systematic revision of some of the American butterflies, with brief notes on those known to occur in Essex Co., Mass. Report Peabody Acad. Sci. for 1871, pp. 24–82.

————. 1872. Abbot's notes on Georgian butterflies. Can. Ent. 4: 73–77.

————. 1875. Historical sketch of the generic names proposed for butterflies. A contribution to systematic nomenclature. Proc. Amer. Acad. Arts and Sci., Second series 10: 91–294.

————. 1889. The butterflies of the eastern U.S. & Canada with special reference to New England. Cambridge, Third volume, [2] + vi + [2] + 1775–1956 pp. + 90 pls. (20 colored) + 3 maps colored.

————. 1893. Brief guide to the commoner butterflies of the northern U.S. and Canada. New York, Henry Holt & Co., [2] + xii + 206 pp. + 10 figs.

SCUDDER, S. H., Editor. 1869. Entomological correspondence of Thaddeus William Harris, M.D., edited by Samuel H. Scudder. Boston, Boston Soc. Nat. Hist., xlviii + 375 pp., frontispiece, (portrait), illus., iv pls. (3 colored), 46 figs. (Occ. papers of the Boston Soc. of Nat. Hist.)

SEITZ, A. 1924. [1907–1924]. The Macrolepidoptera of the world. Vol. 5, (The American Rhopalocera.) Stuttgart, Alfred Kernen, viii + [4] + 1140 pp., 203 pls. colored (American edition).

SEIPMANN, C. G., Secretary. 1931. Proceedings of the Society. Meeting of May 14, 1931. ibid Soc. 26: 265–268.

————. 1937. Proceedings of the Society. Meeting of January 14, 1937. Bull. Brooklyn ent. Soc. 32: 87–89.

SKINNER, H. 1898. A synonymic catalogue of the North American Rhopalocera. Philadelphia, P. C. Stockhausen, xvi + 100 + xiv pp.

————. [1905]. A synonymic catalogue of the North American Rhopalocera. Suppl. 1, Philadelphia, Amer. ent. Soc., 34 pp.

————. 1917. *Anthocharis genutia* and a new variety (Lepidoptera). Ent. News 28: 438.

SKINNER, H. AND E. M. AARON. 1889. A list of the butterflies of Philadelphia, Pa. Can. Ent. 21: 126–131.

SKINNER, H., Recorder. 1892. Doings of Societies, Ent. News 3: 239–240.

SMITH, J. E. 1797. The natural history of the rarer lepidopterous insects of Georgia . . . collected from the observations of Mr. John Abbot. London, T. Bensley, vol. 1, [4] + xvi + 100 pp., 100 pls. colored; vol. 2, pp. 101–214, 104 pls. colored.

SMITH, J. B. 1910. Annual report of New Jersey State Museum including a report of the insects of New Jersey. Trenton, New York, MacCrellish & Quigley, 888 pp., 3 portraits, 1 map colored.

Smith, J. B., H. Skinner, C. H. Fernald, G. D. Hulst, and C. V. Riley. 1891. List of the lepidoptera of boreal America. Philadelphia, P. C. Stockhausen, Amer. ent. Soc., vi + 124 pp.

Smith, J. B., H. Skinner, and W. D. Kearfoot. 1903. Check list of the lepidoptera of boreal America. Philadelphia, P. C. Stockhausen, vi + 136 pp.

Smyth, E. A., Jr. 1900. *Anthocharis genutia* Fabr. Ent. News 11: 465–468.

Staudinger, O. and E. Schatz. 1888. Exotische Schmetterlinge. Fürth, G. Löwensohn, vol. 1, [6] + 334 pp. + 1 map colored.

Strecker, H. 1878. Butterflies and moths of North America with full instructions for collecting, breeding, preparing, classifying, packing for shipment, etc., a complete synonymical catalogue of Macrolepidoptera with full bibliography to which is added a glossary of terms and an alphabetical and descriptive list of localities. Reading, Pa., B. F. Owen, [4] + ii + [2] + 284 pp., + 2 pls.

Talbot, G. 1932–1935. Pieridae I–III. Lepidopterorum Catalogus, vol. 23, pts. 53, 60, 66; pt. 1, 320 pp; pt. II, 321–384; pt. III, 385–698 pp.

Tietz, H. M. [1952]. The lepidoptera of Pennsylvania, a manual. State College, Pa., xii + 194 pp. + 1 fig.

Torrey, J. and A. Gray. 1838–1840. Flora of North America containing abridged descriptions of all the known indigenous and naturalized plants growing north of Mexico, arranged according to the natural system. New York, Wiley & Putnam, 1: 82–87.

Tulloch, G. S., Secretary pro tem. 1939. Meeting of May 12, 1938. Bull. Brooklyn ent. Soc. 34: 226–227.

Viereck, H. L. 1912. Contributions to our knowledge of bees and ichneumon-flies, including the description of twenty-one new genera and fifty-seven new species of ichneumon-flies. U.S. Nat. Mus. Proc. 42: 613–648.

Walker, F. 1863. List of the . . . Lepidopterous insects in the . . . British Museum, pt. 27, Crambites and Tortricities, 286 pp.

Weed, C. M. 1924. Butterflies worth knowing. Doubleday, Page & Co. for Nelson Doubleday, Inc., xiv + 386 pp. + 48 pls., (32 colored).

Weidemeyer, J. W. 1863–1864. Catalogue of North American butterflies. Proc. ent. Soc. Phila. 2: 143–154.

Worthington, C. E. 1880. A list of diurnal lepidoptera inhabiting the state of Illinois. Can. Ent. 12: 46–50.

Wright, W. G. 1905. Complete list of the butterflies of the U.S. [In] The butterflies of the West Coast of the U.S. illustrated with 940 figures in color-photography of butterflies from the West Coast nearly all of which were captured by the author with accurate data for each specimen with colored figures and

descriptions of many new species and new varieties now first published. San Francisco, The Whitaker & Ray Co., Inc., pp. 47–70.

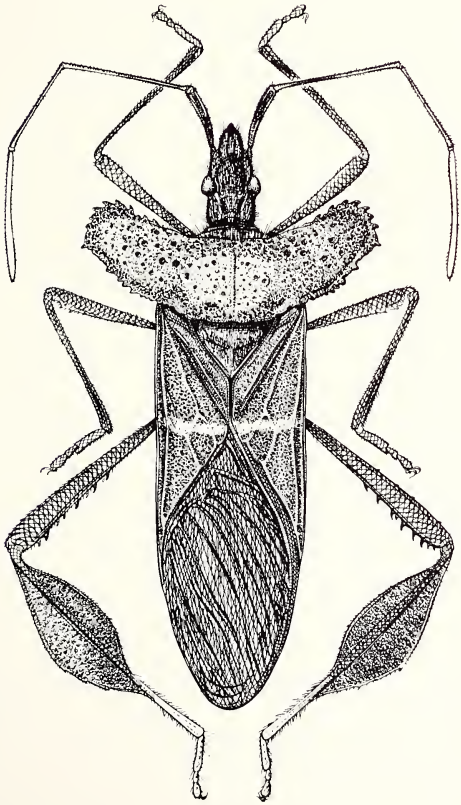
WYSS, A. E. [1932]. Guide to the butterflies of Cincinnati and vicinity. Misc. publication no. 7, compiled by Junior Soc. of Nat. Sci., Cincinnati, Ohio, [38] + errata [2] pp., 4 pls.

ZIMSEN, E. 1964. The type material of J. C. Fabricius. Copenhagen, Munksgaard. 656 pp. + frontispiece.

A REVISION OF THE GENUS *LEPTOGLOSSUS GUERIN* (HEMIPTERA: COREIDAE)

By

Richard Charles Allen



Entomologica Americana
Vol. 45, 1969, pp. 35–140

A REVISION OF THE GENUS *LEPTOGLOSSUS* GUERIN (HEMIPTERA: COREIDAE)[1,3]

By

Richard Charles Allen[2]

Table of Contents

Abstract: All previously known species of the genus *Leptoglossus* are discussed. Five new species are described and redescriptions are given for existing species. A discussion of the taxonomic characters used, a key to all species, and 67 figures are included.

Introduction

A comprehensive world-wide revision of the genus *Leptoglossus* has not been attempted since Stål's *Enumeratio Hemipterorum* in 1870. Much of the material present in museums is largely unidentified, except for the best known species, or where keys to species are available for a particular geographic area. The purpose of this work is to bring together as much information as possible about the genus, to provide a comprehensive key to all existing species, and to redescribe the species that are poorly known. It is hoped that a basis has been estabished for further research in this group.

Accepted for publication October 31, 1968.

[1] A dissertation submitted in partial fulfillment of the requirements for the Degree of Master of Science at the University of Connecticut, Storrs, Connecticut.

[2] Present address: Department of Entomology, University of Kansas, Lawrence, Kansas.

[3] This work was supported in part by National Science Foundation Grant GB-4306X.

Leptoglossus is chiefly a neotropical genus with 26 of the 38 species found primarily in, or restricted to South America. Of the remaining species found in North and Central America, and the Caribbean, all are clearly related to the South American members. The single Eastern Hemisphere species, *australis* (Fabricius), does not present a baffling zoogeographic problem in view of the relationship between it and *gonagra* (Fabricius). These two species are very closely related, with *australis* an obvious derivative of a *gonagra* like stock that has crossed the water barriers and invaded the Ethiopian, Oriental, and Australo-Papuan regions. Further remarks concerning *gonagra* and *australis* may be found in the discussion under the latter species.

Historical Review

Guerin first described the genus *Leptoglossus* with *dilaticollis* as the only included species in 1838; however, the generic and specific names date from 1831 as they were used in reference to a figure published by Guerin in that year (Dupuis 1952). *Leptoglossus* remained monotypic until 1870. In 1837, Spinola described *Anisoscelis*, to which all previously and subsequently named species now in *Leptoglossus* were assigned for many years. Stål (1862) described *lineosus* and established the genus *Theognis* to include those anisosceline species which had the first antennal segments equal to the length of the head. Mayr (1865, 1866) described a number of new species in *Theognis*, many of which have since been synonymized, but he provided in some instances well executed descriptions. In 1870 Stål synonymized his genus *Theognis* with *Leptoglossus* and added three new species. Walker (1871) described five species in the genus *Anisoscelis* and one in *Malvana*. All of these belong to *Leptoglossus* and, of these six, three are valid species. Between 1871 and 1894 four more species were added to the genus, of these Distant described one and Berg three. I have synonymized one Berg species and assigned another to subspecific status. The Lethierry and Severin Catalogue in 1894 was the last check list of species to be compiled for *Leptoglossus* with 35 species included. Before 1909 only three species were known from North America north of Mexico, *phyllopus* (Linnaeus), *oppositus* (Say), and *corculus* (Say). Subsequently Barber and Heidemann have described between them five additional species.

Kiritshenko (1935) resurrected the genus *Theognis* as distinct from *Leptoglossus*. Hussey (1953) supported Kiritshenko's separation of the two genera. For reasons discussed later, I do not agree with Kiritshenko, and have retained *Theognis* as a junior synonym of *Leptoglossus*.

MATERIALS AND METHODS

The type specimens of the following workers were made available through the cooperation of the various museum curators: the Stål collection from the Stockholm Museum; Walker and Dallas types from the British Museum (Natural History); the Berg collection from the La Plata Museum; Blote's types from the Leiden Museum, Holland; and the types of Heidemann and Barber at the United States National Museum. Dr. I. Lansbury at Oxford compared material and made drawings of the genitalia and tibial dilations of the Westwood types. Approximately 2500 specimens were examined for this study.

Genitalia dissections were accomplished according to the methods described by Ashlock (1957 and 1967). The aedeagus required much time and effort to inflate osmotically, and most attempts resulted in failure. By gently pulling on the membranous portion, it is usually possible to extend the aedeagus and with further careful manipulation the various lobes and appendages can be exposed (although their exact shape can only be estimated by this process). The aedeagal drawings were made from an aedeagus extended manually and therefore are only approximations of the size and shape of the various lobes. The genital capsule drawings are of the posterior view with only the dorsal margin and a portion of the lateral margin shown; the shape of the capsule, except for the dorsal margin, is essentially the same for all species. The corresponding morphological structures were drawn to the same scale.

All measurements are in millimeters. The length of the head is measured along a median line from the base of the head to the apex of the juga. Although the tylus is the furthest extension of the head, that portion of it which extends past the juga was not included since it is variable between individuals of the same species and between different species. One example of this is in *clypealis* Heidemann which has the apex of the tylus produced as an acute spine. Width of head is across the eyes when viewed dorsally; interocular distance is the shortest distance between the eyes on the dorsal surface; anteocular distance is measured from the anterior margin of an eye to the apex of the juga; the intersegmental node between antennal segments three and four was included in the length of the third segment; length of pronotum is measured along the median line as is that of the scutellum; width across humeri is also the greatest width of pronotum; total length is the distance from the apex of the juga to the apex of the folded wings; the length of the hind tibia is measured from an imaginary base line drawn across the tibia from the inner, almost right-angle bend at the tibiofemoral joint, to the distal end of the tibia; the lengths of the inner and outer tibial dilations are measured from the same base

line explained for the tibia, to the end of the dilations, regardless of where the dilations actually begin on the proximal portion of the tibia. An exact measurement is sometimes difficult because the dilation diminishes very gradually distally. The width of the dilations is measured from the center of the tibia to the margin of the dilations, with the dilations held in a horizontal plane.

Complete descriptions are given for the less well known species. The North American species are described briefly, and the reader is referred to the original and readily available descriptions of Barber (1918), Heidemann (1909, 1910), and the descriptions given in Blatchley (1926). The references for each species include all synonymies, and additional papers that give useful descriptions, figures, keys, or biological information. Many older references that were cited in the Lethierry and Severin Catalogue (1894), and also those papers pertaining to locality records that were cited in the Van Duzee Catalogue (1917), are omitted here.

Host plant records cited without references are taken from labels on specimens in the material examined.

Taxonomic Characters

Most of the characters used in this paper are those employed by previous workers on this genus. In the past, some taxonomic confusion has resulted due to reliance on only one or two of what have proven to be variable characters. The significant characters, their usefulness in distinguishing species, groups of species, and their variability are discussed below.

(1) Transverse Fascia on Corium—This is an extremely useful character and its presence or absence, and shape can be determined with ease. In many species the pale fascia is as constant as any morphological character, but occasionally the fascia is absent in species that normally have it, such as *ingens* (Mayr), *stigma* (Herbst), *concolor* (Walker), *neovexillatus* n. sp. and *zonatus* (Dallas). In *ingens* the absence or presence of the fascia seems to be correlated with geographic distribution. The fascia also varies in completeness, and may be wide and brightly pigmented or narrow and faint. The terms "irregular" and "straight" pertain to the margins of the fascia: an irregular fascia more or less follows the branching of the radial and medial and the mediocubital cross-vein, this produces sharply angled saw-like margins; the straight fascia occupies the same area as an irregular one, but the area between the veins is also pigmented, a condition producing an evenly margined fascia. *L. ashmeadi* Heidemann and *macrophyllus* Stål have an irregular fascia, but on some individuals this is difficult to determine as the margin

may be only slightly angular and similar to a straight margined fascia. In order to avoid confusion in using the key, I have considered these two species as possessing both types of fascia.

(2) COLORATION—There are a number of useful and reliable color patterns that can be used in grouping species, as well as in separating closely related species. A large group has the thoracic and abdominal venter mottled with numerous small piceous spots (about the size of an ocellus). Another useful pattern is the presence of contrasting yellowish maculae on the thoracic pleura; these maculae are large (about the size of an eye). In one group of species, the individuals have five or six maculae on each side of the thorax; in another group the maculae number approximately ten or twelve. A third color pattern on the thoracic pleura is the shape of pale longitudinal fasciae. Members of this genus also possess various contrasting spots, fasciae, and rectangular bands on the pronotum. These color patterns are useful for distinguishing related species, but in some instances are highly variable and must be used with caution. The key contains a number of couplets which rely on pronotal color patterns, but I have made every attempt to use them only where those species involved showed consistence in expressing a particular pattern.

(3) TIBIAL DILATIONS—These membranous plate-like expansions on the hind tibiae (Figs. 52–63) can be at times completely diagnostic in themselves as in *corculus*, *gonagra*, *alatus*, and *lineosus*, or in other instances the dilations are at best only a secondary character. Some examples of the latter case are typical of the species *zonatus*, *stigma*, *concolor*, and *chilensis*.

The outer dilation refers to the larger dilation, which is directed laterally when the hind tibia is in the position shown in Figs. 1–5. The inner dilation is the medially directed portion. The term "lanceolate" refers to a dilation that has the margin entire or almost entire (Figs. 57–61); and "phylliform" pertains to a dilation which is emarginate or scalloped on the margin (Figs. 52–56, 62–63). The inner dilation is in all species lanceolate with small teeth on the margin, and in all but a few species it is smaller both in width and length than the outer. The outer dilation may be either lanceolate or conspicuously phylliform. A phylliform dilation has a spine-like tooth where an edge of an emargination comes to a point. In many of the older descriptions a phylliform dilation was referred to as having "two or three teeth." A certain amount of variation in the shape of a phylliform dilation can be expected. All species with this type of a dilation may have one to two deep emarginations, and only rarely will all the emarginations be shallow. A lanceolate outer dilation will usually have at least one shallow emargination. The width and length

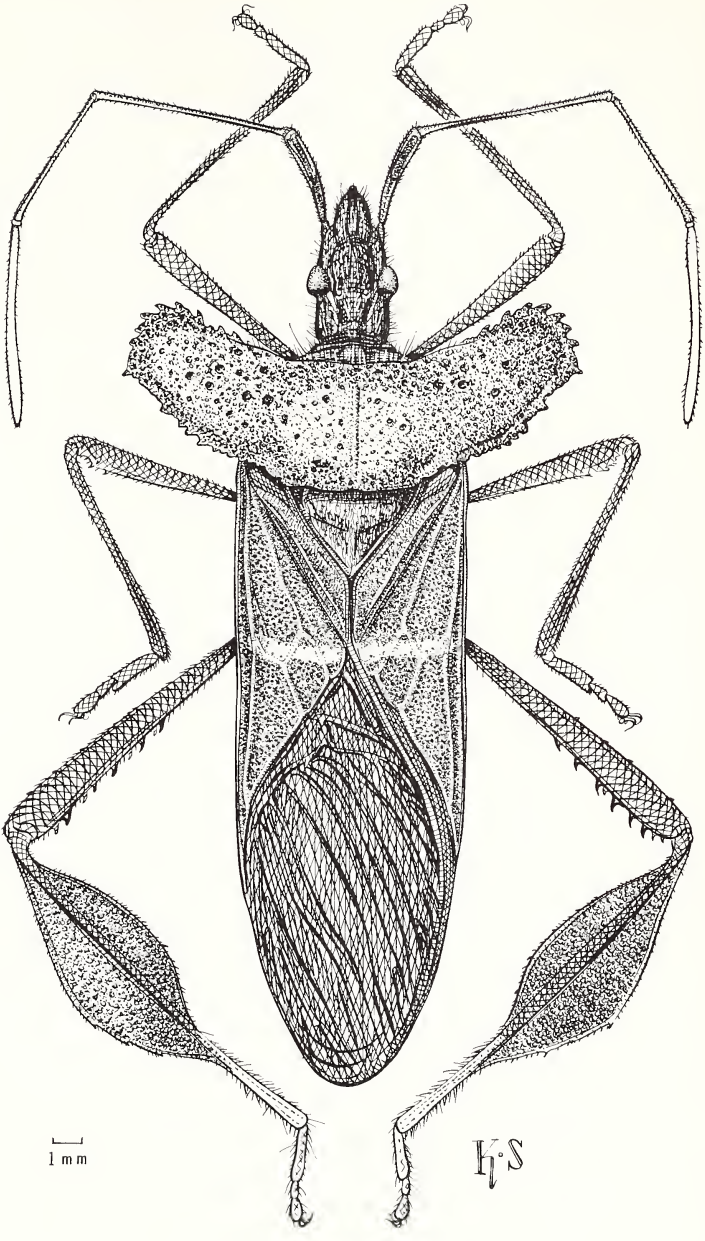


FIG. 1. *Leptoglossus dilaticollis*.

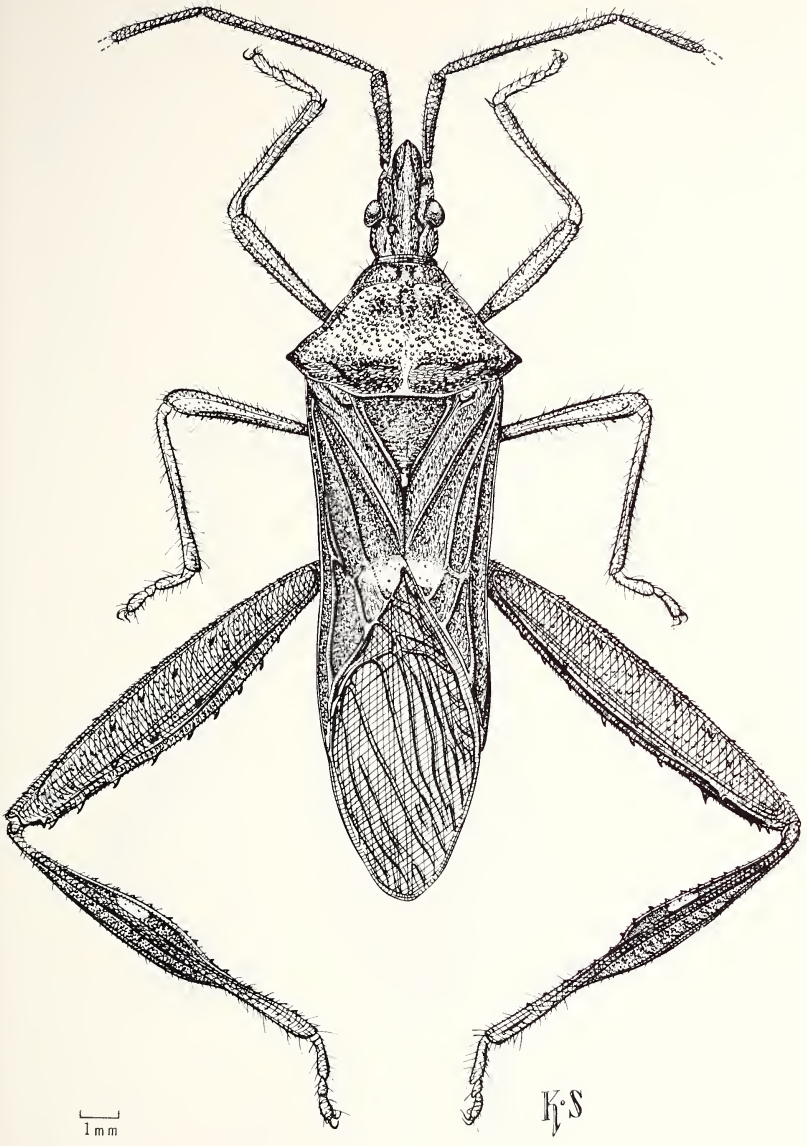


FIG. 2. *Leptoglossus crassicornis.*

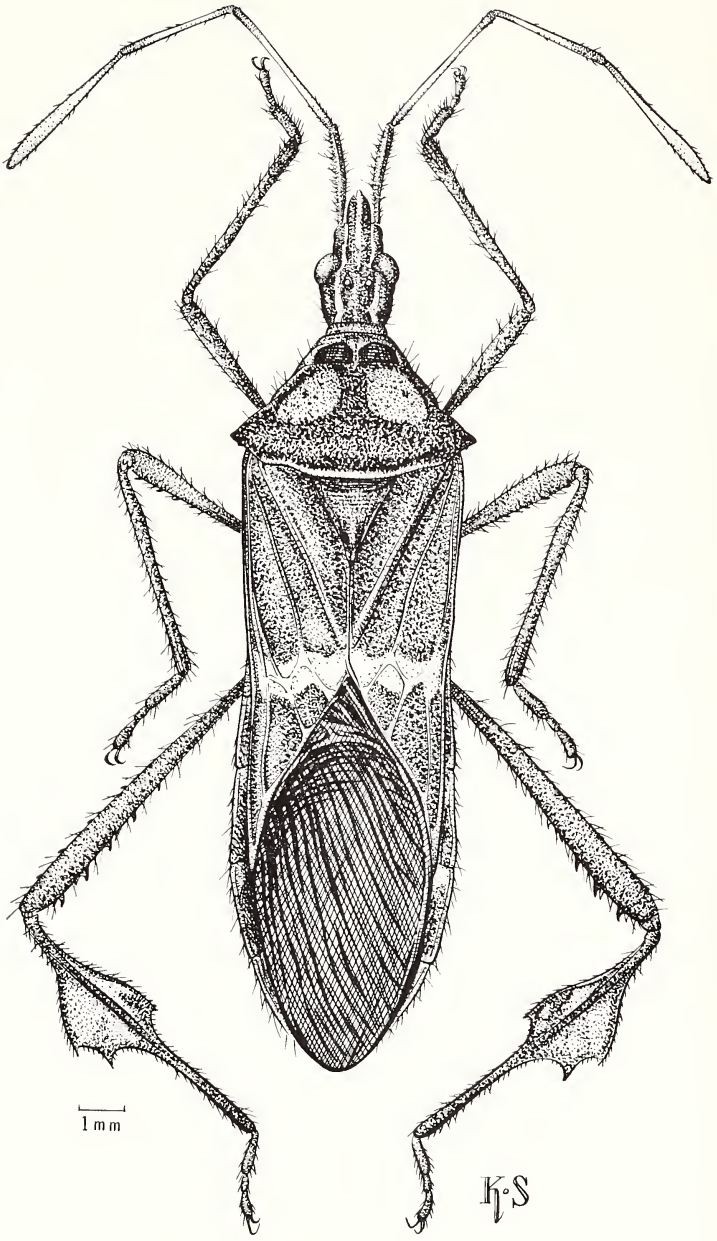


FIG. 3. *Leptoglossus grenadensis.*

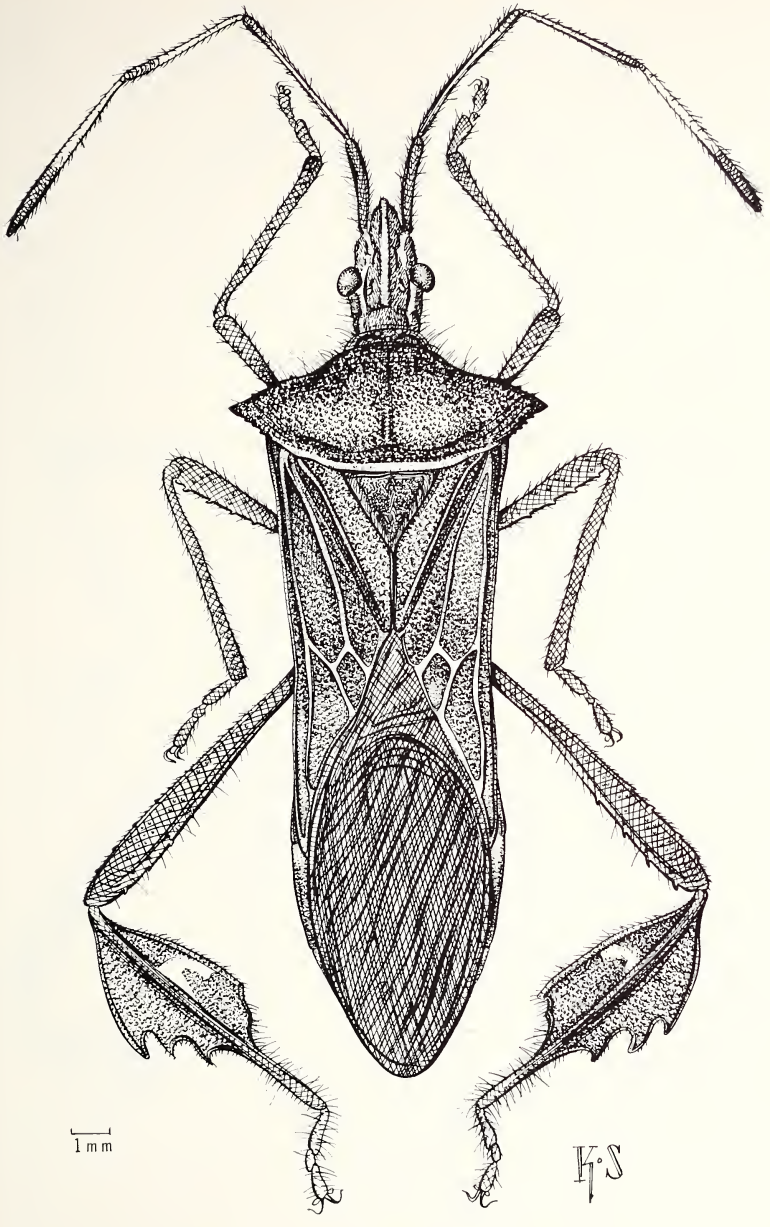


FIG. 4. *Leptoglossus pallidivenosus.*

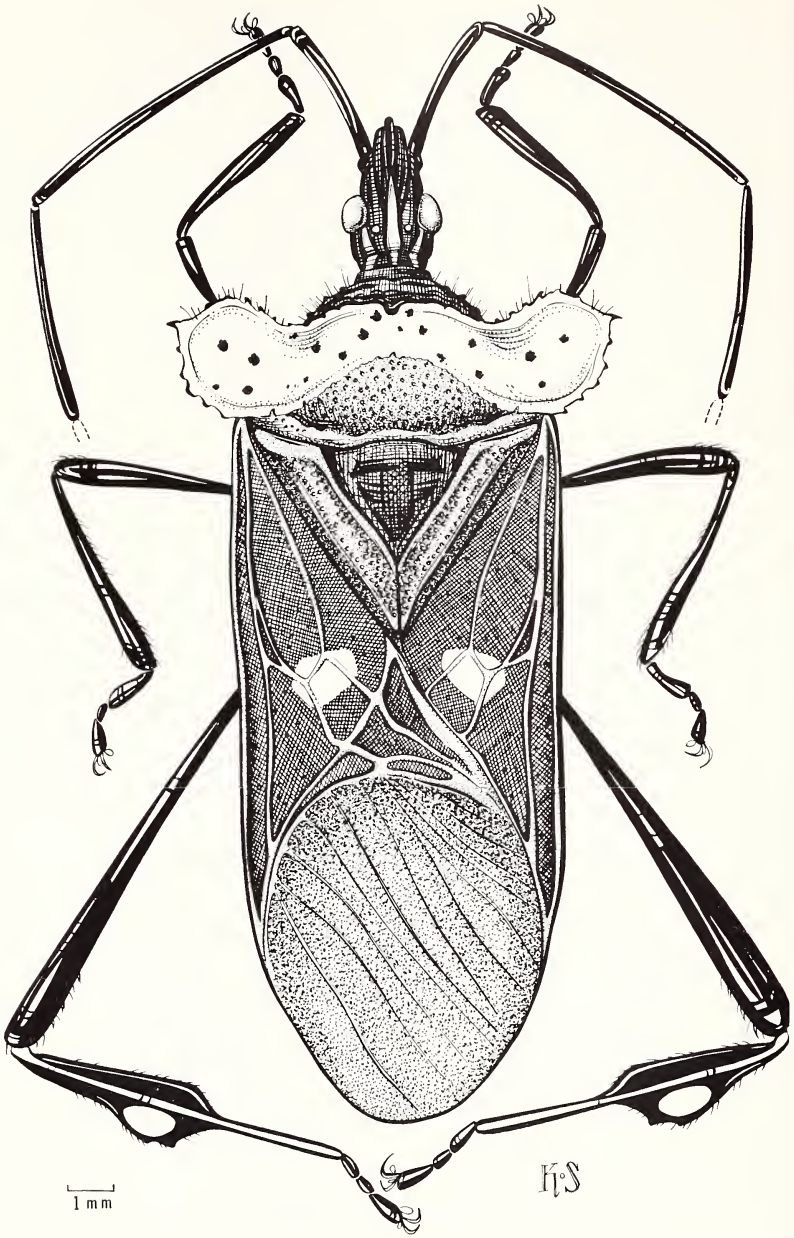


FIG. 5. *Leptoglossus alatus.*

of a dilation are also useful characters, but the length, as mentioned earlier, must be used carefully. I have used the various shapes of the dilation as a diagnostic character only when there was a considerable and constant difference between species.

(4) MALE GENITALIA—The various parts of the male genitalia have been a rewarding character in all but a few instances. By far the most useful structure is the aedeagus. This has proven to be diagnostic between closely related species when the clasper and capsule were similar, and also has been useful in delineating groups of species. I have limited my discussion of the aedeagus to the dorsal sac (Schaefer 1968) of the conjunctiva, because this area is most useful, with its various lobes and scerotized spines. The different lobes on the dorsal sac are indicated according to their position as proximal, medial, or distal (Figs. 64–67). The dorso-lateral appendage (Fig. 67) is generally a well sclerotized flat appendage and basal to the dorsal sac. For descriptive purposes I have referred to the clasper as having three parts, a base, shank, and hook (Fig. 17). The postero-lateral dorsal margin of the capsule is an area displaying good specific characters. I have used the terms median notch and dorsal prongs in describing the shape of the margin (Fig. 42).

Genus **Leptoglossus** Guerin

Leptoglossus Guerin, 1831 (1838):pl. 12, fig. 9.—Guerin, 1838:174. Stål, 1870:160.—Kirkaldy, 1906:257.—Gibson and Holdridge, 1918:3.

Anisoscelis Spinola, 1837:200.

Theognis Stål, 1862:294.—Kiritschenko, 1935:191.—Hussey, 1953: 33.

Small to large species, elongate; head porrect, longer than wide and usually shorter than length of pronotum, prolonged anterior to antenniferous tubercules, tylus slightly exceeding juga usually rounded, ocelli widely separated, distance between ocelli greater than distance from ocellus to eye; pronotum subhexagonal with anterior face declivent, humeral areas usually expanded, sometimes greatly so, greatest width of pronotum across humeri, posterior margin concave, in front of it an unevenly raised transverse ridge, calli present; length and width scutellum subequal; labial length variable, segments one and two subequal with third shortest, fourth variable; first antennal segment curved and thickest, usually subequal to length of head, at least longer than anteocular distance, first segment shortest, with second segment longer than third, fourth segment equal to or longer than third segment; membrane slightly surpassing abdomen; all femora

armed beneath with two rows of distally directed teeth, individual teeth gradually increasing in size distad, tuberculate laterally and above, tubercules more or less oriented in rows, hind femora swollen and usually thicker in males than females; hind tibiae dilated, outer dilation variable in size and shape, usually wider than interocular distance.

Type species—*Leptoglossus dilaticollis* Guerin, 1831. Monobasic.

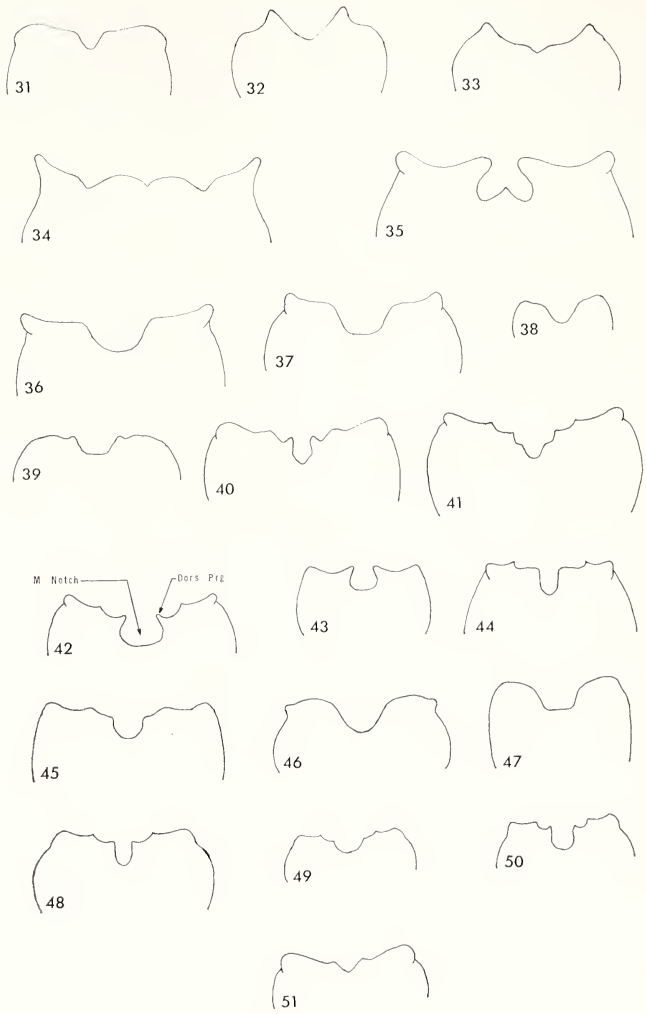
Stål established the genus *Theognis* in 1862, and synonymized it with *Leptoglossus* in 1870. The generic status remained unchanged until Kiritshenko (1935) restored *Theognis* as distinct. This action left only *dilaticollis* in *Leptoglossus*.

The following is a discussion of the characters that Kiritshenko listed in his diagnosis of *Leptoglossus*. After each of his characters, I point out similar characters that can be found in species in the genus *Theognis*, and which in my opinion precludes the separation of the two genera.

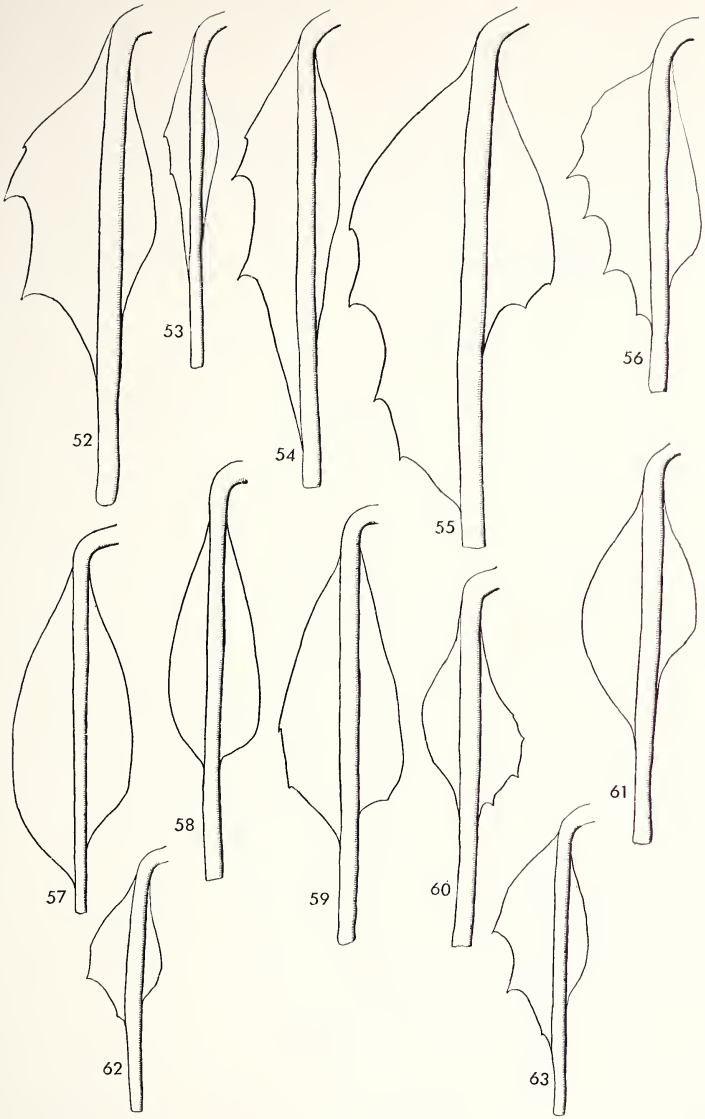
(1) Pronotum with the humeral angles produced as long anteriorly curving processes—*alatus* (Walker) (Fig. 5) has similar angles, although not quite so wide. (2) All lateral margins strongly dentate. *L. alatus* has equally long teeth, and *dentatus* Berg despite its small size is strongly dentate. (3) Pronotal surface above with deeply excavated rounded foveolae. *Rubrescens* (Walker) and *fulvicornis* (Say) both have rugulose and deeply pitted pronotal surfaces, although the punctations are not so deep or so prominent. (4) Body robust, very large species (length 27–39 mm). The two females of *humeralis* n. sp. approach the lower limit of the range for *dilaticollis*. It should be pointed out that the lower limit of the range for *dilaticollis* is of a male, and the upper limit for *humeralis* is of females, so that *dilaticollis* is actually larger. (5) The length of the head is three times the interocular distance. Not all *dilaticollis* specimens have the head quite this long, the lowest ratio of seven specimens was 2.5 and a single specimen of *fulvicornis* has the head 2.4 times the interocular distance. These differences between the two "genera" are ones of degree, not of kind.

Stronger evidence for retaining *Theognis* species with *Leptoglossus* is the similarity of the genitalia, and this is discussed under the *dilaticollis* group. It is true that *dilaticollis* is a unique species, but so is *alatus*. The genitalia of *lineosus* and *subauratus* Distant are as different from other species as are the external characters of *dilaticollis*; therefore, they too are unique. The entire genus is not a homogeneous unit, and until a complete re-evaluation of the generic limits and the relationships among genera of the Anisoscelidini is

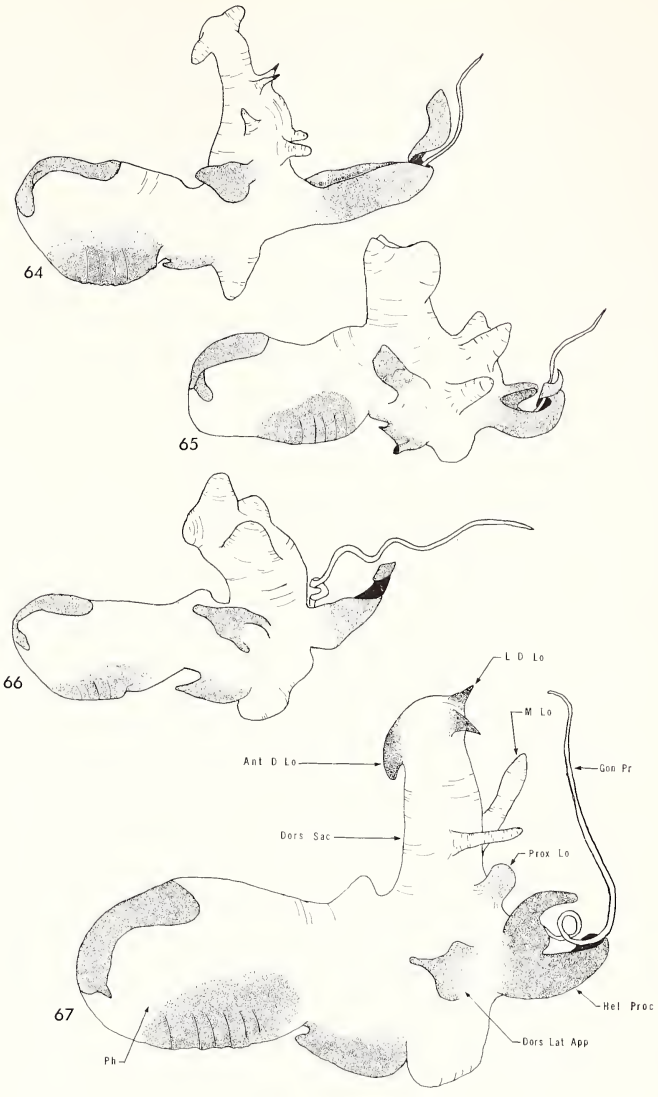
FIGS. 6–30. Right claspers, dorsal view. Fig. 6. *Leptoglossus cinctus*. Fig. 7. *L. harpagon*. Fig. 8. *L. lineosus*. Fig. 9. *L. dilaticollis*. Fig. 10. *L. fulvicornis*. Fig. 11. *L. rubrescens*. Fig. 12. *L. australis*. Fig. 13. *L. chilensis*. Fig. 14. *L. quadricollis*. Fig. 15. *L. dentatus*. Fig. 16. *L. macrophyllus*. Fig. 17. *L. ingens*: Sh, shank; Hk, hook; M Lo, median lobe; I B Lo, inner basal lobe. Fig. 18. *L. zonatus*. Fig. 19. *L. impictipennis*. Fig. 20. *L. conspersus*. Fig. 21. *L. stigma*. Fig. 22. *L. concolor*. Fig. 23. *L. pallidivenosus*. Fig. 24. *L. lonchoides*. Fig. 25. *L. balteatus*. Fig. 26. *L. corculus*. Fig. 27. *L. occidentalis*. Fig. 28. *L. clypealis*. Fig. 29. *L. brevirostris*. Fig. 30. *L. ashmeadi*.



FIGS. 31–51. Genital capsules, posterior view. Fig. 31. *Leptoglossus cinctus*. Fig. 32. *L. harpagon*. Fig. 33. *L. lineosus*. Fig. 34. *L. dilaticollis*. Fig. 35. *L. fulvicornis*. Fig. 36. *L. rubrescens*. Fig. 37. *L. australis*. Fig. 38. *L. chilensis*. Fig. 39. *L. dentatus*. Fig. 40. *L. macrophyllus*. Fig. 41. *L. ingens*. Fig. 42. *L. zonatus*, Dors Prg, dorsal prongs; M Notch, median notch. Fig. 43. *L. impictipennis*. Fig. 44. *L. concolor*. Fig. 45. *L. pallidivenosus*. Fig. 46. *L. corculus*. Fig. 47. *L. occidentalis*. Fig. 48. *L. clypealis*. Fig. 49. *L. brevirostris*. Fig. 50. *L. ashmeadi*. Fig. 51. *L. balteatus*.



FIGS. 52–63. Tibial dilations. Fig. 52. *Leptoglossus australis*. Fig. 53. *L. australis*. Fig. 54. *L. gonagra*. Fig. 55. *L. ingens*. Fig. 56. *L. quadricollis*. Fig. 57. *L. corculus*. Fig. 58. *L. occidentalis*. Fig. 59. *L. clypealis*. Fig. 60. *L. lineosus*. Fig. 61. *L. lonchoides*. Fig. 62. *L. chilensis chilensis*. Fig. 63. *L. chilensis concaviusculus*.



FIGS. 64–67. Aedeagi, lateral view. Fig. 64. *Leptoglossus cinctus*. Fig. 65. *L. harpagon*. Fig. 66. *L. rubrescens*. Fig. 67. *L. ingens*, Ant D Lo, anterior distal lobe; L D Lo, lateral distal lobe; M Lo, median lobe; Prox Lo, proximal lobe; Dors Sac, dorsal sac; Gon Pr, gonoporal process; Hel Proc, helical process; Dors Lat App, dorso-lateral appendage; Ph, phallosoma.

accomplished, there is no reason to revive or establish monotypic genera based on a few bizarre external characters.

SPECIES GROUPS

The aedeagus and the color patterns have been used to establish species groups. Some species and groups of species may not be natural units, nor related to one another to the same degree as other groups. These groups, in turn, have been assembled into two major divisions based on the conformation of the dorsal sac on the conjunctiva. Within these two divisions, I have discussed the closely related species as species groups.

DIVISION A

Comprised of 13 species which have the dorsal sac of the conjunctiva without a sclerotized anterior distal lobe (Figs. 64–66), and which, with the exception of *dilaticollis* and *fulvicornis*, lack the small piceous spots on the venter. Members of this division are more diverse than the species in Division B.

Cinctus Group—This group includes *cinctus* (Herrich-Schaeffer), *fasciatus* (Westwood), and *crassicornis* (Dallas), and is characterized by the presence of six yellow spots on each side of the thoracic pleura, a yellow spot on the last abdominal tergum (frequently absent in females), lanceolate tibial dilations, and the aedeagus (Fig. 64) with two pairs of widely separated medial lobes.

Harpagon Group—This group includes two "pairs" of species each pair only distantly related to the other. *L. harpagon* (Fabricius) and *flavosignatus* Blöte are characterized by the presence of two yellow spots each, on the disk and posterior margin of the pronotum, two spots on the corium, and six yellow spots on each side of the thoracic pleura. The dorsal sac of the conjunctiva (Fig. 65) is unsclerotized, and bears three large proximal lobes. The tibial dilations are short and not deeply emarginate. *L. lineosus* and *subauratus* are characterized by having two pale longitudinal fascia on each side of the thoracic pleura, strongly contrasting pale veins on the clavus and corium, and lanceolate outer tibial dilations (Fig. 60).

The species pairs are grouped primarily on the shape of the clasper (Figs. 7–8) and the capsules (Figs. 32–33). In both groups the clasper has the inner margin of the shank deeply scooped out and the posterior dorsal margin of the capsule is greatly produced backwards. In addition, the dorso-lateral appendage of the conjunctiva is long and heavily sclerotized. The declivous anteocular portion of the head is conspicuously evident in *lineosus* and *subauratus*, but there is only a slight indication of this in *harpagon* and *flavosignatus*.

L. alatus also belongs to this group and most closely resembles *lineosus* and *subauratus* because of the declivent anteocular portion of the head. However, the shape of the pronotum (Fig. 5) and the color is so strikingly different that it is obviously a highly derived species.

Dilaticollis Group—This is probably an artificial grouping composed of *fulvicornis*, *rubrescens*, and *dilaticollis*. All three species have the clasper with the base broad, the inner basal lobe obsolete and the shank without a median lobe. *L. fulvicornis* and *dilaticollis* have a long unsclerotized dorsal sac whereas in *rubrescens* it is short. The various lobes on the dorsal sac and the shape of the dorsal margin on the capsule are all quite different. This group shares in common the presence of a yellowish longitudinal stripe on the abdominal dorsum, a rugulose-like pronotal surface, dentate pronotal margins, and lanceolate tibial dilations. Both *fulvicornis* and *dilaticollis* have small piceous spots on the venter as do members in Division B, but the importance of this character as an indication of relationships is difficult to assess, since the aedeagi are so different.

Australis Group—*L. australis* and *gonagra* are the only members of this group and are characterized by the presence of a pale arcuate transverse fascia on the pronotal disk and pale longitudinal vittae on the abdominal venter. The similar base on the clasper and the simple dorsal sac on the conjunctiva with only two short median lobes near the apex suggest that *fulvicornis* is somewhat related, but as mentioned in the previous group, these species are rather specialized members of this genus.

DIVISION B

This Division contains the largest number of species, and on the whole is a rather uniform complex. The twenty-four species included here may be characterized as follows: a distinctive aedeagus with the dorsal sac of the conjunctiva (Fig. 67) bearing low rounded usually sclerotized proximal lobes, a pair of median lobes which may have secondary appendages, and usually bearing sclerotized distal lobes of which one is larger and anterior to the sclerotized smaller more laterally placed lobes. With few exceptions the thoracic and abdominal venter is mottled with numerous small piceous spots.

Chilensis Group—Members of this group lack the transverse fascia on the corium, have a short labium usually extending to between the meso- and metasterna, serrate to dentate lateral pronotal margins, and a genital capsule without dorsal prongs. Species in this group are *chilensis*, *impictus*, *quadricollis*, and *dentatus*.

Stigma Group—This group of species possesses a genital capsule with dorsal prongs (Figs. 40–43), claspers with both the inner basal

lobe and the median lobe on the shank well developed, usually a long labium, conspicuously phylliform dilations, and a transverse fascia which, when present is irregular. Most of the members are of medium size. Included species are *stigma*, *zonatus*, *concolor*, *impictipennis*, *neovexillatus*, *ingens*, *macrophyllus*, *oppositus*, *grenadensis*, *conspersus*, *lonchoides*, *pallidivenosus*, and *humeralis*. Within this group *ingens* and *macrophyllus* are most closely allied and have a long outer tibial dilation, a "V" shaped median notch on the genital capsule, and low dorsal prongs. *L. zonatus*, *neovexillatus*, and *impictipennis* have similar genitalia and two rounded spots on the pronotum. *L. grenadensis* and *conspersus* also possess pronotal markings, but differ from the last three species in that the anterior distal lobe on the dorsal sac is larger and more heavily sclerotized, and the inner basal lobe on the clasper is longer (Fig. 20). The clasper of *oppositus* and *stigma* is very similar to that of *zonatus* and its relatives, although *oppositus* and *stigma* do not have pronotal markings.

L. concolor and *pallidivenosus* lack dorsal prongs on the capsule. Nevertheless, the structure of the dorsal sac and the general habitus clearly ally these species with the other members of the *stigma*-group (see discussion under the individual species).

L. lonchoides apparently belongs to this group, despite external differences, because of similarities in the genitalia to that of *zonatus*. Although males of *humeralis* were not available, this species will probably prove to belong to this group on the basis of the long labium and phylliform tibial dilations.

Phyllopus Group—*L. phyllopus* and *balteatus* are included here and this group is characterized by a straight transverse fascia on the corium, low rounded dorsal prongs on the capsule (Fig. 51), a clasper (Fig. 25) without a median lobe, and a poorly developed inner basal lobe. These two species are close to the *stigma*-group in general habitus.

Corculus Group—Externally these species are very similar to one another, with the same general color pattern, broadly rounded humeral angles, a gradually declivent pronotum, an irregular transverse fascia, and lanceolate tibial dilations. The group includes three North American species *corculus*, *clypealis*, and *occidentalis*. The clasper (Figs. 26–28) and capsule (Figs. 46–48) of the species differ, but the aedeagi are essentially the same. The clasper of *clypealis* is similar to that of *zonatus*, and there is an indication of dorsal prongs on the capsule. The shape of the pronotum and the tibial dilation of the *corculus*-group resemble *lonchoides*, so that there seems to be a definite link in both genitalia and general habitus to the *stigma*-group.

The remaining two species in this Division are *ashmeadi* and

brevirostris, both appearing to be derived members of the *stigma*-group. These two species share in common an irregular transverse fascia; a short labium, extending between the meso- and metacoxae; small size, and, on the dorsal sac, a sclerotized area near the larger median lobe. *L. ashmeadi* has small dorsal prongs on the capsule, but the short labium, orange and black pigmentation, and the lack of numerous small piceous spots on the venter rather isolates this species from *brevirostris* and the *stigma* group. *L. brevirostris* on the other hand, resembles a diminutive *stigma* or *concolor*, but has a rounded median notch and obsolete dorsal prongs on the genital capsule.

KEY TO SPECIES OF *Leptoglossus*

1. Thoracic pleura dark with at least three, usually more, strongly contrasting yellowish maculae (about the size of an eye), or yellowish maculated fasciae; thoracic and abdominal venter without numerous small piceous spots ... 34
   Thoracic pleura orange to dark reddish brown without strongly contrasting yellowish markings; thoracic and abdominal venter usually with numerous small piceous spots ... 2
2. Width across humeri 5.5 to 6 times width across anterior pronotal margin; large species, length 26–39 mm ... 3
   Width across humeri at most 5 times width anterior pronotal margin; smaller species less than 25 mm in length ... 4
3. Pronotum with humeral areas produced as large, broadly rounded anteriorly curving processes; corium with a straight transverse fascia; hind tibiae with outer dilations lanceolate (Fig. 1) ... *dilaticollis* Guerin (p. 79)
   Pronotum with humeral areas produced into long, gradually tapering projections; corium without a transverse fascia; hind tibiae with outer dilations distinctly phylliform ... *humeralis* n. sp. (p. 126)
4. Transverse fascia on corium always present and straight ... 5
   Transverse fascia on corium irregular, not straight; or fascia absent ... 8
5. Dorsum piceous; all marginal areas of pronotum continuously and widely yellowish orange ... *ashmeadi* Heidemann (p. 134)
   Dorsum reddish brown; at most only the posterior marginal area of the pronotum yellowish ... 6
6. Anterior pronotal disk with a yellowish transverse rectangular band; inner tibial dilation considerably shorter

than outer, occupying 65–70% the length of outer dilations ..... *macrophyllus* Stål (p. 104)

Anterior pronotal disk concolorous or with two longitudinally ovoid spots; inner tibial dilations slightly shorter than outer, occupying 85–90% the length of outer dilations 7

7. Humeral angles acuminate, acute and obliquely ascending; pronotal disk with contrasting yellow areas in the form of distinctly separated ovoid spots or larger more quadrate spot partially fusing medially, posterior marginal area of pronotum yellow; hind wings unicolorous (West Indies) ..... *balteatus* (Linnaeus) (p. 97)

Humeral angles more rounded, subacute; pronotum concolorous, disk rarely with yellowish areas (if yellow areas are present, they are poorly defined, more diffused and dull), posterior marginal area of pronotum never yellow; hind wings with basal half dark, distal half clear (North and Central America). ..... *phyllopus* (Linnaeus) (p. 100)

8. Pronotum with lateral and postero-lateral margins serrate or dentate 9

Pronotum with lateral margins entire; postero-lateral margins serrate, dentate, or entire 18

9. Clavus and corium dark with strongly contrasting pale veins, a pale transverse fascia, or only two large pale maculae ... 10

Clavus and corium without strongly contrasting pale markings, usually unicolorous 12

10. Humeral areas produced as large broadly rounded lateral projections; pronotum piceous with a wide orange band on disk; corium with two large pale maculae (Fig. 5) ..... *alatus* (Walker) (p. 71)

Humeral areas produced as tapering lateral projections not broadly rounded; pronotal disk unicolorous; corium with a pale irregular transverse fascia 11

11. Labium short extending at most to middle of metasternum; posterior marginal area of pronotum concolorous with disk or slightly darker, never pale; small species less than 16 mm in length (North America) ..... *brevirostris* Barber (p. 133)

Labium longer extending to at least anterior margin of second abdominal sternum; posterior marginal area of pronotum pale, strongly contrasting with remainder of disk; larger species, 20 mm or more in length (Fig. 4) (Panama) ..... *pallidivenosus* n. sp. (p. 128)

12. Labium long, extending to at least middle of third abdominal sternum; entire dorsum unicolorous dark reddish brown; abdominal dorsum piceous with a yellow median longitudinal stripe the width of scent gland scars 13

Labium shorter rarely extending to posterior margin of second abdominal sternum (usually to middle of metasternum); dorsum with at least some dark and lighter areas; abdominal dorsum unicolorous or with lateral areas yellow but never with a central yellow longitudinal stripe 14

13. Pronotal humeral area broadly rounded with humeral angles blunt, non-acute (North America) ..... *fulvicornis* (Westwood) (p. 78)

Pronotal humeral area expanded into large gradually tapering projections, humeral angles acute (Brazil) ..... *rubrescens* (Walker) (p. 76)

14. Entire length of lateral pronotal margins with well developed teeth; a single large rounded piceous macula (about the size of an eye) on mesopleuron; abdominal dorsum mesally dark with lateral areas largely yellow ..... *dentatus* Berg (p. 95)

Anterior half of pronotal lateral margins entire, only the posterior half serrate; mesopleuron with at most small piceous maculae (about the size of an ocellus); abdominal dorsum without yellowish areas 15

15. Male genital capsule with prominent dorsal prongs (Fig. 43); anterior half of corium with conspicuously less pubescence than posterior half, this pubescence very dense on veins; hind tibiae with width of outer dilations equal to or greater than width of head ..... *impictipennis* Stål (p. 116)

Male genital capsule without dorsal prongs; pubescence evenly distributed over clavus and corium, if pubescence more dense on posterior half of corium then hind tibiae with width of outer dilations subequal to interocular distance 16

16. Wider more robust species, total length less than 2.5 times width across humeri; dorsal surface of male hind femora with 15–20 prominent tubercules ..... *impictus* (Stål) (p. 91)

Narrower more elongate species, total length greater than 2.5 times width across humeri; dorsal surface of male hind femora with at most 10 prominent tubercules 17

17. Fourth antennal segment averaging 1.2 times width of head; hind tibiae (Fig. 62) with outer dilations narrower and

shorter occupying 62–71% the length of hind tibiae; entire venter usually with numerous small piceous spots ..... *chilensis chilensis* (Spinola) (p. 85)

Fourth antennal segment averaging 1.5 times width of head; hind tibiae (Fig. 63) with outer dilations wider and longer, occupying 71–80% the length of hind tibiae; numerous small piceous spots usually confined to abdominal midventer ..... *chilensis concaviusculus* Berg (p. 88)

18. Hind tibial dilations lanceolate, without deep emarginations along outer margins (Figs. 57–59, 61) 19

Hind tibial dilations conspicuously phylliform with at least one (usually more) deep emargination (Figs. 55–56) .. 22

19. Tylus extending beyond juga as a porrect spine which is as long as, or longer than, length of an eye; broad irregular transverse fascia on corium ..... *clypealis* Heidemann (p. 132)

Tylus rounded or pointed apically, but never spinosely produced; transverse fascia on corium narrow, confined to veins or absent 20

20. Labium short, reaching at most to middle of third abdominal sternum, third labial segment never extending beyond anterior margin of metasternum; pronotal lateral margins straight, humeral angles acute (Brazil) ..... *lonchoides* n. sp. (p. 124)

Labium long, reaching well onto abdomen, at least to the anterior margin of fourth abdominal sternum, third labial segment extending to at least posterior margin of metasternum; pronotal lateral margins sinuate, humeral angles broadly rounded (North America) 21

21. Inner and outer tibial dilations of nearly equal length, dilations shorter, occupying less than 70% length of hind tibia (Fig. 58) ..... *occidentalis* Heidemann (p. 131)

Inner and outer tibial dilations not of equal length, outer dilations conspicuously longer than inner and occupying 85% or more length of hind tibia (Fig. 57) ..... *corculus* (Say) (p. 130)

22. Hind tibiae with outer dilations very long extending for 85–95% length of tibiae and inner dilations much shorter occupying 55–70% length of outer dilations (Fig. 55) .. 23

Hind tibiae with outer dilations shorter occupying 80% or less length of tibiae and inner dilations only slightly shorter than outer dilations 24

23. Dorsum light reddish brown; anterior portion of pronotal disk with a yellowish rectangular transverse band not

reaching lateral margins ..... *macrophyllus* Stål (p. 104)
Dorsum piceous to dark reddish brown; pronotal disk unicolorous or the entire anterior half of pronotum before humeri yellow ..... *ingens* (Mayr) (p. 102)

24. Pronotum dark without strongly contrasting yellowish and dark areas (specimens of *quadricollis* may have an entirely yellow pronotum) 25
Pronotum with strongly contrasting yellowish and dark areas 29

25. Labium short, not extending past metasternum; fourth labial segment shorter than first antennal segment 26
Labium longer, usually extending well onto abdomen, at least past the posterior margin of second abdominal sternum; fourth labial segment longer than first antennal segment 27

26. Transverse fascia on corium present (occasionally very faint); tibial dilations short, occupying 70% or less length of hind tibiae (North America) ... *brevirostris* Barber (p. 133)
Transverse fascia on corium absent; tibial dilations longer, occupying 75–80% length of hind tibiae (Fig. 56) (Brazil) ..... *quadricollis* (Westwood) (p. 93)

27. Postero-lateral margins of pronotum entire; first antennal segment unicolorous; transverse fascia on corium reduced to a short oblique mark on medial vein ..... *oppositus* (Say) (p. 123)
Postero-lateral margins of pronotum serrate; first antennal segment bicolored with a pale inner marginal area; transverse fascia on corium complete (rarely entirely absent) 28

28. Pronotal calli with a rough surface texture, numerous dark thick hairs interspersed with pale hairs on anterior pronotal disk; male genital capsule with a rectangular median notch, no dorsal prongs (Fig. 44) *concolor* (Walker) (p. 118)
Pronotal calli smooth, pale pilose hair only on anterior pronotal disk; male genital capsule with a rounded median notch, dorsal prongs present ..... *stigma* (Herbst) (p. 120)

29. Dorsum piceous; all marginal areas of pronotum continuously and widely yellowish-orange; venter largely bright orange with few small piceous maculae ..... *ashmeadi* Heidemann (p. 134)
Dorsum dark reddish brown; pronotal disk with yellowish areas, or posterior marginal area yellow but never all margins of pronotum continuously yellow; venter tan with numerous small piceous spots 30

30. Second antennal segment entirely fuscous; pronotum with

two large diffuse yellowish-orange areas occupying most of disk and anterior half of humeral area; pronotum behind humeri dark, without contrasting pale area ..... *conspersus* Stål (p. 106)

Second antennal segments bicolored with medial portion pale and the remaining areas dark; pronotal disk with two distinctly round spots or, the posterior disk and the area behind humeri are pale yellow 31

31. Anterior portion of pronotal disk without two distinct pale round spots (Greater Antilles) ... *concolor* (Walker) (p. 118)

Anterior portion of pronotal disk with two distinct pale round spots 32

32. Posterior marginal area of pronotum with a narrow yellowish band strongly contrasting with adjacent darker areas; lateral margins of pronotum nearly straight (Fig. 3) (Lesser Antilles) ..... *grenadensis* n. sp. (p. 108)

Pronotal area behind humeri concolorous without pale areas; lateral margins of pronotum sinuate 33

33. Left median lobe on dorsal sac of aedeagus long, without a secondary lobe; transverse fascia on corium, if present, narrow, confined to veins ..... *neovexillatus* n. sp. (p. 113)

Left median lobe on dorsal sac of aedeagus blunt and with a long secondary lobe; transverse fascia rarely absent, and usually wide, on both corium and veins ..... *zonatus* (Dallas) (p. 110)

34. Clavus and corium dark brown with strongly contrasting pale yellow or ochraceous veins 35

Clavus and corium dark, veins usually concolorous or at most bright red, but never pale yellow or ochraceous ... 36

35. Pronotum with an ochraceous transverse fascia between humeri narrow, approximately width of fore femora; first antennal segment unicolorous, piceous; remaining segments bicolored with strongly contrasting pale and dark areas ..... *lineosus* (Stål) (p. 73)

Pronotum with an ochraceous transverse fascia between humeri wide, covering most of anterior portion of disk; all antennal segments unicolorous, pale ochraceous ..... *subauratus* Distant (p. 75)

36. Pronotal disk with a narrow arcuate pale transverse fascia; thoracic pleura with 10 to 12 pale maculae on each side; abdominal venter with six to seven complete or maculated longitudinal fasciae 37

Pronotal disk without a narrow transverse fascia, usually

unicolorous or with round spots; thoracic pleura never with more than six yellowish maculae on each side; abdominal venter without longitudinal fasciae 38

37. Hind tibiae with outer dilations extending for 85–90% the length of tibiae (Fig. 54); abdominal dorsum with two yellowish spots on scent gland scars (Western Hemisphere) ..... *gonagra* (Fabricius) (p. 84)

Hind tibiae with outer dilations shorter, extending for at most 75% the length of tibiae (Figs. 52–53); abdominal dorsum unicolorous without yellowish spots (Eastern Hemisphere ..... *australis* (Fabricius) (p. 81)

38. Pronotum with four small yellowish spots, two on anterior disk and two on posterior marginal area; lateral margins of pronotum entire, without serrations or teeth 39

Pronotum without spots, generally disk entirely yellow contrasting with remainder of pronotum and hemelytra; lateral margins of pronotum serrate 40

39. Outer tibial dilations small with shallow emarginations, width outer dilations equal to or slightly less than interocular distance; fore and middle tibiae unicolorous without a pale yellow annulus ..... *harpagon* (Fabricius) (p. 68)

Outer tibial dilations larger with deep emarginations, width outer dilations 1.5 times the interocular distance; fore and middle tibiae with a pale yellow annulus ..... *flavosignatus* Blöte (p. 70)

40. Outer tibial dilation narrow and entire, without prominent teeth or emarginations, its width 1.0 to 1.5 times width of inner dilations; length of fourth antennal segment 1.08 to 1.2 times length of third (Fig. 2) ..... *crassicornis* (Dallas) (p. 64)

Outer tibial dilations wider with one or two emarginations, its width 1.8 to 2.0 times width of inner dilations; length of fourth antennal segment 1.2 to 1.8 times length of third 41

41. Thoracic pleura with a single yellow maculae occupying almost the entire ventral third of each pleuron; outer tibial dilation occupying approximately 65% length of hind tibiae ..... *cinctus* (Herrich-Schaeffer) (p. 61)

Pro- and mesopleura with two small yellow maculae, metapleuron with one (maculae about the size of an eye or less); outer tibial dilation occupying approximately 55% length of hind tibiae ..... *fasciatus* (Westwood) (p. 66)

Leptoglossus cinctus (Herrich-Schaeffer)

Anisoscelis cincta Herrich-Schaeffer, 1836:91, fig. 315.
Theognis cincta Mayr, 1866:103.
Leptoglossus cinctus Stål, 1870:164.—Distant, 1881:125.—Lethierry and Severin, 1894:47.—Barber and Bruner, 1947:80.—Wolcott, 1948:197.

Pronotum behind humeri, clavus, basal two thirds of corium, fore and middle legs light brown; head piceous with lateral areas and three narrow dorsal stripes light reddish brown; entire declivous face of pronotum including lateral margins straw yellow with remainder of pronotum, scutellum, veins of clavus and corium, and apical third of corium dull wine red; apex scutellum, straight transverse fascia on corium, single maculae on inner tibial dilations whitish yellow; basal areas of each thoracic pleuron with a large bright yellow macula; first antennal segments piceous with inner margins of first, entire second, third and basal half of fourth light reddish brown; distal half of fourth segment ochraceous; thoracic and abdominal hind tibiae including dilations dull to bright wine red; abdominal dorsum piceous with central portion metallic blue-green, last tergum with a large semicircular straw yellow spot; connexivum, large portions of thoracic and abdominal venter centrally, lateral areas of hind femora, femoral teeth and tubercles piceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures smooth, pronotal punctures slightly larger and farther apart; scutellum transversely rugulose with numerous punctures; thoracic pleura with numerous small patches of dense, short, appressed whitish hairs; remainder of body and appendages with sparse short erect hairs.

Head non-declivent with tylus and juga raised above level of antenniferous tubercles, tylus blunt forming a rounded elevated ridge slightly exceeding juga, length head 2.64, width head 2.28, interocular distance 1.20, anteocular distance 1.44; pronotum gradually declivent with lateral margins serrate and straight, humeral areas not expanded or ascending, humeral angles acute, postero-lateral margins serrate, calli barely elevated, area between calli slightly higher and indistinct from calli, disk posteriorly without low median longitudinal carina, length pronotum 3.04, width across humeri 5.76, width anterior margin pronotum 1.68; length scutellum 2.52, width scutellum 2.40; labium reaching to anterior margin of third abdominal sternum, length labial segments I 2.76, II 2.52, III 1.32, IV 2.28; length antennal segments I 2.64, II 3.84, III 2.64, IV 4.32; hind tibiae with

outer dilations lanceolate with one extremely shallow emargination, occupying 66% length of hind tibiae, width about twice that of inner dilations; inner dilations lanceolate, slightly shorter than outer with numerous small spine-like teeth along entire margins; inner margins of undilated portions of hind tibiae with a double row of small spine-like teeth, length hind tibiae 9.84; length outer dilations 6.48, width outer dilations 1.80; length inner dilations 5.32, width inner dilations 0.84; total length 19.1.

Claspers (Fig. 6) with inner basal lobe broad, long, and rounded; shank thick without a median lobe, hook strongly curved; capsule (Fig. 31) with a simple deep and rounded median notch, no dorsal prongs; aedeagus (Fig. 64) with dorsal sac of conjunctiva as follows: long proximal lobes present; two pairs of median lobes present, one pair lower and laterally situated with tips barely sclerotized, other pair medially and apically situated and heavily sclerotized and spinose; distal lobes present as two broad lateral extensions of sac, unsclerotized.

The description is of a male specimen from Chapada, Brazil. All of the specimens from Cuba, Mexico, and Central America have the transverse fascia on the corium absent or reduced to a short and faint narrow mark. Also Cuban specimens have a dark brownish yellow to light brown pronotal disk, thereby giving the appearance of an almost concolorous dorsum. The above color patterns also occur in a few South American specimens. The labium varies in length extending from the anterior margin of the second to the anterior margin of the fourth abdominal sternum.

L. cinctus may be distinguished from the closely related species *fasciatus* and *crassicornis* by the following characters: outer tibial dilations broader, almost twice the width of those of *crassicornis* and longer than the outer dilations on *fasciatus*; the yellow maculae on the thoracic pleura are larger, occupying almost the entire ventral third of each pleuron; the dorsal sac of the aedeagus has the more distally placed pair of median lobes heavily sclerotized and spinose.

L. cinctus has been collected on guava fruit and *Byrsonia crassifolia* H.B.K. (Barber and Bruner, 1947), and on cactus species of the genera *Cereus* and *Opuntia* (Mann, 1969).

Distribution: A widely distributed species occurring in southern Mexico, Cuba, through Central America and most of South America.

Material Examined: MEXICO: 1♀, Rosamorada, Nayarit, VIII-4-1953, D. Rockefeller Mex. Exp. 1953 (C. & P. Vaurie); 1♀, La-Buena Ventura, Vera Cruz, 7-1909; 1♀, no data; 1♀, 10 mi. SE

Tapanatepec Oax., VIII-8-1963 (F. D. Parker, L. A. Stange); 1♀, 24 mi. west Cintalapa, Chis., VIII-12-1963 (F. D. Parker, L. A. Stange). CUBA: 2♂, 1♀, 14 K. N. of Vinales, Sept. 16–22, 1913; 1♂, same except 7 K. N. of Vinales; 1♀, same except 24 K. N. of Vinales; 1♂, Cayamas (E. A. Schwarz); 1♀, Havana (F. Z. Cervera). HONDURAS: 1♀, Dept. Morazan Esc. Agr. Pan., Zamorano, 2700 ft. (ocotal), July 2, 1948 (T. H. Hubbell 146); 1♀, same except 2600 ft. (llano), July 26, 1948; 2♀, Minas de Oro, Comay, 1-VI (4000 ft.) (J. B. Edwards); 1♂, Subirana Yoro, Jan. (Stadelmann); 1♀, same except 18-11; 1♀, La Ceiba I. de P., Sept. 1938 (Ent. No. 11014), "taken on Peralejo"; 1♂, Zamorano, IX-1953, "on guava fruit" (N. L. H. Krauss). COSTA RICA: 1♀, Pacayas (C. Werckele). PANAMA: 1♂, Amer. centr. Chiriqui. BRITISH GUIANA: 1♀, E. C. Demerara, Pln. Hope, 29-VI-1932 (F. A. Squire). FRENCH GUIANA: 1♂, Cayenne, 4-VIII-1954 (N. L. H. Krauss); 1♂, no data. VENEZUELA: 1♂, Merida. COLOMBIA: 1♂, 2♀, Bogota (Lindig); 1♀, Lake Sapatoza region, Chiriguana District, VIII-XI-1924 (C. Allen). PERU: 1♀, Vilcanota. BOLIVIA: 1♀, Rio Ivon Beni, February, Mulford Bio Expl. 1921–22 (W. M. Mann); 1♂, Prov. del Sara, CM Acc 5068, April 1913 (Steinbach); 1♀, Coroico; 1♂, Prov. Sara (Steinbach); 1♀, no data. BRAZIL: 1♂, 1♀, Chapada (2600 ft.) Nov. 1902 (A. Robert), 1903-96; 1♂, Chapada, Acc. No. 2966; 1♂, 1♀, Chapada, Acc. No. 2966, August; 2♀, same except June; 5♂, same except September; 1♂, 3♀, same except January; 3♀, same except April; 5♂, 1♀, same except March; 1♂, 4♀, same except May; 3♂, 5♀, same except November; 2♂, 4♀, same except December; 2♂, 3♀, same except October; 1♂, 1♀, Chapada Campo, Oct.; 1♀, Corumba, Acc. No. 2966, June; 1♂, 2♀, S. Paulo; 1♂, Amazon (Stevens); 1♂, 1♀, Brasilia bor.; 1♂, Cuyaba, Matto-Grosso; 1♂, Minas geraes Ouropreto, 26-12-1898; 1♀, Annapolla, Goiaz, XI-24-1936 (G. Fairchild); 1♀, Corumba, Matto-Grosso, 1950 (H. G. Barber); 1♂, Para (P. R. Uhler collection); 1♂, Corumba, Feb. PARAGUAY: 1♂, Asuncion, Sept. 1922–April 1923 (E. G. Kent), BM 1925-262. ARGENTINA: 1♂, Puerto Aguirre, Alto Parana, 11-21-III-1-1934 (K. J. Hayward), BM 1934-337; 1♀, Mendoza (H. Rolle, Berlin W.). In United States National Museum (J. C. Lutz coll.), American Museum of Natural History, Stockholm Museum, Museum of Comparative Zoology (Harvard University), Hungarian National Museum, British Museum (Natural History), Carnegie Museum, Berlin Humboldt University Museum, University of Kansas, J. A. Slater and R. C. Allen collections.

Leptoglossus crassicornis (Dallas)
(Fig. 2)

Anisoscelis crassicornis Dallas, 1852:454.
Leptoglossus crassicornis Stål, 1870:164.—Lethierry and Severin, 1894:47.

Pronotum behind humeri, clavus and basal two thirds of corium fuscous; head piceous; declivous face of pronotum straw yellow with anterior margins including calli, lateral margins widely and a rather broad median longitudinal band diminishing posteriorly to opposite humeral angles bright red; head piceous; following areas bright red: head laterally, dorsally with three narrow stripes, first three antennal segments entirely, scutellum, veins of clavus and corium, and apical third of corium; transverse fascia on corium straight, abbreviated not surpassing medio-cubital crossveins laterally, apex scutellum, inner tibial dilations with a single maculae whitish yellow; ventral area of pro- and mesopleura with two and metapleura with one large maculae bright yellow; fore and middle legs, undilated portion of hind tibiae, and punctation on pronotal disk light brown to ochraceous; hind femora and tibial dilations dark reddish brown to fuscous with teeth and tubercles piceous; thoracic and abdominal venter variegated bright red and fuscous; connexivum and abdominal dorsum piceous with anterior portions of connexival segments and last abdominal tergum with a single large rounded spot whitish yellow; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures smooth, pronotal punctations slightly larger and farther apart; scutellum transversely rugulose with few punctures; body moderately and appendages more densely covered with short erect, semi-decumbent pale hairs.

Head non-declivent, both tylus and juga raised above level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge slightly exceeding juga, length head 2.76, width head 2.40, interocular distance 1.20, anteocular distance 1.44; pronotum gradually declivent, lateral margins straight with few extremely small teeth, almost entire, humeral areas not expanded or ascending, humeral angles acute, postero-lateral margins entire, calli barely elevated, area between calli slightly higher and indistinct from calli, disk posteriorly with the low median longitudinal carina obsolete, length pronotum 3.04, width across humeri 5.60, width anterior margin of pronotum 1.68; length scutellum 2.16, width scutellum 2.28; labium reaching to middle of fifth abdominal sternum, length labial segments I 3.60, II 3.48, III 1.80, IV 3.72; length antennal segments I 2.76, II 5.28, III 2.88, IV missing; hind tibiae with outer dilations lanceolate,

entire, occupying 71% length of hind tibiae, very narrow, about 1.2 times width of inner dilations; inner dilations lanceolate, slightly shorter than outer, with numerous small spine-like teeth along margins; inner margins of undilated portions with a double row, dorsal margins for entire length of hind tibiae with a single row of numerous small spine-like teeth, length hind tibiae 10.1; length outer dilations 7.20, width outer dilations 0.72; length inner dilations 6.00, width inner dilations 0.60.

Claspers and capsule as in *cinctus*; aedeagus with dorsal sac of conjunctiva as follows: without proximal lobes; two pairs of median lobes present, one pair lower and laterally situated with a small lobe arising from bases of each and tips barely sclerotized, the other pair medially and apically situated, unsclerotized; distal lobes present as two broad lateral extensions of sac, unsclerotized; dorso-lateral appendage appressed to wall of conjunctiva; total length 17.6.

The above description is of the male holotype. Unfortunately, the fourth antennal segments are missing, but Dallas (1852) stated that the second segment was as long as the third and fourth combined, and the fourth was as long as the third; and that the fourth segment was pale brown with the apex yellow.

I have tentatively identified a large series of specimens from South America as *crassicornis* primarily on the basis of identical hind tibial dilations, the close similarity of the genitalia, and the shortness of the fourth antennal segments. The following are differences exhibited in the series from the holotype: the pronotal lateral margins are generally prominently serrate, although a few individuals do approach the condition found in the type; the combined length of antennal segments three and four is about 1.5 times the length of the second, and length of the fourth antennal segment is 1.08 to 1.20 times that of the third; the humeral angles are not so acute; there are no traces of red on the lateral margins or centrally as a longitudinal band on the pronotum, nor are any of the red areas present as bright as are those on the holotype. Due to the lack of specimens from Bolivia northward to Colombia (the type locality), I do not feel justified in establishing a new species for the southern population at this time. This population has in the past been confused with *fasciatus*.

L. crassicornis may be distinguished from both *cinctus* and *fasciatus* by the narrower tibial dilations and the shorter fourth antennal segments. The aedeagal differences are: from *cinctus*, the absence of proximal lobes and unsclerotized medial lobes; and from *fasciatus*, the close appression of the dorso-lateral appendage to the wall of the conjunctiva.

Distribution: Bolivia, Uruguay, Paraguay, and Argentina. The only Colombian record is of the male holotype.

Material Examined: Holotype: ♂. COLOMBIA. In the British Museum (Natural History). BOLIVIA: 1♂, Cochabamba, III-25-1950 (L. Pena); 1♂, N.E. Cochabamba, II-24-1950 (L. Pena). URUGUAY: 1♀, Pinapolis, I-25 (Doot). PARAGUAY: 1♂, no data (Berg). ARGENTINA: 3♂, 2♀, Cordoba (W. M. Davis); 1♂, Chilecito, La Rioja; 1♂, Campo del Cielo, I-1934 (J. M. Bosq); 2♂, Poso Moza, Formosa, 2-2-1937 (Denier); 1♂, 1♀, Ing. Juares, Formosa, 18-V-1939 (Denier); 4♂, 1♀, Sgo. del Estero, Rio Salado (Wagner); 4♂, 1♀, Andalgala, Catamarca, 3-III-1939 (Biraben-Scott); 1♂, same except 23-III-1939; 1♀, Hualfin, Catamarca 5-III-1939 (Biraben-Scott); 3♂, 3♀, Mendoza; 1♀, same except (Berg); 1♂, 1♀, Mendoza Parque, III-1940 (J. M. Bosq). In United States National Museum, La Plata Museum, Museum of Comparative Zoology (Harvard), J. A. Slater and R. C. Allen collections.

Leptoglossus fasciatus (Westwood)

Anisoscelis fasciata Westwood, 1842:17.
Theognis fasciatus Mayr, 1866:102.
Leptoglossus fasciatus Stål, 1870:164.—Lethierry and Severin, 1894: 47.

Pronotum, scutellum, clavus and corium fuscous; head piceous with lateral areas and above with three narrow stripes light reddish brown; entire declivous face of pronotum, antennae, fore and middle legs, and undilated portion of hind tibiae straw yellow to ochraceous; veins of clavus and corium, and apical third of corium dull wine red; basal portion of third antennal segment, apex scutellum, straight transverse fascia on corium, and a single maculae on inner tibial dilations whitish yellow; pro- and mesopleura with two and metapleuron with one bright yellow maculae; hind femora and tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter variegated dark reddish brown and fuscous; connexivum and abdominal dorsum piceous with a slight tinge of metallic green around scent gland scars; anterior portion of connexival segment and a semicircular spot on last abdominal tergum whitish yellow; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures smooth, with pronotal punctures slightly larger and farther apart; scutellum transversely rugulose with numerous punctures; body and appendages with moderate amounts of short erect and appressed pale hairs.

Head non-declivent with both tylus and juga raised above level

of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge slightly exceeding juga, length head 2.64, width head 2.16, interocular distance 1.20, anetocular distance 1.44; pronotum gradually declivent, lateral margins straight and prominently serrate, humeral areas not expanded and barely ascending, humeral angles subspinose, postero-lateral margins serrate, calli barely elevated, area between calli slightly higher with two low tubercles, disk posteriorly with low median longitudinal carina absent; length pronotum 2.72, width across humeri 5.44, width anterior margin pronotum 1.68; length scutellum 1.92, width scutellum 2.04; labium reaching to posterior margin of fourth abdominal sternum, length labial segments I 3.36, II 3.16, III 1.68, IV 3.00; length antennal segments I 2.76, II 5.04, III 3.24, IV 4.08; hind tibiae with outer dilations lanceolate with two very shallow emarginations, occupying 55% length of hind tibiae, width about twice that of inner dilations; inner dilations lanceolate, slightly shorter than outer, with numerous small spine-like teeth along margins; inner margins of undilated portion with a double row and dorsal margin for the entire length of hind tibiae with a single row of numerous small spine-like teeth, length hind tibiae 10.8; length outer dilations 6.00, width outer dilations 1.20; length inner dilations 4.80; width inner dilations 0.60.

Claspers and capsule as in *cinctus*; aedeagus with dorsal sac of conjunctiva as follows: without proximal lobes; two pairs of median lobes present, one pair lower and laterally situated with a small lobe arising from the bases of each, tips barely sclerotized, the other pair medially and apically situated and unsclerotized; distal lobes present as two broad lateral extensions of sac and unsclerotized; dorso-lateral appendage of conjunctiva more lobate and not closely appressed to wall of conjunctiva, extending posteriorly; total length 16.0.

I have determined the material at hand on the basis of drawings and comparative notes of the holotype which were made possible through the kindness of Dr. I. Lansbury of the University of Oxford Museum. The description is of a male specimen from Macahe, Brazil.

The longer and more acute humeral angles and shorter tibial dilations will distinguish *fasciatus* from both *crassicornis* and *cinctus*. From *cinctus*, *fasciatus* is further distinguished by the generally longer labium, dark reddish brown to fuscous dorsum, smaller maculae on the thoracic pleura and the absence of a heavily sclerotized spinose medial lobe on the dorsal sac of the aedeagus. Additional characters that further separate *fasciatus* from *crassicornis* are: the longer fourth antennal segments, 1.3 to 1.4 times the length of the

third and the large lobate dorso-lateral appendage extending from the conjunctiva.

Bosq (1940) reported *fasciatus* common on *Baccharis* and as feeding on cactus, although these host plant records from Argentina probably pertain to the southern population of *crassicornis*. In the material examined, there are three males from Macahe, Brazil, that were collected on cactus fruits.

Distribution: The recorded distribution includes Argentina, but I believe this to be based on misidentified specimens of *crassicornis*. In a large series of *Leptoglossus* species from the La Plata Museum, there was not a single specimen of *fasciatus*. So far, I have seen only five specimens, all from Brazil.

Material Examined: BRAZIL: 3♂, Macahe, Dec., 1928, "on cactus fruit" (E. Mortensen); 1♀, 1905-100 (Fry); 1♀, Rio de Jan., Nov, Acc. No. 2966. In the Carnegie Museum, British Museum (Natural History), and United States National Museum.

Leptoglossus harpagon (Fabricius)

Cimex harpagon Fabricius, 1775:101.
Cimex harpator Gmelin, 1788:2188.
Lygaeus harpagon Fabricius, 1794:146.
Anisoscelis sexmaculata Stål, 1859:458.
Theognis erythrinus Mayr, 1865:434.—Mayr, 1866:105, fig. 24.
Leptoglossus harpagon Stål, 1870:165.—Lethierry and Severin, 1894: 47.—Blöte, 1936:28.

Head, pronotum, scutellum, clavus and corium uniformly dark reddish brown with two wide piceous stripes on head; pronotal disk anteriorly, submarginal area of posterior pronotal lobe and mediocubital crossvein area of corium each with two dark to whitish yellow round spots; apex scutellum whitish yellow; antennal segments, legs including tibial dilations dark reddish brown, the latter with teeth and tubercles piceous; thoracic pleura dark reddish brown with the following large shining orange yellow maculae: each pleuron with one distinct but poorly defined macula above coxal cavity, propleura with two maculae on posterior marginal area, mesopleura with one dorsal spot on posterior margin; abdominal venter light to dark ochraceous; connexivum and abdominal dorsum piceous with margins and anterior third of each connexival segment and two round spots on scent gland scars yellowish orange; membrane uniformly dark; pronotum coarsely and closely punctate, surface above punctations uneven; clavus and corium closely and more finely punctate; scutellum transversely rugulose with few punctures; body and appendages moderately

covered with short appressed and erect pale hairs, head below and thoracic mid-venter densely covered with thicker grayish hairs.

Head non-declivent with both tylus and juga raised slightly above level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge slightly exceeding juga, length head 2.04, width head 2.16, interocular distance 1.08, anteocular distance 1.08; pronotum gradually declivent with lateral margins slightly sinuate and entire, humeral areas not expanded or ascending, humeral angles subacute, posterolateral margins entire, posterior pronotal disk with an obvious low median longitudinal carina, pronotal calli prominently elevated, raised area between calli with two obscure small tubercles, length pronotum 2.24, width across humeri 4.16, width anterior margin pronotum 1.56; length scutellum 1.92, width scutellum 1.68; labium extending to posterior margin of third abdominal sternum, length labial segments I 2.04, II 1.92, III 1.20, IV 2.04; length antennal segments I 1.56, II 2.88, III 2.16, IV 3.24; hind tibiae with outer dilations slightly phylliform with two shallow emarginations, occupying 67% length of hind tibiae, and about one and a half times width of inner dilations; the latter lanceolate, slightly shorter than outer dilations and armed with a few small spine-like teeth; inner margins of undilated portion of hind tibae without small spine-like teeth, length hind tibiae 5.76; length outer dilations 3.84, width outer dilations 0.84; length inner dilations 3.24, width inner dilations 0.60; total length 13.9.

The above description is based on the female holotype of *L. sexmaculatus* (Stål). The Fabricius type of *harpagon* was not seen. The following description of genitalia is of a male specimen from Corupa, S. Cath. Brazil.

Claspers (Fig. 7) with inner basal lobe very low; hook and shank not differentiated but forming a scooped out blade which curves inward rather sharply at tip; capsule (Fig. 32) with deep median notch and strong dorsal prongs, entire posterior edge greatly produced backwards over curvature of capsule; aedeagus (Fig. 65) with dorsal sac of conjunctiva as follows: three large unsclerotized proximal lobes; medial portion of sac without lobes; distal end of sac with a large blunt posteriorly directed area and two smaller antero-lateral lobes, all unsclerotized.

I have based the description of *harpagon* on Stål's *sexmaculatus* which he himself synonymized. Stål also synonymized Mayr's *erythrinus*, the description of which resembles in every respect Blöte's *flavosignatus*. At present, I feel it is best to treat Blöte's species as valid until both the type of *harpagon* and *erythrinus* can be examined.

Unfortunately, I was unable to associate any male specimens with *flavosignatus* so that the differentiation of these two species is based

only on females. I have before me a number of individuals which are related closely to these species, but possess a number of differentiating characters, especially in the shape of the tibial dilation and the male genitalia. I do not feel it desirable to describe additional species until a larger series of specimens can be definitely associated with the types, in order to evaluate correctly any variation.

The two species may be separated by the following characters: *harpagon* has a smaller tibial dilation, the width being slightly less than, or equal to, the interocular distance, in *flavosignatus* the width of the outer dilation is at least 1.5 times the interocular distance; the fore and middle tibiae have a pale yellow annulus and the dorsum has light and dark areas in *flavosignatus*, while in *harpagon* both the tibiae and dorsum are unicolorous. There is also considerable difference in the size and shape of the corial spots and in overall size between these two species.

Distribution: Brazil.

Material Examined: Holotype, ♀ of *L. sexmaculatus*, Stål. In Stockholm Museum. BRAZIL: 1♂, Parana, 1905-163 (E. D. Jones); 1♂, Corupa, S. Cath., Nov. 1948 (A. Maller). In British Museum (Natural History) and American Museum of Natural History.

Leptoglossus flavosignatus Blöte

Leptoglossus flavosignatus Blöte, 1936:28.

Pronotum, scutellum, clavus and corium dark reddish-brown and fuscous with humeri and posterior submargin of pronotum entirely fuscous; head above and below piceous; pronotal disk with two large longitudinally ovoid spots, submarginal area with two smaller transversely ovoid spots, corium with two large somewhat rectangular spots bright yellowish orange; head striped laterally and with three short narrow stripes above; apex scutellum, median annulus on fore and middle tibiae, undilated portion of hind tibiae, and maculae on inner tibial dilation whitish yellow to ochraceous; all antennal segments, fore and middle legs, basal three fourths and ventral portion of hind femora light to dark reddish brown; tibial dilations and distal portion of hind femora fuscous with teeth and tubercles piceous; thoracic pleura dark reddish brown, with following areas having large strongly contrasting bright yellowish orange spots: each pleuron with one spot above coxal cavity, propleuron with two spots on posterior marginal area, mesopleuron with one dorsal spot; abdominal venter variegated castaneous to fuscous with anterior lateral margins of each sterna whitish yellow; connexivum and abdominal dorsum piceous with anterior half of each connexival segment and a round

spot on each scent gland scar whitish yellow; membrane uniformly dark; pronotum coarsely and closely punctate, surface above punctation uneven; clavus and corium closely and more finely punctate; scutellum transversely rugulose and densely punctate, venter densely clothed with short appressed thick grayish hairs; dorsum and appendages with short, and hind tibiae with longer, erect pale hairs.

Head before eyes slightly declivent with tylus and juga barely below level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge, slightly exceeding juga, length head 2.40, width head 2.52, interocular distance 1.20, anteocular distance 1.20; pronotum abruptly declivent with disk tumid laterally, forming a noticeable wide trough medially, lateral margin entire and strongly sinuate, humeral areas barely expanded with humeral angles acute and not ascending, postero-lateral margins entire, the median low longitudinal carina on disk prominent, calli highly raised and area between calli with two low tubercles, length pronotum 3.20, width across humeri 5.60, width anterior margin pronotum 2.04; length scutellum 2.52, width scutellum 2.40; labium extending to posterior margin of third abdominal sternum, length labial segments I 2.64, II 2.40, III 1.32, IV 2.52; length antennal segments I 2.40, II 4.08, III 3.00, IV 4.80; hind tibiae with outer dilations phylliform with two deep emarginations, occupying 68% length of hind tibiae, width outer dilations slightly less than twice that of inner dilations; inner dilations lanceolate slightly shorter than outer dilations with distal margins possessing a few small spine-like teeth; inner marginal area of undilated portion of hind tibiae without small spine-like teeth; length hind tibiae 9.00; length outer dilations 6.12, width outer dilations 2.04; length inner dilations 5.76, width inner dilations 1.2; total length 17.9.

For diagnostic characters see discussion under *harpagon*.

Distribution: The holotype is without locality data, but the one additional specimen examined is from Peru.

Material Examined: Holotype: ♀, Cat. No. 7. In Leiden Museum. 1♀, Marcapata, Peru. In Hungarian National Museum.

Leptoglossus alatus (Walker)
(Fig. 5)

Anisoscelis alatus Walker, 1871:129.
Leptoglossus alatus Lethierry and Severin, 1894:46.

Medial posterior area of pronotum, most of scutellum, clavus and corium dull black with following parts metallic purple blue: head above, all antennal segments, anterior portion of pronotum including

calli, lateral basal areas of scutellum, punctations on dark areas of dorsum, all legs and tibial dilations; pronotum with a large continuous, sharply defined orange band occupying following areas: entire pronotal disk including caudo-lateral margins and entire humeral area, this orange area interrupted by numerous small piceous spots; entire head below and three narrow stripes above, a large macula occupying most of outer tibial dilations and corium with two rounded spots on medio-cubital cross-vein ochraceous to orange tan; entire thoracic and abdominal venter orange tan with following strongly contrasting dark markings: large spot on antero-dorsal area of pro- and metapleura and a large spot above metacoxal cavities metallic purplish black, a few scattered small piceous spots on remainder of pleura; abdominal venter with four rows of large piceous maculae, two rows dorso-laterally situated, two rows lateral to midline; connexivum and abdominal dorsum piceous with anterior half of each connexival segment, anterior and lateral portions of abdominal dorsum orange to orange tan; membrane uniformly dark; pronotum, clavus and corium regularly and closely punctate, surface above punctures largely smooth; pronotal punctures posteriorly slightly larger and deeper than elsewhere; scutellum transversely rugulose with a few small punctures; entire venter and dorsum with very sparse short erect hairs; scutellum with more dense, longer, pilose hairs; appendages with dark thicker and long hairs.

Head with anteocular portion slightly declivent, tylus and juga below level of antenniferous tubercles, tylus blunt, slightly exceeding juga and barely elevated, length head 3.00, width head 2.76, interocular distance 1.44, anteocular distance 1.68; pronotum steeply declivent with lateral margins conspicuously dentate for entire length, humeral areas greatly expanded into large anteriorly curving and obliquely ascending processes, humeral angles acuminate, postero-lateral margins conspicuously dentate, calli prominently elevated, area between calli only slightly higher with two small tubercles, disk posteriorly with median longitudinal carina obsolete; length pronotum 3.84, width across humeri 9.6, width anterior margin pronotum 2.04; length scutellum 3.12, width scutellum 3.24; labium reaching posterior margin of fourth abdominal sternum, length labial segments I 3.36, II 3.12, III 1.92, IV 4.32; length antennal segments I 3.12, II 4.80, III 3.60, IV missing; hind tibiae with outer dilations almost lanceolate with one very shallow emargination, occupying 57% length of hind tibiae, outer dilations a little wider than inner dilations; inner dilations lanceolate, slightly shorter than outer, furnished with a few small spine-like teeth distally; undilated portions of hind tibiae without teeth, length hind tibiae 9.36; length outer dilations 5.40, width outer

dilations 1.20; length inner dilations 4.80, width inner dilations 0.84; total length 22.0.

L. alatus is a unique species and easily identified by the shape of the humeral expansions, the orange pronotal band and the orange-tan venter that contrasts strongly with the metallic purple-blue and black of the rest of the body. The placement of *alatus* with or near any species or species groups is difficult without a male specimen. A few characters do seem to relate *alatus* to *lineosus* and *subauratus*. These are: declivous condition of the head; shape of the tibial dilations; surface texture; amount of pubescence on the body.

Distribution: Brazil.

Material Examined: Holotype: ♀, "Para," Brazil. In British Museum (Natural History).

Leptoglossus lineosus (Stål)

Theognis lineosus Stål, 1862:295.
Leptoglossus lineosus Stål, 1870:164.—Distant, 1881:126, pl. 12, fig. 17.—Lethierry and Severin, 1894:48.

Pronotum, clavus and corium chocolate brown with head, first antennal segment, pronotal calli, and scutellum piceous; dorsum with strongly contrasting whitish yellow to ochraceous markings as follows: head laterally and with three narrow stripes above, all margins of pronotum, a median longitudinal stripe from collar to a transverse humeral fascia, and a pair of posteriorly tapering rays from calli well onto disk on either side of midline, tubercles on raised area between calli, a narrow median longitudinal stripe on scutellum, narrow straight transverse fascia on corium, very narrowly along claval commissure, all veins on clavus and corium except anterior half of radius; basal three fourths of antennal segments two, three and apex of fourth, fore, middle, undilated portions of hind tibiae, and bases of femora light reddish tan; all femora and hind tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter fuscous to piceous with the following areas strongly contrasting ochraceous to light tan: all marginal areas of propleuron, area above coxal cavities, posterior margins of meso- and metapleura, two well defined longitudinal stripes across thoracic pleura, posterior and lateral marginal areas of abdominal venter, large maculae surrounding spiracular openings and the maculae on inner tibial dilations light reddish tan; connexivum and abdominal dorsum piceous with anterior third of connexival segments ochraceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctations largely smooth; scutellum transversely rugulose and

impunctate; body with sparse short erect and semi-decumbent hairs; femora with more dense appressed pubescense.

Head before eyes declivent, tylus and juga below level of antenniferous tubercles, tylus blunt, slightly exceeding juga and barely elevated, length head 2.28, width head 2.16, interocular distance 1.08, anteocular distance 1.20; pronotum gradually declivent with lateral margins entire and straight, humeral areas not greatly expanded with humeral angles prominent and acuminate, obliquely ascending, postero-lateral margins entire, pronotal disk with a prominent low median longitudinal carina, calli slightly elevated, area between calli with two small tubercles, length pronotum 2.88, width across humeri 5.60, width anterior margin pronotum 1.80; length scutellum 2.04, width scutellum 2.16; labium extending to posterior margin of third abdominal sternum, length labial segments I 2.52, II 2.64, III 0.96, IV 2.64; length antennal segments I 2.40, II 3.84, III 2.28, IV 3.48; hind femora greatly incrassate; hind tibiae with outer dilations lanceolate, occupying 65% the length of hind tibiae, of same width as inner dilations; inner dilations lanceolate, as long as outer dilations, distally with a few strong teeth along margins; undilated portion of hind tibiae along inner margins with a double row of spine-like teeth, length hind tibiae 7.20; length outer dilations 4.68, width outer dilations 0.96; length inner dilations 4.68, width inner dilations 0.96.

Claspers (Fig. 8) with base and shank little differentiated from each other, no lobes present; shank very wide in lateral view and scooped out medially, hook strongly curved dorsally; capsule (Fig. 33) with a shallow median notch, no dorsal prongs, entire posterior edge gradually produced backwards over curvature of capsule; aedeagus with dorsal sac of conjunctiva divided into main lobes with low broad sclerotized proximal lobes, dorso-lateral appendage long blade-like and heavily sclerotized. Total length 17.3.

For diagnostic characters see key and discussion under *subauratus*.

L. lineosus and *subauratus* are closely related species and very distinct from the other members of the genus. They have in common, together with *harpagon* and *flavosignatus*, the following characters: claspers with a deeply scooped out shank; capsule with entire posterior edge projecting backwards over curvature of dorsal portion; a long sclerotized dorsal lateral appendage on conjunctiva.

Distribution: Mexico.

Material Examined: 3 syntypes: 1♂, 2♀, MEXICO (Sallé). In Stockholm Museum. The ♂ specimen (described above) bearing the label "TYPUS" is selected as LECTOTYPE, and an appropriate label has been attached to the specimen. MEXICO: 1♀, Cuernavaca Mor; 1♀, Tamazunchale, San Luis Potosi, V-20-1952 (M. Cazier, W.

Gertsch, R. Scharammel); 1 ♂ (Sallé). In American Museum of Natural History.

Leptoglossus subauratus Distant

Leptoglossus subauratus Distant, 1881:126, pl. 12, fig. 18.—Lethierry and Severin, 1894:49.

Pronotum, scutellum, clavus and corium dark chocolate brown with head piceous; dorsum with following areas strongly contrasting whitish yellow to ochraceous: head laterally and with three narrow stripes above, all margins of pronotum, with a large crescentic macula on pronotal disc, lateral margins and a central longitudinal stripe on scutellum, lateral margins of corium, claval sutures and all veins on clavus and corium and the narrow straight transverse fascia on corium; dorsum of femora and tibiae on fore and middle legs, undilated portion of hind tibiae, maculae on inner tibial dilations, and all antennal segments light to dark tan; the latter with distal portion of segments two and three and base of four somewhat darker; hind femora and tibial dilations dark brown to fuscous with teeth and tubercles slightly darker; thoracic and abdominal venter dark brown with following areas strongly contrasting ochraceous to tan: all marginal areas of propleuron, ventral and posterior margins of meso- and metapleura, two well defined longitudinal vittae across thoracic pleura and posterior and lateral marginal area of abdominal venter; connexivum and abdominal dorsum dark brown to piceous with anterior third of each connexival segment ochraceous; membrane uniformly dark; pronotum, clavus and corium closely and finely punctate with surface above punctures smooth; scutellum transversely rugulose and impunctate; venter with sparse short appressed pale hairs; dorsum with short erect and semi-decumbent pale hairs; appendages with longer more dense pilose hairs.

Head before eyes declivent with tylus and juga below level of antenniferous tubercles, tylus blunt, slightly exceeding juga and barely elevated, length head 2.40, width head 2.04, interocular distance 1.20, anteocular distance 1.44; pronotum gradually declivent with lateral margins entire and straight, humeral areas not greatly expanded or ascending, humeral angles acute, postero-lateral margins serrate, disk with median longitudinal carina obsolete, calli slightly elevated, area between calli higher and with two low tubercles, length pronotum 2.56, width across humeri 5.12, width anterior margin of pronotum 1.56; length scutellum 1.92, width scutellum 1.92; labium extending to posterior margin of fifth abdominal sternum, length labial segments I 2.88, II 2.88, III 1.32, IV 3.24; length antennal segments

I 2.40, II 4.44, III 2.88, IV 3.84; hind femora strongly incrassate; hind tibiae with outer dilations lanceolate and occupying 60% the length of hind tibiae, width of outer dilations about equal to width of inner dilations; inner dilations lanceolate with a few large teeth distally and about equal in length to outer dilations; undilated portion of hind tibiae with a double row of small spine-like teeth along inner margins, length hind tibiae 7.80; length outer dilations 0.96; length inner dilations 4.32, width inner dilations 1.08.

Genitalia as in *lineosus* but aedeagus without proximal lobes on dorsal sac, dorso-lateral appendage with only tip barely sclerotized; total length 16.0.

The description is of a male specimen from Quezaltepeque, El Salvador. *L. subauratus* resembles *lineosus* very closely except for the following differences. The pronotum has the transverse band occupying most of the anterior portion of the disk in *subauratus* whereas in *lineosus* it is a very narrow band between the humeri. *L. subauratus* has more unicolorous antennal segments, in *lineosus* there are strongly contrasting light and dark areas. The postero-lateral margins of the pronotum are serrate and the humeral angles are acute in *subauratus*, whereas in *lineosus* the pronotal postero-lateral margins are entire with the humeral angles acuminate. Aedeagal differences are: for *subauratus* the lack of proximal lobes on the dorsal sac and a shorter less sclerotized dorso-lateral appendage; for *lineosus* the proximal lobes are present and the dorso-lateral appendage is heavily sclerotized and longer.

It should be mentioned that despite the differences listed above, these two species are very closely related. The material examined is insufficient to assess any variation which may be present. Additional collecting may prove these two species to be conspecific.

Adult specimens of *subauratus* have been collected on prickly pear in Guatemala and El Salvador (Mann, 1969).

Distribution: El Salvador. Distant (1881) lists his type series from Guatemala and Nicaragua (deposited in the British Museum).

Material Examined: EL SALVADOR: 1♀, Quezaltepeque, VI-24-1961 (M. E. Irwin); 1♀, Acajutla, 28.8 (Fred K. Knab); 1♂, Metapan, 5-VII-1954, No. 444-34DB (M. S. V.). In United States National Museum and University of California (Davis).

Leptoglossus rubrescens (Walker)

Malvana rubrescens Walker, 1871:134.—Lethierry and Severin, 1894:51.

Leptoglossus rubrescens Distant, 1901b:417–8.

Head, pronotum, scutellum, clavus, corium and thoracic pleura dark reddish brown; veins of clavus and corium wine red; fore and middle legs and apex scutellum ochraceous to tan; abdominal venter rusty reddish brown; connexivum and abdominal dorsum fuscous with a percurrent longitudinal median stripe the width of scent gland scars pale yellow; membrane uniformly dark; pronotum coarsely and closely punctate with surface above punctations scabrous, punctations on pronotum deeper and larger than elsewhere; clavus and corium finely and closely punctate; scutellum transversely rugulose with numerous punctations; head and thoracic pleura thickly clothed with short appressed whitish pubescence; remainder of body and appendages with sparse short erect and semi-decumbent whitish hairs.

Head porrect with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 2.76, width head 2.40, interocular distance 1.20, anteocular distance 1.44; pronotum steeply declivent almost vertical with lateral margins strongly sinuate and dentate caudally, humeral areas broadly expanded into long tapering projections with humeral angles acute, postero-lateral margins strongly dentate, calli elevated and area between calli only slightly higher, disk posteriorly with the low median longitudinal carina obsolete, length pronotum 3.04, width across humeri 8.00, width anterior margin pronotum 1.68; length scutellum 2.28, width scutellum 2.28; labium reaching to posterior margin of fourth abdominal sternum, length labial segments I 3.12, II 3.12, III 1.92, IV 4.08; length antennal segments I 2.52, II 4.68, III 3.48, IV 5.64; hind legs missing.

Clasper (Fig. 11) with inner basal lobe low and rounded, shank thick without a median lobe, hook completely curved around and directed laterally; capsule (Fig. 36) with median notch deep and rounded, no dorsal prongs; aedeagus (Fig. 66) with dorsal sac of conjunctiva rather short and without sclerotized areas, lobes on dorsal sac as follows: no proximal lobes present; left and right median lobes large and of equal size and shape; apex of sac somewhat trifid; total length 17.9.

L. rubrescens is a rather unusual species but it does have some characteristics in common with *fulvicornis*. The most striking similarities are the presence of a pale yellow longitudinal stripe on the abdominal tergum; the coarseness and shape of the pronotal punctures, the dark reddish ground color, and the lack of pale markings on the pronotum and hemelytra. The bases and shanks of the claspers are similar, but the hook in *rubrescens* is exceedingly different in that it bends completely around ventrally and the tip points out laterally. No other *Leptoglossus* species has this kind of hook. The dorsal

margins of the capsules bear no resemblance to each other, with *fulvicornis* having the unique condition. The aedeagal similarities and differences are: both species have the dorsal sac unsclerotized without proximal lobes; medial lobes are present but are smaller and more distally placed in *rubrescens*.

The long tapering humeral areas, the steeply declivent pronotum, and the rounded and simple median notch on the genital capsule will further distinguish *rubrescens* from *fulvicornis*.

Distribution: Known only from the type locality.

Material Examined: Holotype: ♂. BRAZIL. In British Museum (Natural History).

Leptoglossus fulvicornis (Westwood)

Anisoscelis fulvicornis Westwood, 1842:17.
Leptoglossus fulvicornis Stål, 1870:161.—Distant, 1901a:330, pl. 30, fig. 4.—Van Duzee, 1917:89.—Gibson, 1917:70.—Parshley, 1923:747.—Blatchley, 1926:221.—Torre-Bueno, 1941:49.
Leptoglossus magnoliae Heidemann, 1910:191–5, pl. 7.
Theognis fulvicornis Hussey, 1953:30.

Dorsum and venter light to dark reddish brown without pale markings on pronotum or hemelytra; thoracic and abdominal venter mottled with numerous small piceous spots; abdominal tergum with a yellowish median longitudinal fascia; pronotum coarsely punctate almost rugulose, with lateral and postero-lateral margins serrate to dentate; humeri broadly and obtusely rounded; outer tibial dilations lanceolate with two or three very shallow emargination.

Clasper (Fig. 10) with a long broad base and inner basal lobe obsolete; shank without a median lobe; hook short and strongly curved; capsule (Fig. 35) with median notch deep, bottom of notch raised and acute; dorsal prongs broadly rounded and directed medially; aedeagus with dorsal sac of conjunctiva without sclerotized areas, and with only one pair of medial lobes.

In the discussion under *rubrescens*, the similarities and differences between *rubrescens* and *fulvicornis* are pointed out. The relationship of these two species to *dilaticollis* is discussed under the latter species.

The aedeagus in *fulvicornis* is similar in some respects to those of *australis* and *gonagra*. All three species have a long dorsal sac which is totally unsclerotized, and only the median lobes are present. In *fulvicornis* these median lobes are much longer than and not as close to the apex as are those of *australis* and *gonagra*. From all other North American species, *fulvicornis* may be easily distinguished by having lanceolate tibial dilations, a unicolorous dorsum without a pale

transverse fascia on the corium or pale pronotal markings, dentate pronotal lateral margins, broadly rounded humeral angles and the rugulose-like surface of the pronotum.

Heidemann's description of *magnoliae* is based on a male and female, type No. 13228, in the United States National Museum. Both specimens bear the same type number, and I have selected as LECTOTYPE the male specimen; a label to that effect has been attached to the specimen. In the original description, Heidemann also gives information on the feeding habits, and includes descriptions of the eggs and nymphs. The host plant apparently is *Magnolia.*

Distribution: Recorded from Massachusetts and New York and south to Florida and Alabama. A single specimen labeled "Mexico on bananas, Brownsville, Texas" is in the United States National Museum.

Material Examined: 56 specimens: *Florida*: Winter Park; Port Sewall. *Georgia*: Savannah. *Massachusetts*: Humarock. *New Jersey*: Anglesea; Lahaway. *New York*: Rockaway Beach; Long Beach; New York City. *North Carolina*: New Bern; Fort Macon; Southern Pines. *Pennsylvania*: Philadelphia. *Virginia*: Va. Beach; Shenandoah National Park; Falls Church. *Washington, D.C.* In United States National Museum, American Museum of Natural History, Museum Comparative Zoology (Harvard), Stockholm Museum, J. A. Slater and R. C. Allen collections.

Leptoglossus dilaticollis Guerin
(Fig. 1)

Leptoglossus dilaticollis Guerin, 1831:pl. 12, fig. 9.—Guerin, 1838: 174.—Stål, 1870:161.—Distant, 1902:382.—Kirkaldy, 1906: 257.—Kiritschenko, 1935:191.—Costa Lima, 1940:85, fig. 292. —Dupuis, 1952:449.—Hussey, 1953:33.

Pronotum, scutellum, clavus and corium dark reddish brown with head and teeth on margins of pronotum piceous; wide straight transverse fascia on corium and fourth antennal segments whitish yellow; head laterally and with two short stripes above, first three antennal segments and undilated portion of hind tibiae tan to light brown; legs light reddish brown with lateral portion of hind femora fuscous distally; tibial dilations and first three antennal segments with a narrow stripe above fuscous; thoracic and abdominal venter reddish brown with numerous small piceous spots frequently fusing to form larger maculae; connexivum, abdominal dorsum, femoral and tibial teeth and tubercles piceous with a narrow median longitudinal stripe on abdominal dorsum ochraceous; membrane uniformly dark; pronotum

with numerous conspicuous large rounded foveolae and smaller punctations; clavus and corium finely and closely punctate; scutellum transversely rugulose with few punctures; venter with a moderate amount of pale short erect and appressed pubescence; dorsum with short appressed and semi-decumbent yellowish hairs and sparse longer pilose hairs.

Head porrect with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga, forming a rounded elevated ridge, length head 4.56, width head 3.12, interocular distance 1.68, anteocular distance 2.76; pronotum steeply declivent, lateral and postero-lateral margins strongly dentate, some teeth almost spinose, humeral areas broadly expanded into long and wide anteriorly curving slightly ascending processes, calli barely elevated, area between calli almost indistinct from calli and only slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 5.26, width across humeri 17.6, width anterior margin pronotum 2.52; length scutellum 3.36, width scutellum 3.96; labium extending to middle of seventh abdominal sternum; length labial segments I 5.40, II 5.88, III 4.44, IV 9.36; length antennal segments I 3.00, II 5.64, III 4.56, IV 6.60; hind tibiae with outer dilations lanceolate, occupying 64% length of hind tibiae, width about one and a half times width of inner dilations; inner dilations lanceolate, slightly shorter than outer, furnished with numerous small spine-like teeth along margins; inner margins of undilated portions with a double row, and dorsal margins of hind tibiae for entire length with a single row, of numerous small spine-like teeth, length hind tibiae 12.5; length outer dilations 8.32, width outer dilations 2.04; length inner dilations 7.20, width inner dilations 1.32.

Claspers (Fig. 9) with inner basal lobe obsolete and width base gradually tapering to form shank, shank without median lobe, hook strongly curved; capsule (Fig. 34) with median notch shallow, dorsal prongs low, forming a sinuate posterior margin; aedeagus with dorsal sac of conjunctiva as follows: proximal lobes present; two median lobes present on left side only, one short and small below a larger and wider blunt lobe; no distal lobes present; all areas on dorsal sac unsclerotized; total length 29.0.

The above description is of a male specimen from Brasilia, Rio Grande, Brazil.

There is very little variation in the small series examined. Three females and one male lack the small teeth on the dorsal edge of the hind tibiae. Labial extensions vary from the middle of the sixth to just past the posterior edge of the seventh abdominal sternum.

L. fulvicornis, *rubrescens*, and *dilaticollis* resemble each other to

some extent in having a narrow yellow median longitudinal stripe on the abdominal dorsum, claspers with a broad base and the inner basal lobe obsolete, and the shank without a median lobe. The dorsal sac of the conjunctiva is unsclerotized. Both *fulvicornis* and *dilaticollis* have lanceolate tibial dilations.

The resemblance of these three species to one another is more superficial than an indication of a close relationship. *L. rubrescens* and *dilaticollis* are quite specialized members of the genus as evidenced by the shape of the genital structures. This is especially true of *dilaticollis* with its unique humeral expansions and long labium.

Costa Lima (1940) reported *dilaticollis* on *Magnolia* sp.

Distribution: Brazil, Central America, and Mexico.

Material Examined: MEXICO: 1♂, Rinton, Antonio, Oaxaca, Feb. 1908 (F. Hamilton). PANAMA: 1♂, no data. BRAZIL: 1♂, Corupa, S. Cath. (Hansa Humboldt), Apr. 1948 (A. Maller); 1♂, same except III-1949; 1♂, Rio Grande; 1♀, Rio Grande do Sul; 1♀, same except (Staudgr); 1♀, no locality (Boucard). In Hungarian National Museum, Stockholm Museum, and American Museum of Natural History.

Leptoglossus australis (Fabricius)

Cimex australis Fabricius, 1775:708.
Cimex membranaceus Fabricius, 1781:351.
Cimex momordicae Forster, 1844:16.
Cimex orientalis Dallas, 1852:454.
Anisoscelis bidentatus Montrouzier, 1855:101.
Anisoscelis flavopunctatus Signoret, 1863a:27, pl. 21, fig. 4.
Leptoglossus membranaceus bidentatus, Schouteden, 1907:113.
Leptoglossus membranaceus sumbawensis Blöte 1936:29.

This is the only species of *Leptoglossus* that occurs outside of the Western Hemisphere. It is readily recognized by its black or dark brownish color with the following reddish orange or yellowish markings: a narrow arcuate transverse fascia on the pronotal disk, the medial portion of the second, third and apical half of the fourth antennal segments, numerous large maculae covering the entire ventral surface, and a small spot on the mediocubital crossveins. The humeral angles vary from long and spinose to obtuse. The outer tibial dilation may be narrow and lanceolate or wide and phylliform. The claspers (Fig. 12) lack an inner basal lobe and the inner margin gradually tapers into the shank portion; the shank lacks a median lobe and the hook is strongly curved; the capsule (Fig. 37) has a deeply rounded median notch and no dorsal prongs; in the aedeagus the dorsal sac of the

conjunctiva is long and has only small median lobes near the apex; all areas of the dorsal sac are unsclerotized.

L. australis has, until recently, been treated as one of three closely related species. The group was composed of *membranaceus*, *bidentatus* and *australis*. Some authors had relegated *bidentatus* to subspecific rank under *membranaceus*. It is true that individuals referred to as *membranaceus* from the Ethiopian and Oriental regions are quite distinct from specimens of "*australis*" in the South Pacific Islands. However, examination of the large number of specimens assembled in the present study confirms Gross's (1963) opinion that only one species is involved. Individuals from Tahiti, Fiji, New Hebrides, American Samoa, and the Society Islands are small, have subacute humeral angles, and the outer tibial dilation is narrow with one or two shallow emarginations (Fig. 53). Westward to New Guinea and northern Australia specimens tend to be larger and more deeply emarginate. Also present in Australia are specimens that resemble individuals from Tahiti and Fiji. In New Guinea an occasional individual will have a spinose humeral angle. All 32 specimens examined from the Philippines have prominently spinose humeral angles, but here the tibial dilation is more variable, being as wide as African specimens and as narrow as Australian specimens. Throughout the Oriental and Ethiopian regions, specimens consistently have a spinose humeral angle, with the overall size and the width of the outer tibial dilation (Fig. 52) averaging slightly larger than individuals from Australia or New Guinea. These characters seem to be clinal in nature, and a detailed study needs to be undertaken in order to establish the exact relationships. Fortunately, *australis* is a common insect, and large numbers of specimens are available for study.

The relationship between *australis* and *gonagra* is extremely close. In fact, this relationship is not paralleled by any other pair of species in this genus, if one takes into consideration both similarity and distribution. *L. gonagra* is quite distinct from all other *Leptoglossus* species in the Western Hemisphere, which unmistakably makes it stand out as the ancestral stock from which *australis* was derived. These two species share in common the same distinctive color pattern, the same general habitus, and genitalia which are, as far as I can tell, identical. Also the vagility of *australis* and *gonagra* are of the same magnitude, with *gonagra* the most widely distributed species in the New World and *australis* having a tremendous geographic range in the Eastern Hemisphere. It should be mentioned that the present distribution of *australis* may have been in part helped by man, since *australis* is a known pest on various agricultural crops. It cannot be over-empha-

sized that these two species are very closely allied and the characters that distinguish each from the other are not strikingly different. In fact, the validity of their being considered two species may be questioned. On the other hand, selective pressures that would favor morphological distinctness may not have been in operation, since the geographic separation once established, would provide an effective reproductive barrier. Breeding and cytological information will in all likelihood provide answers to the questions concerning the exact nature of this relationship.

The dispersal route into the Eastern Hemisphere may be envisioned as occurring via Africa, for some African specimens of *australis* resemble more closely *gonagra* in color and humeral spine shape than do individuals from other parts of the range. The alternative to this is a route through the oceanic islands of the Pacific, even though the *australis* specimens in the Pacific Islands are morphologically more distinct from *gonagra* than African specimens. Gross (1963) pointed out that the Pacific Island Heteroptera tend to be smaller, and that spines and dilations becomes somewhat smoothed as compared to individuals of the same species on adjacent continental or large land areas. With this in mind, the latter route may be thought of as a rather rapid spread through the islands to the Asian continent and then a subsequent loss of the prominent humeral spines and large tibial dilations on the smaller islands.

From *gonagra*, *australis* can be distinguished by the shorter tibial dilation (65–75% the length of the hind tibiae), the absence of yellow spots on the scent gland scars, and the generally darker brown color (some specimens of *australis* are the same chocolate brown as is *gonagra*). The genitalia of these two species are essentially the same.

The life history, economic importance and control of *australis* has been reported by Szent-Ivany and Catley (1960), Fernando (1957) and Pagden (1928). The latter two authors use the name *L. membranaceus*. A few of the host plant records are cotton, beans, citrus, banana, guava, wild passionfruit and nearly all cucurbitaceous plants. For a complete list of references and generic name changes consult Gross (1963). Schaefer (1965, 1968) describes some morphological aspects of *australis* in his studies on the higher classification of the Coreoidea.

Distribution: Most of Africa, Madagascar, Seychelles Is., Indian subcontinent, Taiwan, South East Asia, Malay Archipelago, Indonesia, Philippines, Micronesia, New Guinea, Northern Australia, New Hebrides, New Caledonia, Solomon Islands, Fiji Islands, Samoa, Cook Island, Tahiti.

Material Examined: Approximately 500 specimens from the above localities.

Leptoglossus gonagra (Fabricius)

Cimex gonagra Fabricius, 1775:708.
Cimex grallator Herbst, 1784:259.
Lygaeus gonagra Fabricius, 1794:140.
Anisoscelis antica Herrich-Schaeffer, 1836:92, fig. 316.
Anisoscelis gonagra Burmeister, 1835:332.
Theognis gonager Mayr, 1866:103.
Leptoglossus gonagra Stål, 1868:51; 1870:165.—Berg, 1879:72.—Distant, 1881:126.—Lethierry and Severin, 1894:47.—Van Duzee, 1917:89–90.—Gibson, 1917:72.—Blatchley, 1926:224.—Barber, 1939:310–11.—Torro-Bueno, 1941:40.—Froeschner, 1942:594, 599.—Barber and Bruner, 1947:80.—Hussey, 1953: 31.
Anisoscelis praecipua Walker, 1871:128.—Distant, 1901:431.

L. gonagra is easily distinguishable from all other *Leptoglossus* species in the Western Hemisphere by the presence of the following yellow areas that strongly contrast with the dark brown color: a narrow arcuate transverse fascia on the pronotal disk, numerous large maculae on the thoracic pleura; seven yellowish longitudinal stripes on the abdominal venter which occasionally are interrupted at the intersegmental sutures, if so, the stripes are made up of a series of rectangular maculae. Also, the humeral angles are strongly spinose, although this is more variable than the color pattern. The outer tibial dilation (Fig. 54) is relatively narrow and gradually tapers to almost the end of the tibiae and occupies about 85 to 90% the length of the hind tibiae.

L. gonagra can be separated from *australis* on the basis of the longer outer tibial dilations, the usually lighter color, and the presence of yellowish round spots on the scent gland scars.

L. gonagra has been reported as a pest on cucurbitaceous plants, *Passiflora*, citrus, and tobacco in Argentina and Brazil (Bosq 1940, Costa Lima 1940); oranges, grapefruit, squashes, pumpkins, corn and guava in Puerto Rico (Wolcott 1948); as breeding on *Luffa cylindrica* M. Roem. and adults feeding on oranges, guavas, and *Taonabo parviflora* Krug. & Urb. in Cuba (Barber and Bruner 1947). Hussey (1952) reported *gonagra* on Brazilian pepper trees (*Schinus terebinthefolia* Raddi) in Florida. It has also been collected on watermelons in Louisiana.

Distribution: From Florida to Texas and south through Mexico

and Central America, into the West Indies, and most of South America.

Material Examined: 51♂, 43♀, UNITED STATES: *Louisiana*; *Florida*. MEXICO: Veracruz; Nochixtlan; Quint. Roo. Xcan Nuevo; La Palma; Vera Cruz; Guerrero, Acapulco; Tezonapa; Chichen Itza; Temax. EL SALVADOR: Quezaltepeque. BRITISH HONDURAS: Benque Viejo; Jamastran. WEST INDIES: St. Croix; St. Vincent; Nevis; Puerto Rico; Cuba; Dominican Republic, Sanchez; Pto. Plata; Haiti; Grande Riviere; Cape Haytien. VENEZUELA: Merida; Caripito. BOLIVIA: Province Sara; Coroico. BRAZIL: Minas Geraes, S. da Caparao; Tres Lagoas, Matto Grosso; Rio Grande so Sul; Rio de Janeiro; Madeira Mamore; Corupa, S. Cath. (Hansa Humboldt); Bahia; Herculanoum; Meilen v. Cuyaba. PARAGUAY: Asuncion. ARGENTINA: Eldorado Misiones. In Hungarian National Museum, American Museum of Natural History, Stockholm Museum, Museum of Comparative Zoology (Harvard), Berlin Humboldt University Museum, British Museum (Natural History), University of California (Davis), University of Kansas, Chicago Natural History Museum, Iowa State University, J. A. Slater and R. C. Allen collections.

Leptoglossus chilensis chilensis (Spinola)

Anisoscelis chilensis Spinola, 1852:172.—Signoret, 1863b:555.—Reed, 1900:46.

Theognis chilensis Mayr, 1866:108.

Leptoglossus chilensis Stål, 1870:164.—Lethierry and Severin, 1893:46.—Pennington, 1922:132.

Pronotum behind humeri, scutellum, clavus and corium a variegated light brown and dark reddish brown with numerous small piceous spots; head above and below, pronotal calli and outer marginal areas of first antennal segments piceous; entire declivous face of pronotum, apex scutellum and corium wine red; head laterally and with three narrow stripes above, inner margins of first and last three antennal segments entirely, fore, middle and undilated area of hind tibiae, and basal and ventral portion of all femora light reddish brown; distal portion of femora dorsad, and tibial dilations fuscous to piceous with teeth and tubercles piceous; thoracic and abdominal venter dark reddish brown with numerous small spots frequently fusing to form larger maculae; connexivum and abdominal dorsum piceous with anterior fourth of connexival segments ochraceous; membrane uniformly dark; pronotum, clavus and corium coarsely and closely punctate with surface above punctures uneven; scutellum

transversely rugulose with few punctures; body rather thickly covered with appressed whitish silvery pubescence and sparse short erect hairs; head below, thoracic and abdominal midventer, and appendages with longer dense erect pilosity.

Head non-declivent with both tylus and juga raised above level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge, slightly exceeding juga, length head 2.04, width head 1.92, interocular distance 1.08, anteocular distance 1.08; pronotum abruptly declivent, lateral margins sinuate, serrate caudally, humeral areas broadly and obliquely ascending, humeral angles subacute, postero-lateral margins serrate, disk posteriorly with median longitudinal carina obsolete, calli slightly elevated, raised area between calli with two small tubercles, length pronotum 2.24, width across humeri 4.32, width anterior margin of pronotum 1.56; length scutellum 1.56, width scutellum 1.68; labium extending to middle of metasternum, length labial segments I 1.68, II 1.56, III 1.20, IV 1.50; length antennal segments I 2.04, II 3.12, III 2.04, IV 2.64; hind tibiae with outer dilations barely phylliform with two shallow emarginations, occupying 64% length of hind tibiae and about twice width of inner dilations; inner dilations lanceolate, shorter than outer dilations, furnished with a few small spine-like teeth on distal margins; inner margins of undilated portions of hind tibiae with a few small spine-like teeth arranged in a double row, length hind tibiae 6.00; length outer dilations 3.84, width outer dilation 1.20; length inner dilations 3.24, width inner dilations 0.60.

Claspers (Fig. 13) with inner basal lobe small and rounded, shank thin with well produced median lobe, hook short and strongly curved; capsule (Fig. 38) with a rounded median notch, no dorsal prongs, lateral margins slightly flared; aedeagus with dorsal sac of conjunctiva as follows: proximal lobes present and sclerotized; median lobes present, left lobe long and wide, right lobe shorter and more narrow; sclerotized anterior distal lobe present; lateral distal lobes of same size and shape, both sclerotized; total length 13.0.

The above description is of a male specimen from El Alfalfal, Province Santiago, Chile. In a large series of specimens the following variations were noted. The last antennal segment varies from entirely light reddish brown to fuscous. The entire declivous face of the pronotum varies from bright yellow to dark tan and is with or without small piceous maculae. A few individuals have so many large and small maculae that the yellow areas are barely evident. These yellow areas may be separated medially forming two distinct spots. The labium varies in length from the middle of the metasternum to the anterior margin of the second abdominal sternum, only rarely does it extend to the anterior margin of the third abdominal sternum. Most

specimens have very shallow emarginations on the outer tibial dilations, but some females have a more phylliform dilation with deep emarginations.

Typical *chilensis* specimens seem to be absent from the north and northeastern corner of Argentina, and it is here that one finds *concaviusculus*. I have also examined from this area a number of specimens that have characters of both *chilensis* and *concaviusculus*. I believe that the two "taxa" are conspecific, with *concaviusculus* a distinct subspecific unit.

L. argentinus described by Bergroth (1894) from La Plata fits the description of *chilensis*. This was also the opinion of Pennington (1922), although he did not list *chilensis* from that area. I have not seen Bergroth's type, but there seems little doubt that he had a specimen of *chilensis*.

L. chilensis is closely related to *impictus*; for the diagnostic characters see the discussion under the latter species.

Thus far *chilensis* has been collected on peaches, nectarines, plums, grapes, figs, and grapefruit.

Material Examined: CHILE: 52♂, 48♀, Province Santiago: El alfalfal; Los Maitenes; El Canelo; Lampa. Province Talca: Talca. Province O'Higgins: Rancagua. Province Nuble: San Carlos. Province Malleco: Angol. Province Cautin: Temuco; Araucancia. Province Bio-Bio: Antuco. Province Coquimbo: Illapel; Huanta. Province Aconcagua: Papudo; Rio Blanco. Province Valparaiso: Valparaiso. Province Concepcion: Concepcion. ARGENTINA: 6♂, 3♀, Mendoza; 2♀, Cabana Cordoba, III-1945 (M. Biraben); 2♀, same except 8-11-1937; 2♂, 2♀, Rio Negro, I-1943, "s/papa" (J. M. Bosq); 1♂, 1♀, Province de San Juan, I-1940 (J. M. Bosq); 1♂, San Juan (J. M. Bosq); 1♂, Correntoso, L. Nah Huapi, 20-X-1926 (R. C. Shannon); 1♀, Tolombon, Salta, 7-III-1939 (Biraben-Scott); 1♀, 1200 m. Province Salta 2.05 (J. Steinbach S.V.); 1♀, Catamarca, Los Angeles, X-1945 (J. M. Bosq); 1♀, Catamarca, El Rodeo, I-1942 (Schaefer); 1♂, Cabana, Cordoba, 10-11-1942 (M. Biraben); 1♀, Isla Los Cisnes, Parana Delta, V-XI-1920 (H. E. Box); 1♂, El Bolson, Rio Negro, III-15-1964 (A. Kovacs); 1♀, Bariloche, Rio Negro, Nov. 1926 (R. & H. Shannon); 2♂, Metan Salta, 1906-I (Vezenyi). In Hungarian National Museum, La Plata Museum, Museum of Comparative Zoology (Harvard), Deutsches Entomologisches Institut, Berlin Humboldt University Museum, Stockholm Museum, United States National Museum, California Academy of Sciences, British Museum (Natural History), American Museum Natural History, J. A. Slater and R. C. Allen collections.

Leptoglossus chilensis concaviusculus Berg new status

Leptoglossus concaviusculus Berg, 1892:70.—Lethierry and Severin, 1894:47.—Pennington, 1922:134.

Pronotum behind humeri, scutellum, clavus and corium uniformly dark reddish brown with head above and mid-ventrally, outer marginal areas of first antennal segments and pronotal calli piceous; entire declivous face of pronotum, and last antennal segment yellowish brown; apex scutellum and large maculae on inner tibial dilations whitish yellow; head laterally and with three narrow stripes above, inner margins of first and entire second and third antennal segments, fore and middle legs, basal third and ventral portions of hind femora, and undilated portion of hind tibiae light reddish brown;dorsal three fourths of hind femora distally, and tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter dark reddish brown with numerous small piceous spots confined to abdominal mid-venter; connexivum and abdominal dorsum piceous with connexival incisures ochraceous; membrane uniformly dark; pronotum, clavus and corium coarsely and closely punctate with surface above punctures uneven; scutellum transversely rugulose with few punctures; body rather thickly clothed with appressed golden pubescence and sparse short erect hairs; appendages, thoracic and abdominal mid-venter also with dense longer erect pilosity.

Head non-declivent with both tylus and juga raised above level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge, slightly exceeding juga, length head 1.92, width head 1.80, interocular distance 0.96, anteocular distance 1.08; pronotum abruptly declivent, lateral margins sinuate and serrate caudally, humeral areas broadly and obliquely ascending, humeral angles sub-acute, postero-lateral margins serrate, disk posteriorly without a median longitudinal carina, calli slightly elevated, raised area between calli non-tuberculate, length pronotum 2.40, width across humeri 4.32, width anterior margin pronotum 1.32; length scutellum 1.68, width scutellum 1.80; labium extending to middle of metasternum, length labial segments I 1.56, II 1.44, III 0.84, IV 1.20; length antennal segments I 1.80, II 2.88, III 1.68, IV 2.52; hind tibiae with outer dilations phylliform with two deep emarginations, occupying 77% length of hind tibiae, and about two and a half times width of inner dilations; inner dilations lanceolate, shorter than outer dilations, furnished with a few small spine-like teeth on distal margins; inner margins of undilated portion of hind tibiae with numerous small spine-like teeth arranged in a double row, length hind tibiae 6.24; length outer dilations 4.80, width

outer dilations 1.56; length inner dilations 3.72, width inner dilations 0.60; genitalia as in *chilensis*; total length 12.8.

This subspecies exhibits essentially the same variation in color patterns as found in *chilensis*. The declivous area of the pronotum may be entirely bright yellow or yellowish brown, or the entire pronotum may be unicolorous. The pronotal disk sometimes has two large medially separated diffuse spots. The dorsum varies from light to dark reddish brown, but is essentially unicolorous not variegated.

L. c. concaviusculus, originally described from Brazil, forms a population distinct from *chilensis*, which is more southern. Along the areas of contact between these two populations there occur a number of specimens intermediate between the two subspecies. The material examined shows the overlapping distribution to be in the northern and northeastern portion of Argentina. In *concaviusculus*, distinguishing characters are the lack of small piceous maculae on the dorsum and thoracic pleura, and the dorsum being lighter and unicolorous brown. In *chilensis* these same areas have numerous piceous maculae and the dorsum is usually a variegated dark brown and fuscous. *Concaviusculus* has a somewhat longer fourth antennal segment averaging 1.48 times the width of the head. In *chilensis* the average is 1.2. The width of the outer tibial dilation to width of head ratio is larger for *concaviusculus*, average 1.1 (0.8–1.6); in *chilensis* the same ratio averages 0.6 (0.5–0.9). *Concaviusculus* has a longer outer tibial dilation (Fig. 63) occupying 76% (71–80%) the length of the hind tibiae, whereas in *chilensis* the dilations (Fig. 62) occupy 65% (62–71%).

Distribution: Northern and northeastern portion of Argentina; Paraguay; Uruguay; southern Brazil.

Material Examined: Syntype Series: 1♂, 2♀, Brazil. In the La Plata Museum. Berg's type series is mixed, a ♀ from Chaco which bears the label *Leptoglossus concaviusculus* is actually a specimen of *impictus*. Of the remaining two specimens, I have selected the ♂ as LECTOTYPE, and have placed an appropriate label on the specimen. BRAZIL: 1♀, Corupa, S. Cath. (Hansa Humbolt), Apr. 1948 (A. Maller); 1♂, same except March 1948; 1♂, 1♀, Rio Natal, S. Cath., XII-1945 (A. Maller); 1♀, Cauna, S. Cath., XII-1945 (A. Maller); 1♀, Pinhal, S. Cath., Dec. 1948 (A. Maller); 1♂, R.G. do Sul, Pio Busk; 1♀, Rio Grande do Sul; 1♀, Sao Paulo (A. Heine); 1♀, Sao Paul; 2♀, Sao Leopoldo; 2♂, 1♀, Brazilien. PARAGUAY: 3♂, Asuncion; 1♂, no data (Berg). URUGUAY: 3♂, Montevideo (Colon), 12-XII-1929 (Tremoleras); 2♂, Montevideo, W. del Cerro, 31-XII-1932 (Tremoleras); 1♀, Cerro Largo, Canada de los Burros (Tremoleras); 1♂, no data (Berg); 1♀, no data (Boucard). AR-

GENTINA: 4♂, 5♀, Misiones Pindapoy, X-1935 (J. M. Bosq); 4 ♀, same except III-1936; 1 ♂, 2 ♀, Entre Rios, Concordia, II-1930 (J. M. Bosq); 1♀, same except IV-1931; 1♀, Corrientes, "on citrus," 10-1935 (J. M. Bosq); 1♀, Corrientes; 1♂, Corrientes, 1-1921 (DeCarlo); 1♂, Corrientes, San Roque, II-1920 (J. M. Bosq); 2♂, 1♀, Cordoba (W. M. Davis); 1♂, La Granja, A. Gracia, Cordoba, 4-1-1939 (C. Bruch); 1♀, Gl. Gracia; 2♀, Forosa (Ciud.), 28-IV-1936 (Denier); 1♀, Formosa, Dto. Pilaga, IV-1938 (Denier); 1♂, 2♀, Prov. Salta, 2500 m. (J. Steinbach, S.V.); 1♀, Santa Fe (J. Steinbach, S.); 3♂, 1♀, Isla de Oro, Formosa, 30-III-1938 (Denier); 1♂, 1♀, R. Arg. La Plata (C. Bruch); 1♂, 1♀, San Ignacio, Misiones, 8-XII-1914 (Biraben, Bezzi); 2 ♀, Puerto Tirol, Chaco, 10-IV-1936 (Denier); 2♀, Province de Buenos Aires (J. M. Bosq); 1♂, Delta Rio Chana, II-1922 (J. M. Bosq); 1♂, Delta Abra Vieja, 15-II-1926 (J. M. Bosq); 1♀, Isla Los Cisnes, Parana Delta, V-XI-1920 (H. E. Box); 1♂, Resistencia, II-1936 (Denier); 1♀, Cabana Cordoba, 4al., 8-II-1947 (Biraben); 1♂, Santiago del Estero, Rio Salado (Wagner); 1♂, Fontana, Chaco, XII-1935 (Denier); 1♂, Chaco (Berg); 1♂, Chaco, 22-X-1899 (S. Venturi); 1♀, Iguazu; 1♀, Province de Cordoba Coconcho, II-1919; 1♀, Salta Capital, 18-IV-1946 (R. Maldonado Bruzzone); 2♂, Corrientes, Corrientes, 15-30-II-1959 (Biraben); 1♀, Manatiales, Corrientes, 1-10-III-1959 (Biraben); 1♂, La Aurora, Sgo. del Estero, II-VI-1945 (R. M. Bruzzone); 2♂, 1♀, José C. Paz, Bs.As., XI-1944 (A. R. Bezzi); 1♀, Toma de Agua, E. Rios, 27-IV-1951 (B. A. Torres); 1♂, 1♀, Ibicuycito, Bs.As., X-1940 (S. R. Castillo); 3♀, José C. Paz, Bs.As., XII-1948 (A. R. Bezzi); 1♀, City Bell, Bs.As., III-1945 (A. Alba); 1♂, San José Misiones, I-1953 (R. Euembuena); 1♂, Clorinda, Formosa, IV-1940 (Denier); 1♂, Ituzaingo, Corrientes, II-1947 (Biraben); 1♀, Pindapoy Misiones, 29-VI-1937 (Denier); 1♂, 1♀, Fontana, Chaco, 20-V-1936 (Denier); 2♂, 4♀, Resistencia, Chaco (Denier); 1♂, Chaco, Rio Araja, IV-1936 (Denier); 3♂, 1♀, Mburucuyá, Corrientes, 16-23-XI-1957 (Birabén); 3 ♂, 4 ♀, Manatiales, Corrientes, II-1946 (Birabén); 4♂, 7♀, Manantiales, Corrientes, V-1946 (T. de Apestol); 2♀, Fontana, Chaco, 28-IV-1936 (P. Denier); 1♂, San Javier Missiones, 4-VII-1937 (P. Denier); 7♂, 8♀, S. José, S. Javier, Pindapoy Misiones, 10al., 29-I-1959 (G. Raimondo); 1 ♂, La Plata, no data; 1♀, Villa Mariá Cordoba, III-1939 (H. Parko); 1♂, Neuquén, XII-1932 (Koehler); 1♂, St. Cruz (Hensel S.). In Berlin Humboldt University Museum, Hungarian National Museum, Stockholm Museum, Carnegie Museum, Museum of Comparative Zoology (Harvard), La Plata Museum, J. A. Slater and R. C. Allen collections.

Leptoglossus impictus (Stål)

Anisoscelis impicta Stål, 1859:233.
Theognis impictus Mayr, 1866:104.
Leptoglossus impictus Stål, 1870:164.—Lethierry and Severin, 1893: 48.—Berg, 1879:72.—Pennington, 1922:131–2.

Pronotum, clavus and corium uniformly dark tan with head above and below and pronotal calli piceous; head with lateral areas and three narrow stripes above light reddish brown; first three antennal segments (with the fourth somewhat lighter), scutellum, veins of clavus and corium, fore and middle legs, undilated portion of hind tibiae, and entire venter dark tan to light reddish brown; apex scutellum, large maculae on inner and a few small maculae on outer tibial dilation whitish yellow to ochraceous; lateral and ventral portion of hind femora and bases of teeth and tubercles light reddish brown, remainder of hind femora and tibial dilations fuscous with tips of teeth and tubercles piceous; connexivum and abdominal dorsum piceous with anterior fourth of connexival segments and apical fourth of last tergum laterally ochraceous; membrane uniformly dark; hind wing concolorous; pronotum, clavus and corium closely punctate with surface above punctures uneven; scutellum transversely rugulose with few punctures; body with whitish to golden appressed, short, erect hairs; legs more densely clothed with long erect pilosity.

Head non-declivent with both tylus and juga raised above level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge slightly exceeding juga, length head 2.04, width head 2.04, interocular distance 1.20, anteocular distance 1.20; pronotum steeply declivent, lateral margins strongly sinuate and denticulate caudally, humeral areas broadly and obliquely ascending, humeral angles subspinose, postero-lateral margins serrate, disk without a median longitudinal carina, calli barely elevated, raised area between calli with two small tubercles laterally, length pronotum 2.72, width across humeri 6.24, width anterior margin 1.56; length scutellum 1.92, width scutellum 2.28; labium extending to posterior edge of metasternum, length labial segments I 1.80, II 1.68, III 1.08, IV 1.44; length antennal segments I 2.40, II 3.36, III 2.04, IV 2.28; hind femora strongly incrassate with a large number of well developed tubercles; outer dilations barely phylliform with two shallow emarginations, occupying 64% length of hind tibiae, and about twice width of inner dilations; inner dilations lanceolate, slightly shorter than outer dilations, furnished with many small spine-like teeth; undilated portion of hind tibiae on inner margins with a double row of small spine-like teeth; length hind tibiae 6.96; length outer dilations 4.44, width outer

dilations 1.44; length inner dilations 3.36, width inner dilations 0.60; genitalia as in *chilensis*; total length 14.9.

In a series of 70 specimens from Piedra Pintada, Neuquén, Argentina, the following differences were noted: dorsum a variegated dark brown and fuscous with numerous piceous maculae; some specimens with declivous face of pronotum entirely yellow or separated medially into two yellow areas, one specimen with entire pronotum yellow; size and number of tubercles and teeth on pronotum and hind femora greater than on other *impictus* individuals and usually entirely piceous. The remainder of the individuals examined are lighter than the above specimens, varying from light tan to dark brown. The holotype is the only individual I have seen without piceous maculae on the abdominal mid-venter.

L. chilensis may be distinguished from *impictus* by the narrower hind femora of the males (both sexes have approximately the same size femora) and by the smaller and fewer tubercles. This is most evident on the dorsal surface where there are only 5–10, whereas in *impictus* the hind femora of the males are noticeably more swollen and have many more prominent tubercles (15–20 on the dorsal surface). In *chilensis* the humeral areas are not greatly expanded and the humeral angles are sub-acute. In *impictus* the opposite is true with the humeral angles subspinose. *L. chilensis* is a narrower species, the length is usually greater than 2.5 times the width across the humeri; in *impictus* the length is usually less than 2.5 (*impictus* average 2.4 (2.2–2.6)—*chilensis* 2.8 (2.5–3.0)). The fourth antennal segment is slightly longer in *chilensis*, averaging 1.3 (1.1–1.7) times the width of the head; in *impictus* the average is 1.1 (1.0–1.3). There is some overlap in the measurements of the two previously mentioned characters and they are difficult to use diagnostically.

Because the series from Piedra Pintada resembles so closely the color pattern of *chilensis*, and there is no significant genitalia difference, I am led to doubt the validity of *impictus* as a species. Yet, *chilensis* and *impictus* seem to be sympatric in their distribution in Argentina, and *impictus* is a wider, more robust species. For these reasons, I think the best solution at the present is to retain *impictus* as a distinct species. There probably will remain some confusion regarding these two species, but until more biological and distributional data are at hand, the exact relationship cannot be understood.

Distribution: Argentina and Uruguay.

Material Examined: Holotype: ♂, Montevideo, Uruguay. In Stockholm Museum. ARGENTINA: 1♂, 3♀, Estancia Don Roberto, Lavaisse, St. Luis. 12 Oct. 1942; 1♂, Carmen, Patagones (Berg); 1♀, Santiago del Estero, Rio Salado (Wagner); 1♀, Santa

Fe (J. M. Bosq); 1♂, 1♀, Mendoza; 1♀, San Pablo, 1905-X (Vezenyi); 1♂, Mendoza (H. Rolle, Berlin W.); 1♀, Rio Negro, Rio Colorado, XII-1930 (J. M. Bosq); 1♀, Cordoba, III-1944 (J. M. Bosq); 1♂, Cordoba (J. M. Davis); 1♀, Salta, Chicoana, "s/tabaco" (J. M. Bosq); 42♂, 28♀, Piedra Pintada, Neuquén, 9-11-1941 (R. Maldonado). In La Plata Museum, Hungarian National Museum, Museum of Comparative Zoology (Harvard), British Museum (Natural History), Deutsches Entomologisches Institut, J. A. Slater and R. C. Allen collections.

Leptoglossus quadricollis (Westwood)

Anisoscelis quadricollis Westwood, 1842:17.
Anisoscelis inconspicuus Stål, 1860:32.
Theognis pulcher Mayr, 1865:434.—Mayr, 1866:106, fig. 25.
Leptoglossus quadricollis Stål, 1870:164.—Lethierry and Severin, 1894:48.
Leptoglossus impressicollis Berg, 1892:69.—Pennington, 1922:134. NEW SYNONYMY.

Pronotum, scutellum, clavus and corium dark reddish brown with head above and below, pronotal calli and outer areas of first antennal segment piceous; pronotum and scutellum with indistinct piceous maculae; veins of clavus and corium reddish tan; medial area of third and entire fourth antennal segments, apex scutellum, and large maculae on inner tibial dilations yellow; head laterally and with three narrow stripes above, fore and middle legs, undilated portion of hind tibiae and inner margin of first antennal segments light brown; antennal segments two and remainder of three somewhat darker brown; distal three fourths of hind femora and tibial dilations fuscous with femoral teeth and tubercles piceous; thoracic and abdominal venter light brown with many small piceous spots frequently fusing to form larger maculae, also large piceous areas as follows: dorsal half of meso- and metapleura, mid-venter of thorax, most of ventral area on second, third, and fourth abdominal sterna; connexivum and abdominal dorsum piceous with connexival incisures ochraceous; membrane uniformly dark; pronotum, clavus and corium coarsely and closely punctate; pronotum with surface above punctures smooth medially, uneven laterally; scutellum transversely rugulose with few punctures; body and appendages with appressed golden pubescence and erect short hairs, becoming more dense on head, anterior portion of pronotum, propleura and hind femora; anterior portion of pronotum and scutellum with longer erect pilose hairs.

Head non-declivent with both tylus and juga raised above level

of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge, slightly exceeding juga, length head 2.04, width head 2.04, interocular distance 1.08, anteocular distance 1.20; pronotum steeply declivent, lateral margins sinuate and entire, humeral areas broadly and obliquely ascending, humeral angles subacute, postero-lateral margins barely crenulate, disk slightly tumid with a very shallow median longitudinal furrow, median longitudinal carina obsolete, calli prominently elevated, raised area between calli with two small tubercles, length pronotum 2.24, width across humeri 5.12, width anterior margin pronotum 1.44; length scutellum 1.80, width scutellum 2.04; labium extending to posterior margin of second abdominal sternum, length labial segments I 2.16, II 1.92, III 1.08, IV 1.92; length antennal segments I 2.40, II 3.60, III 2.16, IV 3.12; hind tibiae with outer dilations conspicuously phylliform with one shallow and three deep emarginations, occupying 81% length of hind tibiae, about twice width of inner dilations; inner dilations lanceolate, shorter than outer dilations, armed with many small spine-like teeth; undilated portion of hind tibiae with few small spine-like teeth arranged in a double row on inner margins, length hind tibiae 8.16; length outer dilations 6.60, width outer dilations 2.16; length inner dilations 5.52, width inner dilations 0.96.

Claspers (Fig. 14) with inner basal lobe low and rounded, shank thin without a median lobe, hook strongly curved; capsule with a rounded median notch, no dorsal prongs, lateral margins barely flared; aedeagus with dorsal sac of conjunctiva with sclerotized proximal lobes present; medial lobes present and unsclerotized, left lobe long and wide, right lobe shorter, more narrow; sclerotized anterior distal lobe present, two lateral distal lobes of same shape and size, both sclerotized; total length 14.4.

The description is of the male lectotype of *L. inconspicuus*.

In the small series of specimens examined, there is little variation in the color pattern, although one individual has the entire pronotum yellow and with small piceous spots. The labium varies in length from the posterior margin of the metasternite to the posterior margin of the second abdominal sternite.

L. quadricollis is a member of the *chilensis* group as evidenced by the short labium, lack of the transverse fascia on the corium, the genital capsule with a rounded median notch and no dorsal prongs. The lack of a serrate lateral margin on the pronotum, the larger and more phylliform tibial dilation, and the distinctive clasper with the median lobe of the shank absent will distinguish *quadricollis* from the other members of the group.

After examining the male holotype of *impressicollis* Berg, I found

it to be conspecific with *quadricollis* and I hereby formally synonymize *impressicollis*.

Distribution: Argentina and Brazil.

Material Examined: Syntype series of *Leptoglossus inconspicuus* Stål: 1♀, Brazil; 1♂, Brazil (F. Sahlb); 1♀, Rio Janeiro (F. Sahlb); 1♂, Rio Jan. (Stål). In Stockholm Museum. The ♂ specimen from Rio Jan. (Stål) is selected as LECTOTYPE of *inconspicuus*, and an appropriate label has been placed on the specimen to that effect. ♂ holotype of *Leptoglossus impressicollis* Berg from Corrientes, Argentina. In La Plata Museum. BRAZIL: 1♂, 1♀, Rio de Janeiro, Brasilien (Dr. Studt G.). In Berlin Humboldt University Museum.

Leptoglossus dentatus Berg

Leptoglossus dentatus Berg, 1892:68.—Lethierry and Severin, 1894: 47.—Pennington, 1922:133.

Pronotum, clavus and corium uniformly dark reddish brown, head above piceous and veins of corium more reddish; apex scutellum, fourth antennal segments, fore and middle legs, basal third of hind femora, undilated portion of hind tibiae and maculae on tibial dilations yellowish to ochraceous; head below and with three narrow stripes above, first antennal segments (with segments two and three somewhat lighter), hind femora dorsally, and tibial dilations dark reddish brown; thoracic and abdominal venter light reddish brown with a single large piceous spot on antero-dorsal area of mesopleuron, pronotal teeth and femoral teeth and tubercles piceous; connexivum and abdominal dorsum fuscous with anterior fourth of connexival segments, large portions of antero-lateral areas of abdominal dorsum and segmental sutures bright yellow, strongly contrasting with remaining dark areas; membrane uniformly dark; pronotum, clavus and corium coarsely and closely punctate, surface above punctures uneven; scutellum transversely rugulose with few punctures; body with short appressed silvery white hair, very dense in patches on anterior pronotal disk; body with sparse short and long erect hairs; legs with more dense, longer, erect pilosity.

Head non-declivent with tylus and juga raised above level of antenniferous tubercles, tylus forming a rounded elevated ridge, barely exceeding juga, distal end of tylus slightly produced dorsally as a low rounded knob, length head 2.28, width head 2.16, interocular distance 1.20, anteocular distance 1.20; pronotum steeply declivent, lateral margins with well spaced teeth much larger than serrations on postero-lateral margins, humeral areas broadly rounded and almost vertically ascending, humeral angles acute, calli prominently elevated, raised

area between calli with two small tubercles, length pronotum 2.24, width across humeri 4.48, width anterior margin pronotum 1.44; length scutellum 1.92, width scutellum 1.80; labium extending to middle of metasternum, length labial segments I 1.92, II 1.80, III 1.08, IV 1.44; first antennal segment with a few short teeth, length antennal segments I 2.52, II 3.72, III 2.28, IV 3.96; hind tibiae with outer dilations phylliform, with two deep and one shallow emargination, occupying 66% length of hind tibiae and almost two and a half times width of inner dilations; inner dilations lanceolate, considerably shorter than outer dilations, distal margins furnished with a few small spine-like teeth, undilated portion of hind tibiae with a double row of small spine-like teeth on inner margins, length hind tibiae 7.44; length outer dilations 5.04, width outer dilations 2.04; length inner dilations 3.60, width inner dilations 0.60.

Claspers (Fig. 15) with inner basal lobe small and rounded, shank thin with prominent median lobe, hook short and strongly curved; capsule (Fig. 39) with a rounded median notch and with prominent but low rounded dorsal prongs, lateral margins flared; aedeagus with dorsal sac of conjunctiva with sclerotized proximal lobes; unsclerotized medial lobes present, right lobe almost as long as dorsal sac, left lobe shorter and not as wide; large anterior distal lobe present, lateral lobes present—one spinose, one rounded, all distal lobes sclerotized; total length 15.0.

The description is of a male specimen from Tucuman, Argentina. There is no significant variation in the material examined, except that some individuals have a few small piceous maculae on the abdominal venter.

L. dentatus is an easily identifiable species by the possession of strongly dentate pronotal lateral margins, the single large black spot on the metapleura, and the yellow pattern on the abdominal dorsum. The placement of *dentatus* within the *chilensis* group is based on the short labium and lack of the transverse corial fascia. The presence of small dorsal prongs on the capsule suggests a relationship to the *stigma* group. *L. dentatus* is one species in Division B that lacks numerous small piceous spots on the entire venter, although a few individuals have faint piceous spots confined to the abdominal mid-ventral area.

Mann (1969) reports that *dentatus* feeds upon a variety of cactus species, primarily prickly pear (*Opuntia* spp.).

Distribution: Argentina and Uruguay (Mann, 1969).

Material Examined: Holotype. 1♀, Cordoba, Argentina. In La Plata Museum, Argentina. ARGENTINA: 2♀, Santiago del Estero, Rio Salado (Wagner); 1♂, Corodoba (W. M. Davis); 1♂, Cordoba;

1 ♂, Tucuman, II-1-1950 (P. Wygodzinsky); 1 ♂, Guemes, IV-3-1930 (H. A. Jaynes); 1 ♂, 2 ♀, Santiago del Estero Fernandez, 30-1-1939 (J. M. Bosq); 2 ♀, Santiago del Estero (Wagner); 2 ♂, Chaco, Las Brenas, IV-1941 (Bosq); 1 ♀, Chaco, Asila Leg. (Bosq); 1 ♀, Corzuela, 8-1-1936 (Denier); 1 ♂, Colonia Benitez, 1-V-1939 (Denier); 1 ♀, Prov. de La Rioja (Bosq); 1 ♀, S/algodoners danos no constat, S. Pena, 1-IV-1938 (Denier); 2 ♀, T. Formosa, Paso Angelito, S/el rio Porteno Lag, Nainec, 12-XII-1935 (Denier); 1 ♂, Tablillas, Salta, II-1945 (Martinez); 1 ♀, Concaran S. Luis, 16-III-1960 (Vidal S. —Trotta). In La Plata Museum, Museum of Comparative Zoology (Harvard), United States National Museum, J. A. Slater and R. C. Allen collections.

Leptoglossus balteatus (Linnaeus)

Cimex balteatus Linnaeus, 1771:534.
Cimex auctus Fabricius, 1781:351.
Lygaeus auctus Fabricius, 1794:139.
Lygaeus balteatus Fabricius, 1794:142.
Anisoscelis fasciatus Herrich-Schaeffer, 1851:277.
Anisoscelis thoracicus Guerin, 1857:386.
Theognis schaefferi Mayr, 1866:102–3.
Leptoglossus auctus Stål, 1868:52.
Leptoglossus balteatus Stål, 1870:161–2.—Barber, 1939: 310–11.—Barber and Bruner, 1947:80.—Wolcott, 1948:197.
Anisoscelis selecta Walker, 1871:127–8. NEW SYNONYMY.

Pronotum, scutellum, clavus and corium dark reddish brown with head above, outer areas of first antennal segments and pronotal calli piceous; medial portion of antennal segments two and three and apical half of fourth, a narrow band on posterior marginal area and two large well separated, longitudinal ovoid spots on disk of pronotum ochraceous, the latter interspersed with numerous small piceous spots; apex scutellum, straight transverse fascia on corium, large maculae on inner tibial dilations, and undilated portion of hind tibiae whitish yellow; head below and with three narrow stripes above, inner margin of first antennal segment with distal portion of segments two and three and apical half of fourth segment, basal and ventral portions of all femora, fore and middle tibiae entirely, and hind tibial dilations light reddish brown; dorsal portion of femora fuscous with teeth and tubercles piceous; thoracic and abdominal venter light to dark reddish brown with numerous small piceous spots frequently fusing to form larger maculae; connexivum and abdominal dorsum piceous with connexival sutures and medial area of dorsum broadly ochraceous; mem-

brane uniformly dark; pronotum, clavus and corium coarsely and closely punctate with surface above punctures uneven, scutellum transversely rugulose with small punctures; venter with dense short and appressed whitish hairs; clavus and corium with short semi-decumbent golden hairs and anterior half of pronotum with thick darker hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 2.64, width head 2.16, interocular distance 1.20, anteocular distance 1.32; pronotum abruptly declivent, lateral margins straight and entire, humeral areas slightly expanded with humeral angles spinose and obliquely ascending, postero-lateral margins serrate, calli prominently elevated with area between calli only slightly higher, disk posteriorly without a median longitudinal carina, length pronotum 3.04, width across humeri 5.76, width anterior margin pronotum 1.56; length scutellum 2.16, width scutellum 2.04; labrum reaching to anterior margin of fourth abdominal sternum, length labial segments I 2.76, II 2.52, III 1.44, IV 2.64; length antennal segments I 2.64, II 3.96, III 2.88, IV 4.56; hind tibiae with outer dilation phylliform with one shallow and two deep emarginations, occupying 63% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate, shorter and with margin distally furnished with a few small spine-like teeth; undilated portion of hind tibiae armed inwardly with a double row of small spine-like teeth, length hind tibiae 8.40; length outer dilations 5.28, width outer dilations 1.92; length inner dilations 4.44, width inner dilations 0.84.

Claspers (Fig. 25) with prominent and rounded inner basal lobe, median lobe on shank rounded and well developed, hook strongly curved; capsule (Fig. 51) with median notch "V" shaped, dorsal prongs low and rounded almost obsolete, lateral margins flared and extending beyond curvature of capsule; aedeagus with dorsal sac of conjunctiva bearing paired sclerotized proximal lobes, two long similar median lobes present with tips slightly sclerotized, anterior distal lobe and two lateral distal lobes present with lateral lobes spinose, all three distal lobes heavily sclerotized; total length 17.3.

The above description is of a male specimen from Jamaica. The variation in color present is of a geographic nature. Specimens from the Bahamas, Cuba, and Jamaica have the two ochraceous pronotal spots rounded and well separated, the first antennal segment is unicolorous and the pubescence on the dorsum is generally pale and long. The specimens from Puerto Rico, Dominican Republic, and Haiti have pronotal spots that are larger, quadrate, and tending to spread out laterally and medially sometimes partially fusing together, the first

antennal segment is bicolored, and the pubescence appears to be short and sparse. Stål (1871) and Barber (1939) both mentioned the pronotal coloration, but neither stated the locality of specimens involved.

I have examined Walker's *selectus* from St. Domingo, and found it to be identical to *balteatus*. Walker probably described the species as new based on the difference in pronotal coloration since Linnaeus described *balteatus* from a Jamaican specimen. *Leptoglossus selectus* is here formally synonymized.

L. balteatus is closely related to *phyllopus* and can be distinguished from the latter by the pronotal coloration. Although some individuals of *phyllopus* may develop yellow pronotal spots, the margins of these spots are not well defined, but appear diffused. The lateral angles of *balteatus* are acute to subspinose and ascending, while those on *phyllopus* are subacute and only slightly turned up. The length of the outer tibial dilation is also of diagnostic value, in *phyllopus* this dilation extends 76–87% the length of the hind tibiae; in *balteatus* it varies between 63–70%. The unicolorous hind wing of *balteatus* is easily distinguished from the obviously bicolored hind wing of *phyllopus*. The median notch on the genital capsule and the basal portion of the claspers are essentially the same in the two species. In *balteatus* the lateral posterior margins are flared and project backwards over the curvature of the capsule, and the clasper has a well developed median lobe on the shank. The lateral margins on the capsule are not flared or prominent in *phyllopus* and the clasper has only a small median lobe. *L. balteatus* has been confused with *grenadensis* in the past, but the two species are quite distinct. The shape and color of the pronotum is almost identical except that in *grenadensis* the lateral angles are not quite so acute or ascending. The clavus and corium are more uniform in color and the transverse fascia on the corium is straight, while *grenadensis* has the claval area and the veins lighter in color than the rest of the corium, and the transverse fascia is distinctly angular. The difference in the genital capsule is very prominent, *grenadensis* has distinct dorsal prongs and *balteatus* (Fig. 51) has a simple margin, with prongs obsolete. The claspers and aedeagus also differ considerably.

L. balteatus has been reported as feeding on cotton, tomatoes, leguminous plants, oranges, and cowpeas (Barber and Bruner, 1947; Pagden, 1928). Barber and Bruner (1947) also state that it breeds on guava (*Psidium guafara* [*sic*] L.) and *Luffa* species.

Distribution: This species is present in the Greater Antilles, the Bahama Islands, and there is at least one record from Florida (Barber,

1914). The localities cited by Uhler (1893) were based on erroneous identifications (see discussion under *grenadensis*).

Material Examined: BAHAMA ISLANDS: 1♂, 1♀, New Providence, Nassau, July 1904 (Allen, Banbom, and Ronjant); 1♂, Andros Island, Fresh Creek, April 23, 1953, Van Voast, A.M.N.H. Bahama Island Exped. (E. B. Hayden, L. Giovannoli). JAMAICA: 5♂, 2♀, Torrington, July 18, 1960 (P. and C. Vaurie). CUBA: 1♀, vic. of Havana (T. Barbour); 1♂, 3♀, Habana (F. Z. Cervera); 1♀, Jaronu, V-13-31, "on weeds" (L. C. Scaramuzza); 1♂, Guane, Sept. 24–26, 1913; 1♀, Soledad, 20-II-1925 (J. G. Myers); 3♂, 3♀, Nov. 1874 (Gundlack); 1♀, no data. DOMINICAN REPUBLIC: 1♂, 1♀, San Jose de las Matas 1000–2000 ft., June 1938 (Darl.); 1♂, 2♀, Puerto Plata (Hurst). PUERTO RICO: 1♀, Humacao, July 1937 (J. Carrion); 1♀, Ensenada, June 14–19, 1915; 1♂, Nov. 1874 (Krug). SAINT THOMAS: 1♀, Angek, 19-1-1908 (L. Eggert); 2♂, 1♀, no data. In American Museum of Natural History, Museum of Comparative Zoology (Harvard), Berlin Humboldt University Museum, Stockholm Museum, University of Kansas (Snow collection), J. A. Slater and R. C. Allen collections.

Leptoglossus phyllopus (Linnaeus)

Cimex phyllopus Linnaeus, 1767:731.
Lygaeus phyllopus Fabricius, 1794:139.
Anisoscelis albicinctus Say, 1831:326.
Anisoscelis phyllopa Westwood, 1842:16.
Anisoscelis fraterna Westwood, 1842:16.—Distant, 1901a:334.
Anisoscelis confusa Dallas, 1852:453.
Theognis phyllopus Mayr, 1866:103.—Hussey, 1953:32.
Leptoglossus albicinctus Stål, 1868:52.
Leptoglossus phyllopus Stål, 1870:161.—Distant, 1881:124, 361.—Lethierry and Severin, 1894:48.—Van Duzee, 1917:88.—Gibson, 1917:72.—Parshley, 1923:747.—Blatchley, 1926:225–26, fig. 46.—Deay, 1928:377.—Torre-Bueno, 1941:50.—Froeschner, 1942:594, 599.—Hussey, 1953:32.—Drew and Schaefer, 1963: 114.

A medium sized species; uniformly dark chocolate brown on the dorsum with occasionally yellow spots on the pronotal disk; a straight whitish yellow transverse fascia on the corium, venter light to dark tan with numerous small piceous spots; hind wings prominently bicolored, with the basal portion clear and the apical portion with a brownish tinge; hind tibiae with outer dilation phylliform usually with two deep emarginations. Genitalia similar to *balteatus*.

L. phyllopus and *balteatus* are closely related species as evidenced by the similarity of the genitalia and general color pattern. The absence of pronotal spots, possession of a bicolored hind wing, and sub-acute to rounded humeral angles will serve to distinguish *phyllopus* from *balteatus*. In general, *phyllopus* may be separated from any member of the *stigma*-group by the straight transverse fascia on the corium (*stigma*-group members either lack the corial fascia or if present, it is irregular not straight), the rounded median notch, and the absence of dorsal prongs on the genital capsule (*concolor* in the *stigma*-group lacks dorsal prongs; in this case the median notch is deeply rectangular in shape and not rounded). Specifically, *phyllopus* may be separated from both *concolor* and *oppositus* by the shorter labium, which usually does not extend past the second abdominal sternum, in *stigma* and *oppositus* the labium usually extends well onto the abdomen around the third and fourth sternum; and from *oppositus* by having at least the pronotal postero-lateral margins crenulate to serrate (*oppositus* has all lateral margins on the pronotum entire).

L. phyllopus, a very common insect in the southern United States, has been reported as a pest on a number of important agricultural crops, where occasionally large numbers of individuals inflict considerable damage. The following is a partial list of crops recorded as having been attacked by *phyllopus:* citrus fruits (Ebeling 1959, Watson and Berger 1932), peaches (Snapp 1948), sunflowers (Adams and Gaines 1950), cucumbers and squash (Kelsheimer 1949). Blatchley (1926) lists *phyllopus* as common on yellow-flowered thistle, *Cirsium horridulum* Michx. Schaefer (1965, 1968) describes some morphological aspects of *phyllopus* in his studies on the higher classification of the Coreoidea.

Distribution: A wide ranging species occurring as far north as New York, south to Florida, west to Iowa and Kansas, and southwest through Texas to Lower California and into Central America. I have seen specimens from as far south as Costa Rica, and Distant (1881) lists Panama and Brazil as well.

Material Examined: UNITED STATES: 191 ♂, 142 ♀, Alabama, Arkansas, California, Florida, Georgia, Iowa, Kansas, Louisiana, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, South Carolina, Texas, and Virginia. MEXICO: 1 ♂, Hidalgo, Tezontepec, 21 m. S.W. Actopan, 6600 ft. 27 August 1962 (Ordway and Marston); 2 ♂, Presisio (Forrer); 1 ♀, Salle, no data; 1 ♀, no data (Boucard). GUATEMALA: 1 ♂, 3 ♀, Olas de Moka, Dept. Solola, 3000, Sept. 1908. COSTA RICA: 1 ♂, Zarzero (Schild-Burgdorf); 1 ♀, San Jose (Schild-Burgdorf). In University of Kansas, Stockholm Museum,

Berlin Humboldt University Museum, United States National Museum, Iowa State University, Museum of Comparative Zoology (Harvard), American Museum of Natural History, Hungarian National Museum, California Academy of Sciences, J. A. Slater and R. C. Allen collections.

Leptoglossus ingens (Mayr)

Theognis ingens Mayr, 1865:434.—Mayr, 1866:108, fig. 26.
Leptoglossus ingens Stål, 1870:166.—Lethierry and Severin, 1894: 48.
Anisoscelis santaremus Walker, 1871:129. NEW SYNONYMY.

Pronotal disk, scutellum, clavus and corium dark reddish brown with head above, outer margin of first antennal segment, humeral and lateral areas of pronotum and pronotal calli piceous; veins of clavus and corium wine red; apex scutellum, fourth antennal segment and maculae on inner tibial dilations dark yellow to ochraceous; head below and with three narrow stripes above, inner margins of first, second and third antennal segments, bases and ventral portions of all femora, fore and middle tibiae light reddish brown; dorsum of all femora and hind tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter light reddish brown with numerous small piceous spots frequently fusing to form larger maculae; connexivum and abdominal dorsum piceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate, surface above punctures largely even; scutellum transversely rugulose with few punctures; head, anterior half of pronotum, scutellum, and legs with rather dense long and erect yellowish pilosity; venter, clavus and corium with moderate amounts of short decumbent to semidecumbent yellowish hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, forming a rounded elevated ridge, slightly exceeding juga, length head 2.88, width head 2.64, interocular distance 1.44, anteocular distance 1.56; pronotum abruptly declivent with lateral margin entire and sinuate, humeral areas broadly and obliquely ascending, humeral angles subacute, postero-lateral margins serrate, disk posteriorly with median longitudinal carina obsolete, calli prominently elevated, area between slightly higher, length pronotum 3.68, width across humeri 8.00, width anterior margin pronotum 1.68; length scutellum 2.76, width scutellum 2.76; labium extending to posterior margin of third abdominal sternum, length labial segments I 3.12, II 2.88, III 1.80, IV 3.60; length antennal segments I 2.52, II 4.20, III 3.00, IV 5.40; hind tibiae with outer

dilations phylliform with one shallow and three deep emarginations, dilations very long, occupying 92% length of hind tibiae and width about twice width of inner dilations; inner dilations lanceolate considerably shorter, 55% length of outer, furnished with numerous small spine-like teeth on distal half of margins; inner margins of undilated portions of hind tibiae with two rows of many small spine-like teeth, length hind tibiae 10.8; length outer dilations 9.90, width outer dilations 2.76; length inner dilations 5.52, width inner dilations 1.32.

Claspers (Fig. 17) with lateral basal area only slightly bulbous with inner basal lobe long, thick and rounded, median lobe on shank very prominent, hook thick, blunt and not strongly curved; capsule (Fig. 41) with median notch deep and bottom of notch "V" shaped, dorsal prongs prominent, medial posterior margins mesally projecting slightly antero-dorsally; aedeagus (Fig. 67) with dorsal sac of conjunctiva bearing sclerotized proximal lobes, two median lobes of equal size and shape with tips slightly sclerotized; anterior distal lobes large, lateral distal lobes large and spinose, all distal lobes heavily sclerotized; total length 21.6.

The above description is of a male specimen from Caviuna, Parana, Brazil. This species has considerable color variation in that the pronotum may be entirely dark, or the anterior half before the humeri may be yellow, and the irregular transverse fascia on the corium may or may not be present. Specimens also vary from being uniformly piceous dorsally to a dark reddish brown. I have tentatively identified three female specimens from Olivenca, Brazil as *ingens* that have longer and more spinose humeral angles, but otherwise do not differ from typical *ingens* specimens.

I have examined the female holotype of *Leptoglossus santaremus* (Walker), from Santarem, Brazil, which is deposited in the British Museum (Natural History). I was unable to find any differences between it and *ingens* other than the fact that *santaremus* possesses a transverse fascia on the corium. Therefore, I am formally synonymizing *santaremus* with *ingens*. I should like to point out that all the specimens with a transverse fascia are more northern in distribution than the specimens without it. The results of additional collecting will probably establish these two forms as distinct but conspecific populations.

L. ingens may be distinguished from *macrophyllus* by its darker color, lack of the rectangular yellow fascia on the pronotum and by the presence of two equal sized median lobes on the dorsal sac of the conjunctiva. The wide, elongate outer tibial dilations will serve to distinguish both *macrophyllus* and *ingens* from other members of the genus.

Distribution: Brazil, Bolivia, Paraguay, and Argentina.

Material Examined: (Specimens with a corial transverse fascia): BOLIVIA: 3♂, Yungas de la Paz, 1000 m. (O. Garlepp); 1♂, same except (Linnaea V.); 1♂, Province Sara (Steinbach); 1♂, Buena Vista, Province Tchito, Dep. Santa Cruz, 400 m., 1956 (F. Steinbach); 1♂, 1♀, Rio Cristal Mavu, 50 mi. N.E. Cochabamba, XII-8-1949 (L. Pena); 1♀, Juntus, no data; 1♂, no data. BRAZIL: 1♂, 2♀, Amazon, sup. Olivenca. PARAGUAY: 1♀, Horqueta, 57-10, W. 23–24 N., 44 kilm. East Paraguay Riv., 1-17-1935 (A. Schulze). Specimens without a corial transverse fascia: BRAZIL: 2♂, Caviuna, Parana, Feb. 1947 (A. Maller); 1♀, same except XI-1945; 1♀, Corupa (Hansa Humbolt), S. Cath., I-1946; 1♂, Nova Teutonia, Santa Catarina, IV-10-1948 (F. Plaumann). PARAGUAY: 1♀, Horqueta, 57-10, W. 23–24 N., 44 kilm. East Paraguay Riv., XII-18-1934 (Alberto Schulze); 1♀, same except 1-3-1936. In Stockholm Museum, Hungarian National Museum, Berlin Humboldt University Museum, Museum of Comparative Zoology (Harvard), American Museum of Natural History, J. A. Slater and R. C. Allen collections.

Leptoglossus macrophyllus Stål

Leptoglossus macrophyllus Stål, 1870:162.—Lethierry and Severin, 1894:48.

Pronotal disk posteriorly, scutellum, clavus and corium bright reddish brown with head, first antennal segment, marginal areas of pronotum, calli, and claval sutures piceous; pronotal disk anteriorly with one large sharply defined rectangular transverse band, irregular transverse fascia on corium, and maculae on inner tibial dilations whitish yellow; inner margins of first, medial portions of second and third and the entire fourth antennal segments ochraceous, with proximal and distal portions and a narrow dorsal stripe on segments two and three fuscous; head laterally and with three narrow stripes above, fore and middle tibiae, and undilated portion of hind tibiae light reddish tan; basal half and ventral portions of all femora bright reddish brown with remainder of femora and tibial dilations dark reddish brown to fuscous; thoracic and abdominal venter dark reddish tan with numerous small piceous spots frequently fusing to form larger maculae; connexivum and abdominal dorsum fuscous to piceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures largely even; scutellum transversely rugulose with a few punctures; head, anterior half of pronotum, scutellum, appendages, and mid-venter with dense

golden pilose hairs; remainder of venter and clavus and corium with short appressed and semi-decumbent golden hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a low rounded ridge, length head 2.76, width head 2.40, interocular distance 1.32, anteocular distance 1.56; pronotum abruptly declivent with lateral margins entire and sinuate, humeral areas broadly rounded and only barely obliquely ascending, humeral angles sub-acute, postero-lateral margins crenulate, disk posteriorly with median longitudinal carina obsolete, calli prominently elevated, area between calli higher, length pronotum 3.36, width anterior margin pronotum 1.56; length scutellum 2.28, width scutellum 2.40; labium reaching to anterior margin of fourth abdominal sternum, length labial segments I 2.88, II 2.76, III 1.68, IV 3.00; length antennal segments I 2.40, II 3.84, III 2.88, IV 4.80; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, dilations very long, occupying 86% length of hind tibiae, width about twice that of inner dilations; inner dilations lanceolate, considerably shorter, 68% length of outer with a few small spine-like teeth on distal half of margins; inner margins of undilated portions of hind tibiae with a double row of small spine-like teeth; length hind tibiae 8.88, length outer dilations 7.68, width outer dilations 2.52; length inner dilations 5.58, width inner dilations 1.08.

Claspers (Fig. 16) with lateral basal area bulbous, inner basal lobe prominent, wide and rounded, median lobe on shank prominent and sharply curving back onto shank, hook thick, blunt, not strongly curved; capsule (Fig. 40) with median notch deep and bottom of notch "V" shaped, dorsal prongs prominent with inner margins straight, posterior medial margin projecting slightly antero-dorsad, aedeagus with dorsal sac of conjunctiva with sclerotized proximal lobes; unsclerotized median lobes present, left lobe short with right lobe much longer; large anterior distal lobe present, two lateral lobes large and spinose, all distal lobes heavily sclerotized; total length 19.4.

The following minor color variations were noted: four specimens have a narrow reddish stripe on the yellow pronotal band, with one individual having this band almost divided in two; the abdominal dorsum may be a rusty reddish brown instead of piceous; the scutellum occasionally piceous instead of a bright reddish brown.

L. macrophyllus closely resembles *ingens* in shape and size. The hind tibial dilations are identical, except that the outer dilation is a little longer in *ingens*. The difference in color between the two species is considerable. *Macrophyllus* is a brightly colored species and the yellow rectangular band on the pronotum will distinguish it from the

darker colored *ingens*. In *macrophyllus* the two unequal sized median lobes are present on the dorsal sac of the conjunctiva, in *ingens* the same lobes are of equal size and shape.

Distribution: Venezuela and Colombia.

Material Examined: Two syntypes: 1♂, 1♀, Bogota (Lindig), Colombia. In Stockholm Museum. The ♂ specimen bearing the label Allotypus is here selected as LECTOTYPE, and a label has been attached to the insect to this effect. VENEZUELA: 1♂, 3♀, Merida; 1♂, Rancho Grande nr. Maracay, 2-IX-1946; 1♀ (Breddin); 1♀, Carepilo, June, 1937 (Pablo J. Anduze). COLOMBIA: 1♂, 1♀, Villavicencio; 1♀, Villa Vincencio, 1919; 1♂, Caqueza, Cundinamarca, XII-8-39 (F. J. Otoya); 1♀, Aquadita, VI-1914. In United States National Museum, California Academy of Sciences, American Museum of Natural History, University of Kansas (J. R. de la Torre-Bueno collection), Stockholm Museum, Deutsches Entomologisches Institut, J. A. Slater and R. C. Allen collections.

Leptoglossus conspersus Stål

Theognis vexillatus, 1866 (*nec* Stål):101.

Leptoglossus conspersus Stål, 1870:163.—Lethierry and Severin, 1894:47.

Pronotum posteriorly dark chocolate brown; anterior portion of corium dark reddish brown with scutellum, clavus, apex corium, and veins contrasting bright reddish brown; head, first two antennal segments and pronotal calli piceous; two large medially separated yellowish orange areas interspersed with numerous small piceous spots on pronotum, these light areas occupying almost the entire pronotal disk, extending laterally to margins and obliquely ascending posteriorly to include anterior half of humeral areas; fourth antennal segments and a wide irregular transverse fascia on corium whitish yellow; head below and with three narrow stripes above, basal portion of third antennal segments, small scattered maculae on outer tibial dilation and larger maculae on inner dilations light reddish tan; all legs and tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter light reddish tan with numerous small piceous spots frequently fusing to form larger maculae; connexivum and abdominal dorsum fuscous to dark reddish brown with anterior portion of each connexival segment light reddish brown; membrane uniformly dark; pronotum, clavus and corium closely and finely punctate, surface above punctures largely smooth; scutellum transversely rugulose with numerous small punctures; dorsum with short semi-decumbent golden hairs, with head behind eyes, anterior half of pronotum and

appendages more densely clothed with longer pilose hairs; venter with short erect and appressed whitish hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga, forming a rounded elevated ridge, length head 2.16, width head 2.04, interocular distance 1.08, anteocular distance 1.08; pronotum abruptly declivent with lateral margins entire and barely sinuate, humeral areas not strongly produced and humeral angles sub-acute, postero-lateral margins finely serrate, posterior pronotal disk with an obsolete median longitudinal carina, calli prominently elevated, area between calli slightly higher and with two small tubercles, length pronotum 2.40, width across humeri 4.32, width anterior margin 1.32; length scutellum 1.80, width scutellum 1.92; labium reaching to middle of third abdominal sternum, length labial segments I 2.16, II 2.04, III 1.08, IV 1.92; length antennal segments I 2.16, II 3.12, III 2.40, IV 4.44; hind tibiae with outer dilation phylliform with one shallow and two deep emarginations and occupying 74% length of hind tibiae; width outer dilation about twice width of inner dilations; inner dilations shorter and lanceolate with margins distally furnished with a few small spine-like teeth; undilated portion of hind tibiae armed inwardly with several small teeth in a double row, length hind tibiae 7.56; length outer dilations 5.44, width outer dilations 1.80; length inner dilations 4.32, width inner dilations 0.84.

Clasper (Fig. 20) with bulbous lateral margins on base and inner basal lobe very prominent, shank thick with median lobe hardly evident, hook strongly curved with a small knob on outer curvatures; capsule with median notch deeply rounded with dorsal prongs strongly produced and acute; aedeagus with dorsal sac of conjunctiva with sclerotized proximal lobes; median lobes present with left and right lobes bifid; anterior distal lobe large and heavily sclerotized, lateral lobes spinose and heavily sclerotized; total length 14.4.

In the type series two females are darker and have a more uniform color to the clavus and corium. The labium varies in length from the posterior margin of the metasternum to the third abdominal sternum.

L. conspersus is closely allied to *grenadensis*, having darker and lighter reddish tan areas on the clavus and corium and similar genitalia, but differing in that *conspersus* has large diffused pronotal markings, a longer and wider outer tibial dilation, more blunt and less elevated humeral angles, and (although not completely diagnostic) the labium is generally shorter. The following characters will separate *conspersus* from *zonatus*, *neovexillatus*, and *impictipennis*: large pronotal spots occupying most of disk, a more or less bicolored clavus and corium; clasper (Fig. 20) with a long inner basal lobe and a more

blunt median lobe on the shank; a very large heavily sclerotized anterior distal lobe on the dorsal sac of the conjunctiva and the right median lobe bifid.

Distribution: Colombia and Brazil.

Material Examined: Four syntypes: 1♂, 3♀, Bogota, Colombia (Lindig). In Stockholm Museum. The ♂ specimen (described above) bearing the "Typus" label is here selected as LECTOTYPE and an appropriate label attached to the specimen. One additional specimen was available for study, a ♂ from Minas Geraes, Brazil, also in the Stockholm Museum.

Leptoglossus grenadensis new species
(Fig. 3)

Leptoglossus balteatus Uhler, 1893 (*nec.* L.):705.
Leptoglossus zonatus Uhler, 1894 (*nec.* Dallas):178.
Leptoglossus balteatus Distant, 1901b (*nec.* L.):417 (pt.).

Pronotum, scutellum, and corum dark reddish brown with clavus a light reddish tan; head above, pronotal calli and humeral angles piceous; irregular transverse fascia on corium, posterior sub-marginal area and two large separated longitudinally ovoid spots on disk of pronotum, apex scutellum, and maculae on inner tibial dilations whitish to dark yellow; head laterally and with three narrow stripes above, medial area of antennal segments two and three and entire fourth segments light reddish tan; legs light reddish brown with femora distally, tibial dilation, entire first antennal segment and basal and distal portions of second and third segments fuscous; femoral and tibial teeth and tubercles piceous; thoracic and abdominal venter ochraceous, mottled with numerous small piceous spots occasionally fusing to form larger maculae; connexivum and abdominal dorsum piceous with anterior third of connexival segments and intersegmental sutures on dorsum ochraceous; membrane uniformly dark; pronotum, clavus and corium coarsely and closely punctate with surface above punctures on pronotum uneven; scutellum transversely rugulose with few small punctures; venter densely clothed with short appressed whitish pubescence; dorsum with short semi-decumbent golden pubescence with head behind eyes, anterior portion of pronotum, scutellum, and legs also with longer pilose hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly longer than juga and forming a low rounded elevated ridge, length head 2.40, width head 2.16, interocular distance 1.20; anteocular distance 1.32; pronotum abruptly declivent with lateral margins entire and straight, humeral areas not

expanded with humeral angles acute and obliquely ascending, posterolateral margins serrate, calli prominently elevated with area between calli slightly higher, disk posteriorly without a median longitudinal carina, length pronotum 2.88, width across humeri 5.12, width anterior margin pronotum 1.44; length scutellum 2.04, width scutellum 2.04; labium reaching to anterior margin of fourth abdominal sternum, length labial segments I 2.52, II 2.40, III 1.32, IV 2.52; length antennal segments I 2.52, II 3.84, III 2.88, IV 4.68; hind tibiae with outer dilations phylliform and with two deep emarginations occupying 62% length of hind tibiae, width of outer dilations about twice width of inner dilations; inner dilations slightly shorter, lanceolate with entire margin furnished with many small spine-like teeth; undilated portion of hind tibiae inwardly with a double row of small spine-like teeth, length hind tibiae 7.80; length outer dilations 4.80, width outer dilations 1.44; length inner dilations 4.20, width inner dilations 0.84; genitala as in *conspersus*; total length 15.5.

The following variations were noted in the type series: some individuals with pronotum, clavus and corium a light red brown and yellowish orange areas not so strongly contrasting as in dark red brown individuals; low obscure longitudinal carina on pronotal disk evident on many specimens; scutellum varying from black to red brown and first antennal segment having a prominent inner light stripe; variation in extension of labium from the middle of third to posterior margin of fourth abdominal sternum, one specimen has labium extending to posterior margin of fifth sternum.

The diagnostic characters which separate *grenadensis* from its most closely related species, *conspersus*, are as follows: the pronotal coloration in *grenadensis* is two well defined yellow ovoid spots and a pale posterior sub-marginal area, in *conspersus* these pronotal spots are large and diffuse, occupying most of the pronotum anteriorly, and the posterior sub-marginal area is concolorous with the rest of the dark ground color of the pronotum. *L. grenadensis* has acute, elevated humeral angles, whereas in *conspersus* these angles are more rounded and barely ascending. The length of the outer dilation is smaller in *grenadensis*, occupying 61–64% of the length of hind tibiae, while that of *conspersus* is 74–81% the length of hind tibiae. From *balteatus*, *grenadensis* differs chiefly in that it has dorsal prongs on the capsule and an irregular transverse fascia on the corium.

Distribution: *L. grenadensis* was first reported from St. Vincent by Uhler (1893) as *L. balteatus*. Uhler (1894) again reported it as *L. zonatus* occurring on the island of Grenada. Both of these papers pertain to the collection made by H. H. Smith. Distant (1901b) after seeing the H. H. Smith collection (now in the British Museum) re-

ferred to all the specimens of this species from Grenada as *L. balteatus*. I have seen seven specimens from the British Museum that bear the labels of the H. H. Smith collection, and these are definitely *grenadensis*.

HOLOTYPE: ♂. GRENADINES: Grenada, Balthazar, windward side (H. H. Smith). In United States National Museum, type no. 70225.

PARATYPES: GRENADINES: 1♂, 1♀, Mustique I. (H. H. Smith); 1♂, 2♀, Becquia I. (H. H. Smith); 3♀, Grenada (H. E. Summers); 1♀, Grenada, 8-25-1891 (H. E. Summers); 1♂, 1♀, Grenada, St. Georges, Aug. 1910 (Allen and Brues); 1♀, Grenada, Santeurs, Sept. 1910 (Allen and Brues); 1♂, Grenada, Mount Gay Est. leeward side (H. H. Smith); 1♂, Grenada, Lake Antoine Est. windward side (H. H. Smith); 1♂, 1♀, St. Vincent, Yambu River Valley, 10-3-31, "on guava" (M. Kisliuk, C. E. Cooley); 1♂, 1♀, same except 10-2-31; 1♂, no data. In United States National Museum, Museum of Comparative Zoology (Harvard), Iowa State University, British Museum (Natural History), and J. A. Slater collections.

Leptoglossus zonatus (Dallas)

Anisoscelis zonata Dallas, 1852:452.
Anisoscelis vexillatus Stål, 1855:185. NEW SYNONYMY.
Theognis zonatus Stål, 1862:295.
Theognis vexillatus Stål, 1862:295.
Leptoglossus zonatus Stål, 1870:162.—Distant, 1881:125, 361, pl. 12, fig. 16.—Lethierry and Severin, 1894: 49.—Van Duzee, 1917:88.—Gibson, 1917:72.—Torre-Bueno, 1941:50–1.
Leptoglossus vexillatus Stål, 1870:162.—Lethierry and Severin, 1894: 49.

Pronotum, scutellum, clavus and corium dark chestnut brown with head above, outer marginal areas of first antennal segment, pronotal calli and marginal areas of humeri piceous; apex scutellum, wide irregular transverse fascia on corium, larger maculae on inner tibial dilations and two large well separated distinctly longitudinal ovoid spots on pronotal disk whitish yellow, the latter interspersed with numerous small piceous spots; basal three fourths of antennal segments two and three and entire fourth antennal segments light reddish brown with inner margins of first somewhat darker and distal portion of second and third fuscous; head below and with three narrow stripes, above reddish brown; fore, middle and undilated portion of hind tibiae, all tarsi, basal and ventral portions of femora and small

scattered maculae on outer tibial dilation light brown to reddish brown; distal portion of femora dorsad and tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter variegated dark and light brown with numerous small piceous spots frequently fusing to form irregular maculae; connexivum and abdominal dorsum piceous with anterior fourth of connexival segments and narrow areas around intersegmental sutures yellow; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures smooth; scutellum transversely rugulose with numerous small punctures; venter thickly clothed with short appressed whitish pubescence, and sparse short erect hairs; legs, anterior portion of pronotum and scutellum with more dense, longer and erect pale pilose hairs; dorsum with semi-decumbent whitish hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge; length head 2.88, width head 2.64, interocular distance 1.44, anteocular distance 1.56; pronotum abruptly declivent, lateral margins only slightly sinuate and entire, humeral areas moderately expanded, not obliquely ascending, humeral angles small sub-acute, postero-lateral margins serrate, calli prominently elevated, area between calli only slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 3.36, width across humeri 6.56, width anterior margin pronotum 1.68; length scutellum 2.52, width scutellum 2.64; labium reaching middle of fourth abdominal sternum, length labial segments I 3.24, II 3.12, III 1.80, IV 3.36; length antennal segments I 3.12, II 4.80, III 3.36, IV 4.68; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, occupying 72% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate, slightly shorter than outer, distally furnished with numerous small spine-like teeth along margins; inner margins of undilated portions of hind tibiae with a double row of small spine-like teeth, length hind tibiae 10.1; length outer dilations 7.20, width outer dilations 2.40; length inner dilations 6.00, width inner dilations 1.20.

Claspers (Fig. 18) with inner basal lobe strongly produced and rounded, shank with median lobe prominent and rather sharply curving back onto shank, hook strongly curved and outer curvature with a small knob, capsule (Fig. 42) with median notch deeply rounded, dorsal prongs prominently acute and projecting medially; aedeagus with dorsal sac of conjunctiva as follows: proximal lobes sclerotized; median lobes present, left median lobe short with tip sclerotized and a longer thin lobe arising from its base, right median lobe longer and wider, anterior distal lobe small and closely appressed to wall of sac,

one distal lateral lobe large and spinose the other smaller and more blunt, all three distal lobes strongly sclerotized; total length 20.8.

The description is of a male specimen from Yucatan, Mexico.

In the large series of specimens examined there is a considerable amount of variation present. Individuals will vary from light brown to dark brown. The transverse fascia is typically a wide irregular band, but some specimens have the narrow band confined to the area of the veins. Two individuals lack the band. There is considerable variation in the width of the outer dilation on the hind tibiae. The labium varies in length from the anterior margin of the second sternum to the posterior margin of the fourth.

Stål distinguished *vexillatus* from *zonatus* on the basis of its smaller hind tibial dilations and because there were only two emarginations or "teeth" on the margin of the outer dilation. At that time, *zonatus* was known only from Mexico and typical *zonatus* specimens from Mexico have a considerably wider dilation and usually possess one shallow and two deep emarginations. After examining a large series of specimens, I feel Stål's type series of *vexillatus* represents the smaller extreme of variation present in *zonatus*. The color pattern and other external characters as well as male genitalia are identical for these two taxa. I am at this time formally synonymizing *vexillatus* with *zonatus*. Stål's syntype series from Colombia consists of four specimens with the following labels: 2 males, Bogota (Lindig); 1 male, no data; 1 female, Remidios. These are deposited in the Stockholm Museum. The male specimen bearing the "typus" label is selected as LECTOTYPE with an appropriate label attached.

L. zonatus is closely related to *impictipennis* and *neovexillatus*, and may be distinguished from the former by its lack of serrate lateral margins on the pronotum and from the latter by the less steeply declivent pronotum, straighter lateral margins and humeral areas that are almost horizontal, not obliquely ascending. The aedeagus is distinct from both *impictipennis* and *neovexillatus* in that the short left median lobe has a secondary appendage. The following characters, although less reliable are worth stating because of their slight variability: *zonatus* is generally a larger species; the labium usually reaches to the fourth abdominal sternum; the pronotal disk has two large distinctly ovoid spots; the transverse fascia on the corium is usually a wide, brightly pigmented band, only five specimens out of 143 examined lacked this fascia.

L. zonatus has been reported to feed on oranges, watermelons, dates, and cotton (Cockerell 1905). It is also known to transmit the heart rot of pomegranates (Burgess and Hawkins 1945).

Distribution: Lower California and southwestern United States, through Central America and into the northern half of South America.

Material Examined: 51♂, 92♀. *California*: Calexico, Canipole; San Jose del Cabo; San Diego; Pasadena; Angeles Bay, San Pedro; Imperial Valley; Santa Cruz; El Marmol. *Arizona*: Huachuca Mts.; Tucson; Phoenix; Yuma Co.; Patagonia; Whetstone Mts. *Texas*: Davis Mts. MEXICO: Puebla; Antiguo; Morelos; Cuernavaca; Jalapa; Salle; Tepie; Sinaloa, Los Mochis; Oaxaca, Oax.; Tehuantepec; Mazatlan; Telmantepec; L. Chapata; Cyn Sapopa, Sonora; Chilpancingo; Vera Cruz; Hoege; Jacaia Hidalgo; Yucatan; Tesopaco; Baja California; Las Parras. GUATEMALA: Antigua; S. Gerocimo; Los Amates. HONDURAS: no locality. EL SALVADOR: San Miguel. NICARAGUA: La Calera; Managua. COSTA RICA: Palmer, Dept. Puntarenas; Turrialba; San Jose. PANAMA: Porto Bello; Boquete; La Campana; V. de Chiriqui; Bugaba; Cerro Zunil. VENEZUELA: Merida; Pts. Cavello. COLOMBIA: Villavicencio; Cali; Villa Vieja. ECUADOR: Paramba. PERU: Satipo; Monson Valley, Tingo Maria; Cumbase; Selipo; Tarapoto. BOLIVIA: Rurrenabaque Beni; Province Sara; Rio Cristal Mavu, N.E. Cochabamba. BRAZIL: Amazon; Olivenca. In Museum of Comparative Zoology (Harvard), California Academy of Sciences, Stockholm Museum, United States National Museum, American Museum of Natural History, Iowa State University, British Museum (Natural History), Berlin Humboldt University Museum, J. A. Slater and R. C. Allen collections.

Leptoglossus neovexillatus new species

Pronotum, scutellum, clavus and corium dark reddish brown with head above, outer areas of first antennal segments, pronotal calli, and marginal areas of humeri piceous; two large poorly defined ovoid spots on pronotal disk yellow, interspersed with numerous small dark brown to piceous maculae; apex scutellum, narrow irregular transverse fascia on corium confined to veins, maculae on inner and outer tibial dilations, and undilated portion of hind tibiae whitish yellow; head below and with three narrow stripes above, inner margins of first antennal segment, entire second and third with distal portion slightly darker and fourth segments with apex somewhat darker, entire fore and middle legs ochraceous to light tan; distal three fourths of hind femora and tibial dilations fuscous with bases and ventral portion of femora light reddish brown; femoral and tibial teeth and tubercles piceous; thoracic and abdominal venter tan to light brown with numerous small piceous spots frequently fusing to form larger maculae; connexivum fuscous and abdominal dorsum piceous with anterior third of con-

nexival segments and intersegmental sutures whitish yellow; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures uneven; scutellum transversely rugulose with few punctations; venter rather thickly clothed with short appressed whitish pubescence and sparse short erect hairs; legs also with more dense longer and erect pale pilose hairs; dorsum with short semi-decumbent golden hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 2.40, width head 2.16, interocular distance 1.20, anteocular distance 1.32; pronotum steeply declivent, almost vertical, lateral margins sinuate, entire, humeral area moderately expanded, rounded and obliquely ascending, humeral angles small sub-acute, postero-lateral margins barely serrate, calli prominently elevated, area between calli only slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 1.92, width across humeri 3.60, width anterior margin pronotum 1.44; length scutellum 1.90, width scutellum 1.90; labium reaching posterior margin of second abdominal sternum, length labial segments I 2.16, II 1.92, III 1.20, IV 1.92; length antennal segments I 2.40, II 3.48, III 2.40, IV 4.08; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, dilations occupying 68% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate, slightly shorter than outer, with numerous small spine-like teeth along margins; inner margin of undilated portion of hind tibiae with a double row of small spine-like teeth, length hind tibiae 7.80; length outer dilations 5.28; width outer dilations 1.92; length inner dilations 4.44, width inner dilations 0.84.

Clasper and capsule as in *zonatus*; aedeagus with dorsal sac of conjunctiva as follows: sclerotized proximal lobes present; medial lobes present with left lobe small and thin, right lobe longer and wider; sclerotized anterior distal lobe present and not appressed to wall of sac; one lateral distal lobe modified into a long spine, the other obsolete, both sclerotized; total length 15.5.

There is a considerable amount of color variation in the type series. Specimens vary from light brown to a dark reddish brown. The irregular transverse fascia on the corium can be a sharply outlined and brightly pigmented stripe or it can be completely lacking, as well as with all intermediate conditions. The yellow pronotal markings vary from two well defined spots to a broad uninterrupted band occupying the entire anterior pronotal area. Four specimens of the 51 examined have this yellow pronotal pattern reduced to small maculae. The labium varies in length from the anterior margin of second to anterior

margin of fourth abdominal sternum (only seven species possess labia that pass the posterior margin of the second sternum).

Specimens of *neovexillatus* have been misidentified as *vexillatus* because many of the males have a narrower and double "toothed" tibial dilation. *L. neovexillatus* may be distinguished from *zonatus* by its generally smaller size, the almost vertical declivity of the pronotum, the more strongly sinuate pronotal lateral margins, the more rounded and obliquely ascending humeral angles, the generally shorter labium and the dorsal sac of the conjunctiva with the left median lobe simple and without any secondary appendages, and one distal lateral lobe being obsolete. It may be distinguished from *impictipennis* by its non-serrate lateral pronotal margin and by the unequal sized lateral lobe on the dorsal sac of the conjunctiva.

HOLOTYPE: ♂. Brazil: Corumba, Acc. No. 2966, March. In Carnegie Museum.

PARATYPES: PERU: 1♂, Bella Vista, San Martin, Dec. 8, 1946, "alt. 1500 ft." (J. C. Pallister); 1♂, Vilcanota, no data (J. M. Bosq). BRAZIL: 1♂, Corupa (Hansa Humbolt), S. Cath., I-1945 (A. Maller); 1♀, same except I-1946; 1♀, same except XI-1945; 1♀, Nova Teutonia, Santa Catarina, XII-7-1948 (F. Plaumann); 1♂, 1♀, same except I-II-1949; 1♂, 1♀, Rio Grande, no data; 1♂, Parana, Tibagye (V. Konigswald); 1♂, no data; 2♀, Loreto, Missiones, II-XII-1941 (Biraben-Bezzi); 1♀, San Ignacio Missiones, 8-XII-1941 (Biraben-Bezzi); 1♀, Corumba, Acc. No. 2966, March, "lowland"; 1♀, same except April, "highland"; 1♂, 1♀, Matto Crosso, 96-204 (Spencer Moore); 1♀, Bahia, Iguassu, Sv. Amaz. Exp., 22 Aug. (Roman); 1♂, Curitiba, Para., "on berries of *Schinus terebinthifolius*" III-1954 (N. L. H. Krauss); 1♀, Bilbao, 1904. BOLIVIA: 1♂, 1♀, 1904-311 (J. Steinbach); 1♂, Prov. Sara (Steinbach). PARAGUAY: 1♂, Horqueta, XII-26-33 (Al. Schulze); 1♀, V. Encarracion, 2-III (F. Schade); 1♂, Rio Apa, Dto Carlos entre, Punta Apa y, Bellavista, 5-XII-1935 (Denier). URUGUAY: 1♀, Minas Geraes, no data; 1♀, Colonia Benitez Chaco, 1-V-1939 (Denier). ARGENTINA: 2♂, 1♀, Province Salta 2500 m. (J. Steinbach S.V.); 1♀, Province Salta, 2.05 (J. Steinbach S.V.); 1♂, 1♀, Salta las Canas, III-1938; 1♂, Fab. Chaco, 22-X-1899 (S. Venturi); 1♀, S. Tome, Corrientes; 1♀, Guemes Salta, #45 (Martinez-Bezileg); 1♀, Salta; 1♂, Jujuy; 3♀, Prov. of Buenos Aires (J. Bosq); 1♂, Prov. Tucuman, 7-IX-1900; 1♂, Tucuman, 11-13-1918, Est. Expt. Agric. No. 1307; 1♀, Tucuman, no data; 1♀, Bob. de Misiones (J. M. Bosq); 1♀, no locality (J. M. Bosq). In the American Museum of Natural History, United States National Museum (J. C. Lutz collection), Hungarian National Museum, La Plata Museum, Stockholm Museum, Berlin

Humboldt University Museum, Carnegie Museum, British Museum (Natural History), California Academy of Sciences, Museum of Comparative Zoology (Harvard), J. A. Slater and R. C. Allen collections.

Leptoglossus impictipennis Stål

Leptoglossus impictipennis Stål, 1870:163.—Lethierry and Severin, 1894:47.

Pronotum, clavus and corium rusty reddish brown with scutellum fuscous; head, pronotal calli and margins of humeri piceous; two indistinct and partially separated ovoid spots on pronotal disk ochraceous and interspersed with numerous small piceous spots; apex scutellum and maculae on inner tibial dilations whitish yellow; head laterally and with three narrow stripes above, all antennal segments with the fourth segments somewhat lighter, and all legs light reddish brown; dorsum of hind femora distally and tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter dark reddish brown with numerous small piceous spots frequently fusing to form larger maculae; connexivum fuscous with anterior fourth of each segment ochraceous; abdominal dorsum piceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures largely smooth; scutellum transversely rugulose with few punctures; body above and below with moderate amounts of short pale erect and semi-decumbent hairs; thoracic and abdominal mid-venter, legs, head dorsally and anterior portion of pronotum with more dense long pilose hairs.

Head porrect with tylus and juga raised above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 2.04, width head 1.92, interocular distance 1.08, anteocular distance 1.20; pronotum abruptly declivent with lateral margins almost straight and serrate caudally, humeral areas not expanded, humeral angles acute and obliquely ascending, postero-lateral margins serrate, calli prominently elevated with area between calli only slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 2.24, width across humeri 4.96, width anterior margin pronotum 1.44; length scutellum 1.80, width scutellum 1.92; labium reaching to anterior margin of fourth abdominal sternum, length labial segments I 1.92, II 1.92, III 1.20, IV 2.16; length antennal segments I 2.04, II 3.24, III 2.16, IV 3.48; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, dilations occupying 77% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate slightly shorter than outer, with numerous small spine-like teeth along

margins; inner margins of undilated portions of hind tibiae with a double row of small spine-like teeth, length hind tibiae 7.44; length outer dilations 5.76, width outer dilations 1.80; length inner dilations 5.04, width inner dilations 0.72.

Claspers (Fig. 19) with median basal lobe very small, rounded, shank with median lobe prominent, rounded hook gradually curved; capsule (Fig. 43) with median notch deep, dorsal prongs prominent, rounded, and wide; aedeagus with dorsal sac of conjunctiva as follows: proximal lobes present and sclerotized; medial lobes present, right lobe large and wide, left lobe smaller and thin; sclerotized anterior distal lobe not closely appressed to wall of sac; lateral distal lobes present, of same size and shape, both sclerotized; total length 14.4.

Stål described *impictipennis* on the following characters: shorter labium and antennae, and lack of the transverse fascia. Among Stål's four male syntypes there are three specimens that I feel belong to *L. zonatus*. They have similarly shaped pronotum and genitalia as do typical *zonatus* specimens. The remaining male syntype (labeled "Typus") is here selected as LECTOTYPE and an appropriate label attached. This specimen differs from the others in the type series and *zonatus* by the following characters: lateral margins serrate and almost straight; humeral areas not rounded but forming an acute humeral angle; left medial lobe on dorsal sac of conjunctiva a simple, long, and thin unsclerotized appendage. Additional characters which may be less reliable are as follows: the pronotal markings are not such clearly defined spots as in *zonatus* and are only partially separated medially; the basal median lobe on the clasper is lower and the median lobe on the shank is not so prominent.

I have assigned to this species 13 other specimens that have *impictipennis* characters, but differ in having wider tibial dilations, a clasper similar to *zonatus* and a capsule with dorsal prongs projecting vertically. There is also a considerable amount of short incumbent pubescence on the posterior portion of the corium, this is barely evident on the type specimen. Two females in this series have the entire anterior half of the pronotum yellow, and without the small black spots. Until a larger series of *impictipennis*-like individuals can be assembled, I do not feel justified in assigning these specimens to a new species.

All of the *impictipennis* specimens differ from *neovexillatus* by the presence of serrate lateral margins on the pronotum and the lateral distal lobes on the dorsal sac of the conjunctiva are both spinose and of the same size. In *neovexillatus* only one lateral distal lobe is spinose, the other is obsolete.

Distribution: Brazil, Bolivia, British Guiana, and Colombia.

Material Examined: Holotype. ♂. Colombia: Bogota (Lindig). In Stockholm Museum. BRITISH GUIANA: 1♂, no locality, B.M. 1948-60 (Bartlett). BOLIVIA: 3♂, Province Sara (Steinbach). BRAZIL: 2♀, Chapada, Acc. No. 2966, March; 1♀, same except June; 2♀, same except Nov., 1♂, same except April; 1♀, Matto Crosso (Zobrys & Wolter); 1♀, Corumba, Matto Grosso, 1950 (H. G. Barber); 1♀, Maracaju, M. Grosso, Feb. 1937 (R. C. Shannon); 1♂, Matto Grosso (Kolowsky). In Museum of Comparative Zoology (Harvard), British Museum (Natural History), United States National Museum, La Plata Museum, Berlin Humboldt University Museum, and Carnegie Museum.

Leptoglossus concolor (Walker)

Anisoscelis concolor Walker, 1871:128.
Leptoglossus concolor Distant, 1881:124.—Lethierry and Severin, 1894:47.—Distant, 1901b:430.

Pronotum, scutellum, clavus and corium dark chestnut brown with head, outer margins of first antennal segments, pronotal calli, and margins of humeri piceous; fourth antennal segments, apex scutellum, wide irregular transverse fascia on corium, maculae on inner tibial dilations and undilated portion of hind tibiae whitish yellow; head laterally and with three narrow stripes above, inner margins of first segment and segments two and three of antennae, fore and middle legs except distal fourth of femora above, basal third and ventral area of hind femora reddish tan; distal portion of all femora above and hind tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter light reddish tan mottled with numerous small piceous spots frequently fusing to form larger maculae; connexivum and abdominal dorsum piceous with anterior fourth of each connexival segment and narrow intersegmental sutures on dorsum ochraceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures smooth; scutellum transversely rugulose with numerous small punctures; venter with moderate amounts of short appressed whitish pubescence, and sparse short erect hairs; legs and scutellum also with more dense longer pilose hairs; dorsum with short semi-decumbent golden hairs and pronotum anteriorly in area of calli with thicker dark almost spinose hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 3.00, width head 2.64, interocular

distance 1.32, anteocular distance 1.68; pronotum abruptly declivent, lateral margins slightly sinuate, entire, humeral areas moderately expanded, barely ascending, humeral angles sub-acute, postero-lateral margins serrate, calli prominently elevated with surface rough, area between calli slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 3.68, width across humeri 6.72, width anterior margin pronotum 1.80; length scutellum 2.64, width scutellum 2.52; labium reaching to middle of fourth abdominal sternum, length labial segments I 3.72, II 3.60, III 2.04, IV 4.80; length antennal segments I 3.12, II 5.40, III 3.84, IV 6.36; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, occupying 77% length of hind tibiae, width about two and one half times width of inner dilations; inner dilations lanceolate, slightly shorter than outer, and distally furnished with numerous small spine-like teeth, inner margins of undilated portions of hind tibiae with few small spine-like teeth arranged in a double row, length hind tibiae 11.3; length outer dilations 8.64, width outer dilations 3.00; length inner dilations 7.44, width inner dilations 1.20.

Claspers (Fig. 22) with inner basal lobe low and rounded; shank with median lobe prominent, gradually curving back onto shank, hook strongly curved; capsule (Fig. 44) with median notch deep, rectangular, no dorsal prongs; aedeagus with dorsal sac of conjunctiva as follows: proximal lobes present and sclerotized; median lobes present, left lobe short blunt and simple, right lobe longer and wide; sclerotized anterior distal lobe closely appressed to wall of sac; one distal lateral lobe sclerotized, large and spinose, the other lobe absent; total length 21.0.

The above description is of a male specimen from Chuminopolis, Yucatan, Mexico.

A generally uniform color pattern is present in the series before me. Lighter and darker individuals do occur, also there is variation in the appearance of the transverse fascia on the corium: of the 83 specimens examined, 22 have the fascia narrow, confined to the veins; two, including the type, have the fascia completely lacking; the remaining specimens have a wide and brightly pigmented fascia. The labium extension varies from the anterior portion of the fourth to the anterior portion of the sixth abdominal sternum. Fifteen specimens from the Caribbean have, on the posterior portion of the pronotal disk, a large yellow rectangular area, and the posterior marginal area of the pronotum is also yellow. This is quite unlike any other specimens of *concolor*, all of which have a unicolorous pronotum.

Previous to this revision, all specimens with phylliform tibial dilations and a pronotum without yellow spots had been referred to as

stigma. After dissecting the male genitalia of a number of specimens, it was apparent that two distinct species were represented. The type of *stigma* was described from Surinam. I have referred to *stigma* all specimens with dorsal prongs on the genital capsule, and to *concolor* the specimens with a rectangular notch on the capsule.

Externally, these two species are extremely close and the only characters, other than male genitalia, which distinguish *concolor* from *stigma* are the roughness of the pronotal calli, the thicker spinulose hairs around the calli, and the less steeply declivent pronotum. The lack of definite rounded pronotal spots and the rectangular median notch on the genital capsule will separate *concolor* from other members of the *stigma*-group.

Walker described his type as new based on the fact that it lacked the transverse fascia on the corium. This character is not absolutely diagnostic in this species. The type did not differ in any other respect from specimens with a transverse fascia.

Mann (1969) states that adult insects questionably identified as *concolor* were found on prickly pear.

Distribution: Mexico, Central America, and Greater Antilles.

Material Examined: Holotype: ♀, 58.135, Oajoca, Mexico. In British Museum (Natural History). 40♂, 42♀. MEXICO: Tampico; Catemaca; Barbarita; Aguazarca; Yucatan; Tamaulipas; Ocotlan; Chuminopolis; Oaxaca, Tehuantepec; Navarrete. GUATEMALA: Yepocapa; Morales; Antigua; Vizcaya; Panzos. BRITISH HONDURAS: Punta Gorda; San Antonio; Tegucigalpa. COSTA RICA: Hamburg Farm; Piedras Negras. PANAMA: Chiriqui; Colon; Barro Colorado Island. CUBA: Soledad; San Juliano; San Jose; Prov. St. Clara; Santiago de las Vegas; San Blas; San Vincente Pinar del Rio; Upper Yara Valley; Camaguey. HAITI: St. Marc. DOMINICAN REPUBLIC: Pto. Plata; Sanchez. PUERTO RICO: Barranquitas; Jayuya; Mayaguez. VIRGIN ISLANDS: St. Croix. In Berlin Humboldt University Museum, American Museum of Natural History, Museum of Comparative Zoology (Harvard), United States National Museum, Stockholm Museum, Hungarian National Museum, California Academy of Sciences, J. A. Slater and R. C. Allen collections.

Leptoglossus stigma (Herbst)

Cimex stigma Herbst, 1784:258, pl. 39B, fig. 1.
Hypselonotus scriptus Hahn, 1826:5.
Anisoscelis scripta Westwood, 1842:16.
Anisoscelis indocta Westwood, 1842:16.—Distant, 1901a:334.
Anisoscelis minor Dallas, 1852:452.

Theognis scriptus Mayr, 1866:101.
Leptoglossus stigma Stål, 1870:163.—Lethierry and Severin, 1894: 49.

Pronotum, scutellum, clavus and corium dark reddish brown with head, outer area of first antennal segment, pronotal calli and margins of humeri piceous; veins of clavus and corium wine red; apex scutellum, wide irregular transverse fascia on corium, and maculae on inner tibial dilations whitish yellow; head laterally and with three narrow stripes above, inner margins of first segment and segment two and three of antennae, fore and middle legs and undilated portion of hind tibiae dark tan to light brown; fourth antennal segments with base and apex ochraceous and medial portion somewhat darker; basal fourth and ventral area of hind femora light reddish brown with femora above and hind tibial dilation fuscous; femoral and tibial teeth and tubercles piceous; thoracic and abdominal venter variegated rusty reddish brown and light brown with numerous small piceous spots frequently fusing to form irregular maculae; connexivum and abdominal dorsum piceous with anterior fourth of each connexival segment and narrow areas of intersegmental sutures on dorsum ochraceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with surface above punctures largely smooth; scutellum transversely rugulose with numerous small punctures; venter with moderate amounts of short appressed and erect pale hairs and dorsum with short erect and semi-decumbent yellowish hairs; anterior pronotum, scutellum and legs with more dense longer and erect pilose hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 3.00, width head 2.28, interocular distance 1.20, anteocular distance 1.56; pronotum abruptly declivent, lateral margins strongly sinuate and entire, humeral areas expanded and obliquely ascending, humeral angles sub-acute, postero-lateral margins serrate, calli prominently elevated, area between calli slightly higher, without tubercles, disk posteriorly with median longitudinal carina obsolete, length pronotum 3.04, width across humeri 5.92, width anterior margin pronotum 1.68; length scutellum 2.04, width scutellum 2.16; labium reaching to posterior margins of third abdominal sternum, length labial segments I 3.00, II 2.88, III 1.32, IV 3.12; length antennal segments I 2.52, II 4.44, III 3.12, IV 7.20; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, occupying 79% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate, slightly shorter than outer

and apically furnished with few small spine-like teeth; inner margins of undilated portions of hind tibiae with few small spine-like teeth arranged in a double row, length hind tibiae 9.84; length outer dilations 7.80, width outer dilations 3.24, length inner dilations 6.36, width inner dilations 1.44.

Claspers (Fig. 21) with basal median lobe low rounded and hardly prominent, gradually curving back onto shank, hook strongly curved; capsule with median notch deep and rounded with dorsal prongs prominent and acute; aedeagus with dorsal sac of conjunctiva as follows: sclerotized proximal lobes present; left median lobe long and wide, right median lobe short, blunt and simple; sclerotized anterior distal lobe closely appressed to wall of sac; one distal lateral lobe large, spinose and sclerotized the other lobe absent; total length 17.6.

The above description is of a male specimen from Santarem, Brazil.

Three specimens of the 38 examined lack the transverse fascia on the corium and all specimens have a unicolorous pronotum and are without any yellowish pigments. *L. stigma* may be distinguished from *concolor* by the smooth pronotal calli, pale pilose hairs around the area of the calli, and the more steeply declivent pronotum. The males of *stigma* may be readily distinguished by the distinctive dorsal prongs on the genital capsule. The females of the two species are difficult to separate, and will probably continue to be confused with one another. Fortunately, there seems to be a geographic separation, with *stigma* present chiefly east of the Andes in northern South America, while *concolor* is present in Central America, Mexico, and the southern United States.

Both *concolor* and *stigma* completely lack one distal lateral lobe on the dorsal sac of the conjunctiva and have the right median lobe short. Also they do not have any yellow ovoid spots on the anterior portion of the pronotal disk. These characters will serve to distinguish *concolor* and *stigma* from the other members of the *stigma*-group.

Barber (1939) and Wolcott (1948) list guava fruit as the normal host plant for *stigma* in Puerto Rico; *stigma* also feeds on achiote (*Bixa orellana* L.) (Wolcott 1948), cashew (*Anacardium*) (Barber and Bruner 1947). Hussey lists *stigma* as taken on lychee in Florida. The above host plant records more than likely pertain to *concolor* (see discussion under *concolor*).

Heidemann (1910) used the trinomen *L. stigma* var. *minor* Dallas for *brevirostris* (see discussion under *brevirostris*).

Distribution: Surinam, Ecuador, Brazil and Paraguay.

Material Examined: SURINAM: 1♀, St. Laurent (C. Heller S.V.). ECUADOR: 1♂, Rio Napo, 15-35 (Rolf Blomberg); 1♂, 1♀, no locality, 1942; 2♂, Balzapamba (R. Haensch S.). BRAZIL: 1♀, Caviuna Parana, XI-1945; 1♀, same except 11-1946 (A. Maller); 1♀, Amazon sup., Olivenca; 1♀, Teffe, X-24, F 6160, Acc. 33591 (H. Bassler); 1♀, Amazonas, Manana, Uypiranga, Rio Negro, 14 km. from Manaus 81 m., X-1941 (Alberto Rabaut); 1♀, Amazon sup., Teffe; 2♀, Brasilien; 1♂, 1♀, Amazon (Deyrolle); 1♀, Maranguate Mts. (Mann); 1♂, 1♀, Manaos, Amazon (Roman); 1♂, Rio de Janeiro, 1930; 1♂, Santarem, Acc. 2966; 1♂, same except May 1919, Acc. 6324; 3♂, 2♀, Villarica, XI (F. Schade); 2♀, Amer. mer., no data. PARAGUAY: 2♂, Horqueta, 45 m. E. of Paraguay Riv., III-23-1933 (Alberto Schulze); 1♂, same except III-24-1933; 1♀, no locality (Vezenyi); 1♂, Rio Yguagu, Mar. 10 (Donald Wees). In the United States National Museum, Hungarian National Museum, Museum of Comparative Zoology (Harvard), American Museum of Natural History, Stockholm Museum, Berlin Humboldt University Museum, Carnegie Museum, J. A. Slater and R. C. Allen collections.

Leptoglossus oppositus (Say)

Anisoscelis oppositus Say, 1832:12.
Anisoscelis tibialis Herrich-Schaffer, 1842:12.
Leptoglossus oppositus Stål, 1870:163–4.—Lethierry and Severin, 1894:48.—Van Duzee, 1917:89.—Gibson, 1917:71.—Blatchley, 1926:223–4, fig. 44.—Deay, 1928:378.—Torre-Bueno, 1941: 50.—Froeschner, 1942:594–5.—Drew and Schaefer, 1963:114.
Theognis oppositus Hussey, 1953:31.

Dorsum and appendages more or less uniformly dark reddish brown; whitish yellow transverse fascia on the corium reduced and confined to medial vein above where crossvein begins; venter light brown mottled with numerous small piceous spots; pronotum with all lateral margins entire, non-serrate; humeri rounded with humeral angles obtuse; labium extending to at least third abdominal sternum; hind tibial dilations phylliform. Claspers and capsule similar to *zonatus*. The only difference in the aedeagus is that *oppositus* has the left median lobe long and bifid at the tip, without a longer and thin secondary appendage as in *zonatus*.

In the specimens examined, there are four individuals from Texas that have two very faint and poorly defined yellowish areas and small piceous spots on the anterior portion of the pronotum. One specimen, also from Texas, has the medio-cubital crossvein yellow. None of the

individuals examined had a complete transverse fascia on the corium, although Blatchley (1926) states that one specimen from Florida had a complete fascia.

The form of the genitalia places *oppositus* in the *stigma*-group, closest to *zonatus*. The lack of a serrate postero-lateral margin on the pronotum will distinguish *oppositus* from all members of this group. Additional characters that will separate *oppositus* from *zonatus* are: the lack of a complete transverse fascia on the corium; the lack of clearly defined pronotal spots; and the previously mentioned aedeagal difference.

L. oppositus has been reported in the economic literature as attacking essentially the same crops and plants as *phyllopus*. The life history and habits were reported by Chittenden (1902, 1925). McCullough (1968) reported the acid and aldehyde compounds in the scent fluid.

Distribution: Eastern United States from Florida to New York, west to Iowa and Wisconsin, southwest to Arizona, Texas and into Mexico.

Material Examined: 49♂, 59♀, UNITED STATES: Alabama, Arizona, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Louisiana, Maryland, Mississippi, Missouri, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Tennessee, Texas, Virginia, Washington, D.C., Wisconsin. In American Museum of Natural History, Museum of Comparative Zoology (Harvard), Stockholm Museum, Iowa State University, United States National Museum, University of California (Davis), Chicago Natural History Museum, J. A. Slater and R. C. Allen collections.

Leptoglossus lonchoides new species

Pronotum, scutellum, clavus and corium light reddish brown, head, calli and a few small spots on disk of pronotum piceous; two large, separated but poorly defined ovoid spots on pronotal disk, apex scutellum, and medio-cubital crossveins dark ochraceous; fourth antennal segments and maculae on inner tibial dilations whitish yellow; head laterally and with three narrow stripes above, inner marginal areas of first antennal segment and basal portions of segments two and three, all legs except femora above tan to light brown; outer marginal area of first antennal segment and distal portion of segments two and three, femora above and hind tibial dilations fuscous with teeth and tubercles piceous; thoracic and abdominal venter ochraceous to light brown with numerous small piceous spots frequently fusing to form larger maculae; connexivum and abdominal dorsum piceous with

anterior margins of connexival segments and narrow area around intersegmental sutures on dorsum yellow; membrane uniformly dark; pronotum, clavus and corium coarsely and closely punctate with surface above punctures uneven; scutellum transversely rugulose with numerous punctures; body with moderate amounts of short appressed and sparse short erect hairs; head behind eyes anterior portion of pronotum, scutellum and legs with more dense longer pilose hairs.

Head non-declivent with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 2.40, width head 2.28, interocular distance 1.32, anteocular distance 1.32; pronotum moderately declivent with lateral margins straight and entire, humeral areas not expanded or ascending, the humeral angles barely prominent and acute, postero-lateral margins entire, calli prominently elevated, area between calli only slightly higher, disk caudally with median longitudinal carina obsolete, length pronotum 3.36, width across humeri 5.12, width anterior margin pronotum 1.56; length scutellum 2.40, width scutellum 2.28; labium reaching to posterior margin of metasternum, length labial segments I 2.16, II 2.16, III 1.08, IV 2.16; length antennal segments I 2.40, II 3.84, III 2.76, IV 3.84; hind tibiae with outer dilations lanceolate with only one very shallow emargination present, occupying 65% length of hind tibiae, width slightly less than twice width of inner dilations; inner dilations lanceolate, shorter than outer with a few small spine-like teeth along distal half of margins; inner margins of undilated portion of hind tibiae with a double row of small spine-like teeth, length hind tibiae 9.24; length outer dilations 6.00; width outer dilations 1.44; length inner dilations 4.68; width inner dilations 0.84.

Claspers (Fig. 24) with inner basal lobe large and rounded; shank thick without a median lobe, hook thick and strongly curved; capsule with median notch deep and rounded dorsal prongs prominent and acute; aedeagus with dorsal sac of conjunctiva as follows: sclerotized proximal lobes present; median lobes present with right lobe long and wide, left lobe with tip sclerotized somewhat shorter and not as wide as right lobe and with a secondary appendage arising from approximately middle of lobe; large sclerotized anterior distal lobe present and closely appressed to wall of sac; spinose distal lateral lobes present and of same size and shape, both sclerotized; total length 17.8.

Holotype: ♂. Brazil: Nova Teutonia, Santa Catarina, VI. 28, 1943 (F. Plaumann). In United States National Museum, type no. 70226.

Paratypes: BRAZIL: 1♀, Nova Teutonia, Santa Catarina, IX-9-1950 (F. Plaumann); 1♀, same except IV-29-1948; 1♂, same except 11-8-1948; 1♂, Amazonas, Manaus, Uypiranga Rio Negro, 14 km. from Manaua, 81 m., XI-15-XII-15-1941 (August Rabaut). PERU: 1 ♀, Rio Santiago, XI-22. 24, F. 6012. In American Museum of Natural History and the United States National Museum.

The type series exhibits some important color variations. One specimen has the pronotal disk entirely dark ochraceous. Two individuals have a complete irregular transverse fascia on the corium which is confined primarily to the veins. Two specimens lack the fascia completely. The tibial dilation is relatively constant in shape, although three individuals have completely lanceolate outer dilations, lacking even a shallow emargination. Labial length varies from the posterior margin of the metasternum to the middle of the third abdominal sternum.

L. lonchoides is a very distinctive species externally. To some extent the tibial dilation (Fig. 61) resembles that of *lineosus*; the steepness of the pronotum is of the same degree as in *clypealis*; the unexpanded humeral areas and the straight non-sinuate lateral margins are close to the condition found in *crassicornis* species from Argentina. Despite the external dissimilarity, the genitalia of *lonchoides* is of the same type as that found in the *stigma*-group, with the clasper reminiscent of that in *concolor*, the capsule identical to that of *zonatus*, and the aedeagus close to *oppositus*. The lanceolate tibial dilations and the non-serrate postero-lateral margins on the pronotum will serve to distinguish *lonchoides* from all other members of the *stigma*-group.

Leptoglossus humeralis new species

Pronotum, scutellum, clavus and corium dark brown with head above, outer areas of first antennal segments and pronotal humeral areas piceous; veins of clavus and corium dark tan; basal two thirds of second and third segments, entire fourth antennal segment, apex scutellum, and maculae on inner tibial dilations pale yellow to ochraceous; head below and with three narrow stripes above, inner margins of first antennal segment, all legs except femora above tan to light brown; distal third of antennal segments two and three, and femora above fuscous with hind tibial dilations dark reddish brown; femoral teeth and tubercles piceous; thoracic and abdominal venter tan to light brown with numerous small piceous maculae frequently fusing to form larger maculae; connexivum and abdominal dorsum largely piceous with some dark reddish brown areas; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate with

surface above punctures largely smooth; scutellum transversely rugulose with numerous punctures; head above, anterior half of pronotum, scutellum and legs with dense long and erect pale pilose hairs; remainder of dorsum, and venter with short appressed and semi-decumbent hairs.

Head porrect with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 3.72, width head 2.76, interocular distance 1.44, anteocular distance 2.16; pronotum steeply declivent almost vertical, lateral margins serrate caudally and strongly sinuate, humeral areas produced as broad long and tapering lateral projections and obliquely ascending, humeral angles sub-acuminate, posterolateral margins serrate, calli barely elevated, area between calli only slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 4.80, width across humeri 12.4, width anterior margin pronotum 1.92; length scutellum 3.36, width scutellum 3.60; labium reaching to posterior margin of fourth abdominal sternum, length labial segments I 4.56, II 4.20, III 2.64, IV 5.40; length antennal segments I 3.24, II 5.76, III 4.20, IV 7.08; hind tibiae with outer dilations phylliform with one shallow and two deep emarginations, occupying 84% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate, considerably shorter than outer dilations, furnished with two small spine-like teeth on distal margin; undilated portion of hind tibiae without teeth, length hind tibiae 12.3; length outer dilations 10.4, width outer dilations 3.68; length inner dilations 7.04, width inner dilations 1.76; total length 26.0.

Holotype: ♀. BRITISH GUIANA: Kartabo, VIII-1925 (S. H. Williams). In Carnegie Museum.

Paratype: FRENCH GUIANA: 1♀, Cayenne (Wm. Schaus). In United States National Museum.

L. humeralis has the humeri expanded in a fashion identical with those on *pallidivenosus*, but considerably longer, the width across humeri is 5.5 to 6.0 times the width of the anterior pronotal margin, whereas in *pallidivenosus* it is 4.5 to 4.8. The hind tibial dilation in *humeralis* is similar to that in *ingens* and *macrophyllus* with the inner dilation much shorter than the outer. Since there were no males available, I can only tentatively place *humeralis* in the *stigma*-group based on the above similarities.

The large size, prominently expanded humeri, long labium and distinctive tibial dilations as well as the serrate pronotal lateral margin and the lack of pale areas anywhere on the dorsum, will distinguish *humeralis* from any other *Leptoglossus* species.

Leptoglossus pallidivenosus new species
(Fig. 4)

Pronotum, scutellum, clavus and corium dark reddish brown with head, outer areas of first antennal segment and humeral areas piceous; basal half of fourth antennal segment, posterior margin of pronotum, apex scutellum, all veins on apical half of corium and maculae on inner tibial dilation whitish yellow; head laterally and with three narrow stripes above, inner margin of first antennal segment and segments two and three and apex of fourth segment, fore and middle legs and undilated portion of hind tibiae tan to light brown; all femora above fuscous with basal and ventral portion of hind femora and tibial dilations dark reddish brown; femoral and tibial teeth and tubercles piceous; abdominal venter tan with numerous small piceous spots; connexivum fuscous with anterior margin of each segment ochraceous; abdominal dorsum piceous; membrane uniformly dark; pronotum, clavus and corium finely and closely punctate, surface above punctures largely even; scutellum transversely rugulose with numerous small punctures; head, anterior portion of pronotum, scutellum, legs, thoracic and abdominal mid-venter with dense long erect pale pilose hairs; remainder of venter and dorsum with dense short appressed and semi-decumbent yellowish hairs; scutellum with lateral margins and a narrow median longitudinal area densely clothed with short appressed golden pubescence.

Head porrect with tylus and juga above level of antenniferous tubercles, tylus blunt, slightly exceeding juga and forming a rounded elevated ridge, length head 2.76, width head 2.52, interocular distance 1.32, anteocular distance 1.56; pronotum abruptly declivent with lateral margins serrate caudally and strongly sinuate, humeral areas broadly expanded and obliquely ascending with humeral angles subacuminate, postero-lateral margins dentate, calli prominently elevated, area between calli only slightly higher, disk posteriorly with median longitudinal carina obsolete, length pronotum 3.68, width across humeri 8.16, width anterior margin pronotum 1.68; length scutellum 2.52, width scutellum 2.52; labium reaching to middle of third abdominal sternum, length labial segments I 2.88, II 2.88, III 1.44, IV 3.24; length antennal segments I 3.00, II 5.04, III 3.84, IV 5.88; hind tibiae with outer dilations phylliform and with three deep emarginations, occupying 72% length of hind tibiae, width about twice width of inner dilations; inner dilations lanceolate, slightly shorter than outer dilations, with numerous small spine-like teeth along margins; inner areas of undilated portion of hind tibiae with few small spine-like teeth in a double row, length hind tibiae 11.2; length outer dila-

tions 8.04, width outer dilations 2.52; length inner dilations 6.96, width inner dilations 1.20.

Claspers (Fig. 23) with inner basal lobe very small and rounded; shank without a median lobe, hook strongly curved and short; capsule with median notch deep and rounded, lateral margin of notch sinuate and forming a wide angle, no dorsal prongs; aedeagus with dorsal sac of conjunctiva as follows: sclerotized proximal lobes present; right median lobe slightly smaller than left lobe and unequally bifid, left median lobe large and simple; sclerotized anterior distal lobe present; sclerotized distal lobes present, one lobe spinose, the other smaller and acute; total length 20.0.

Holotype: ♂. PANAMA: Canal Zone, Barro Colorado Island, 2 May 1956, "taken at light" (Carl W. & Marian E. Rettenmeyer). In University of Kansas (Snow collection).

Paratypes: PANAMA: 1♂, Canal Zone, Barro Colorado Island, 2 May 1956, "taken at light" (Carl W. & Marian E. Rettenmeyer); 1♀, same except June 14, 1956; 1♂, same except Apr. 28, 1956; 1♂, same except 4 April 1956; 2♂, Canal Zone, Barro Colorado Island, 14-II-1955 (C. W. Rettenmeyer); 1♂, same except 16-III-1955; 1♂, same except IX-X-40, "collected at light" (Jas Zetek); 1♀, Barro Colorado Island, 3-14-37 (S. W. Frost). In United States National Museum and University of Kansas (Snow collection).

There is some color variation in the type series: only the holotype and one other male specimen have all the veins on the apical half of the corium completely pale; the remaining individuals have some portions of the veins in this area slightly darker and not as strongly contrasting with the corium; one specimen has the pale areas confined to the usual portion of the veins that are included in the transverse fascia.

This species has a number of characters which relate it to the *stigma*-group. The ground color of the dorsum, the fact that pale pronotal markings are absent on the disc, and in some respects the shape of the humeral expansions are characters shared by *stigma* and *concolor*. The serrate lateral margins of the pronotum are similar to *impictipennis*, as well as the claspers—both *pallidivenosus* and *impictipennis* have the inner basal lobe low and rounded and both lack a well produced medial lobe on the shank. The shape of the dorsal margin of the genital capsule is in some ways like that of *ingens* and *macrophyllus* except that in the latter two species, dorsal prongs are present.

L. pallidivenosus may be distinguished from other members of the *stigma*-group by the following combination of characters: lack of pale markings on the pronotal disc, the posterior edge of the pronotum

pale yellow, all margins of the pronotum serrate, the labium not extending past the third abdominal sternum, and the genital capsule having a wide median notch without dorsal prongs.

Leptoglossus corculus (Say)

Anisoscelis corculus Say, 1832:12.—Leconte, 1859:326.
Theognis excellens Mayr, 1865:434.
Leptoglossus corculus Stål, 1870:165.—Lethierry and Severin, 1894: 47.—Van Duzee, 1917:88–9.—Gibson, 1917:70, 71.—Parshley, 1923:747.—Blatchley, 1926:222–3.—Deay, 1928:377–8.—Torre-Bueno, 1941:49.—Froeschner, 1942:594, 599.
Theognis corculus Hussey, 1953:30.

Ground color varying from light to dark brown with pronotum and venter prominently mottled with small piceous spots, pale yellow irregular transverse fascia on corium narrow, confined to the veins, sometimes obsolete or completely absent; pronotum with all margins entire, broadly and obtusely rounded; hind tibial dilations lanceolate with outer dilations longer than inner dilations.

Clasper (Fig. 26) with inner basal lobe low and rounded, shank with a median lobe, hook strongly curved with a small knob on outer margin; capsule (Fig. 46) deep and rounded, no dorsal prongs; aedeagus with dorsal sac of conjunctiva as follows: proximal lobes present barely sclerotized; a pair of median lobes present, of similar size and shape, small sclerotized anterior distal lobe present; sclerotized lateral distal lobes present, one spinose, one blunt.

L. corculus and *occidentalis* are strikingly similar in appearance, but the outer tibial dilations (Fig. 57) of *corculus* occupy a greater percentage of the length of the tibiae (85–95%) and are distinctively longer than the inner dilations; in *occidentalis* (Fig. 58) both the inner and outer dilations are approximately the same length and occupy 66–72% the length of the hind tibiae. The differences between the claspers are: in *corculus* there are prominent inner basal and medial lobes on the shank; in *occidentalis* both lobes are absent. The median notch of the capsule in *occidentalis* is more rectangular with the bottom flat, not rounded; in *corculus* the notch is "V" shaped, deeper and with the bottom of the notch rounded.

Distribution: *L. corculus* has an eastern United States distribution, being found from New York south to Florida, west to Missouri, and southwest to Texas. Deay (1928) lists a single specimen without a locality from Kansas. Published records include New Mexico, Arizona, Colorado, and California (Van Duzee 1917; Blatchley 1926), but in all the specimens received from the various museums in the

United States, I have not seen a single specimen from further west than Texas. It is possible that the Van Duzee records were based on *occidentalis* specimens.

Material Examined: 45♂, 53♀, UNITED STATES: Arkansas; Alabama; Florida; Georgia; Maryland; Mississippi; New Jersey; North Carolina; Ohio; Pennsylvania; Texas; Virginia; Washington, D.C. In United States National Museum, Museum of Comparative Zoology (Harvard), American Museum of Natural History, Chicago Natural History Museum, Iowa State University, University of Kansas, J. A. Slater, P. D. Ashlock, and R. C. Allen collections.

Leptoglossus occidentalis Heidemann

Leptoglossus occidentalis Heidemann, 1910:196–7, pl. 8, fig. 2.—Van Duzee, 1917:89.—Gibson, 1917:70, 71.—Torre-Bueno, 1941: 49.

Theognis occidentalis Hussey, 1953:29–30, 31.

The ground color varies from light reddish brown to dark brown with pronotum (usually) and venter mottled with numerous small piceous spots; pale yellow irregular transverse fascia on corium narrow, confined to veins, sometimes obsolete to completely absent; pronotum moderately declivent with humeri broadly rounded, all pronotal margins entire; tibial dilations lanceolate, both inner and outer dilations of approximately same size and shape.

Clasper (Fig. 27) with inner basal lobe absent, shank with median lobe absent, hook strongly curved; capsule (Fig. 47) with a wide rectangular shaped median notch; aedeagus as in *corculus*.

As pointed out in the discussion of *corculus*, these two species are closely related, and the best diagnostic characters are the tibial dilations. The shorter equal-sized inner and outer tibial dilations (Fig. 58) will serve to distinguish *occidentalis* from *corculus*.

Koerber (1963) in his report on the biology and economic importance of *occidentalis*, lists 12 species of conifers that serve as host plants. Schaffner (1967) states that in Iowa Scotch pine, *Pinus sylvestus* L., appeared to be the most commonly utilized host plant. Schaefer (1965, 1968) describes some morphological aspects of *occidentalis* in his studies on the higher classification of the Coreoidea.

Distribution: From southern British Columbia and Alberta southward to Arizona, New Mexico and Texas, eastward to Iowa.

Material Examined: Syntypes: 1 ♂, Utah, Amarilla; 1 ♀, Cal. Placer Co. (E. C. Van Dyke). In United States National Museum, Type No. 13230. The ♂ specimen has been chosen as LECTOTYPE, and an appropriate label attached. UNITED STATES: 36♂, 38♀,

California; Colorado; Idaho; Iowa; Kansas; Montana; New Mexico; Oregon; Texas; Washington. In Chicago Natural History Museum, Iowa State University, Museum of Comparative Zoology (Harvard), University of California (Davis), American Museum of Natural History, United States National Museum, University of Kansas, J. A. Slater, P. D. Ashlock and R. C. Allen collections.

Leptoglossus clypealis Heidemann

Leptoglossus clypealis Heidemann, 1910:195–6, pl. 8, fig. 1.—Van Duzee, 1917:90.—Gibson, 1917:70, 71.—Deay, 1928:378–9.—Torre-Bueno, 1941–49.—Froeschner, 1942:593, 599, pl. 4, fig. 42.—Drew and Schaefer, 1963:114, pl. 1, fig. 17.
Theognis clypealis Hussey, 1953:30.

Ground color varying from yellowish tan to light brown with head and scutellum piceous; a wide irregular transverse fascia on corium and anterior half of each connexival segment whitish yellow to ochraceous; membrane transparent and pale; tylus produced anteriorly as a conspicuous stout spine; humeri broadly rounded and all pronotal margins entire, tibial dilations lanceolate.

Clasper (Fig. 28) with a prominent rounded inner basal lobe, shank with a large median lobe, hook strongly curved; capsule (Fig. 48) with a rectangular shaped median notch, no dorsal prongs; aedeagus as in *corculus* except all distal lobes more heavily sclerotized and larger.

L. clypealis, a member of the *corculus*-group, is a distinctive species in this genus. The spine on the tylus and pale membrane will readily separate *clypealis* from all other *Leptoglossus* species.

Clypealis has been recorded as injurious to plums and almonds (Heidemann 1910), ornamental pomegranate (Torre-Bueno), and aromatic sumac (*Rhus aromatica* Ait.) (Froeschner 1942).

Distribution: Central and southwestern United States and into Mexico.

Material Examined: Holotype: ♂, Colorado, Platte Canon, 5-20-01 (Dyar and Caudell). In United States National Museum, Type No. 13229. UNITED STATES: 33♂, 46♀, Arizona; California; Colorado; Iowa; Kansas; New Mexico; Texas. MEXICO: 3♂, 1♀, Sabinas Hidalgo Nuevo Leon, 130VI-1939 (Ralph Hagg); 1♀, same except Jacala, 4-VII-1939. In Iowa State University, University of California (Davis), Museum of Comparative Zoology (Harvard), Chicago Natural History Museum, American Museum of Natural History, Stockholm Museum, Hungarian National Museum, United States

National Museum, University of Kansas, J. A. Slater, P. D. Ashlock and R. C. Allen collections.

Leptoglossus brevirostris Barber

Leptoglossus brevirostris Barber, 1918:35–6.
Theognis brevirostris Hussey, 1953:30.

A small species; dorsum reddish brown with piceous humeri and occasionally a few small piceous spots on pronotal disk, venter mottled with numerous small piceous spots; a pale yellow narrow transverse fascia on corium (occasionally very faint); humeri prominently expanded, humeral angles acute to acuminate; hind tibial dilations phylliform.

Claspers (Fig. 29) with inner basal lobe low and rounded, shank with a prominent median lobe, hook strongly curved; capsule (Fig. 49) with median notch rounded; dorsal prongs obsolete; aedeagus with dorsal sac of conjunctiva as follows: sclerotized proximal lobes present; right median lobe large with its base sclerotized; left median lobe as a small sclerotized area; large sclerotized anterior distal lobe present; one spinose distal lateral lobe present.

L. brevirostris closely resembles *chilensis* in size and color, but there are a number of differences between these two species. In *brevirostris* the lateral margins of the pronotum are entire (rarely crenulate) not serrate, a transverse fascia is present on the corium, and the dorsal sac of the conjunctiva has only one median lobe and one distal lobe. *L. brevirostris* appears to be more closely related to *stigma* in respect to the similarity of the habitus and the genitalia. *L. ashmeadi* and *brevirostris* are the only North American species with a short labium and short phylliform tibial dilations.

Barber (1906) first referred to *brevirostris* as a possibly undescribed species from southwest Texas. Heidemann (1910) used the name *Leptoglossus stigma* var. *minor* Dallas, in a list of *Leptoglossus* species occurring in the United States without any further reference to the origin of the name. Barber (1918) in the original description of *brevirostris* states that he and Mr. Heidemann had previously been using the name *stigma* var. *minor* Dallas for *brevirostris*, although Barber never used the trinomen in any earlier literature.

Distribution: Southwestern United States.

Material Examined: Holotype: ♂. ARIZONA: Huachuca Mts., Aug. 6, 05. In United States National Museum, Type No. 61107. Paratypes: 6♀, same data as holotype. TEXAS: 1♀, St. Tomas, Brownsville (Charles Schaeffer). In United States National Museum. UNITED STATES: 11♂, 15♀, Arizona; California; Texas. MEX-

ICO: Baja California. In American Museum of Natural History, United States National Museum; California Academy of Sciences, J. A. Slater and R. C. Allen collections.

Leptoglossus ashmeadi Heidemann

Leptoglossus ashmeadi Heidemann, 1909:237.—Van Duzee, 1917: 90.—Gibson, 1917:70, 72.—Blatchley, 1926:225, fig. 43.—Torre-Bueno, 1941:50.

Theognis ashmeadi Hussey, 1953:31.

One of the most brightly colored *Leptoglossus* species in North America. Dorsum and appendages piceous with following areas strongly contrasting orange-yellow: all margins of pronotum widely and confluently and irregular transverse fascia on corium; venter almost entirely orange-yellow; humeri moderately expanded with humeral angles acute; hind tibial dilations phylliform.

Clasper (Fig. 30) with inner basal lobe prominent and rounded, shank thick with a low median lobe, hook strongly curved; capsule (Fig. 50) with a deep round median notch, dorsal prongs small; aedeagus as in *brevirostris*.

Blatchley (1926) states that adults and nymphs were collected on mistletoe, *Phoradendron flavescens* (Pursh.) Nutt. Three specimens that I have examined from Natchez, Mississippi were also collected on mistletoe.

Distribution: Southeastern United States.

Material Examined: Holotype: ♀. Florida: St. Nicholas. In United States National Museum, Type No. 12191. ALABAMA: 2♀, Mobile, XI-18-1927 (Th. van Allen). FLORIDA: 2♀, 7-Oaks, May 1, 1908 (Van Duzee); 1♂, Orlando, 12-26-1908 (A. W. Morril); 1♀, Dune Din, 4-1-1921 (W. S. B.). MISSISSIPPI: 1♂, Ocean Springs, Jan. 22, 1944, S.S. #9546. 3♀, Natchez, V-26-1909, "on *Phoradendron flavescens*," Hunter No. 1667 (E. S. Tucker). In United States National Museum, California Academy of Sciences, and Chicago Natural History Museum.

ACKNOWLEDGMENTS

I wish to express my gratitude and appreciation to my major advisor Dr. James A. Slater, who first suggested this study, and made available his time, personal library and collection. I am indebted to Drs. Carl W. Schaefer and Peter D. Ashlock and Mrs. Darleen Wilcox for their generous advice, suggestions, and discussions on many matters. My thanks go to Dr. Ralph M. Wetzel for critically reading the manuscript.

I am most grateful to the following persons and institutions for their generosity in lending material: Dr. G. Petersen (Deutsches Entomologisches Institut), Dr. Pieter H. van Doesburg, Jr. (Leiden Museum), Dr. A. Soos (Hungarian National Museum), Dr. A. Göllner-Scheiding (Berlin Humboldt University Museum), the late Dr. E. Kjellander (Stockholm Museum), Dr. W. J. Knight and Mrs. G. M. Black (British Museum (Natural History)), Dr. I. Lansbury (Hope Museum, Oxford University), Dr. George Wallace (Carnegie Museum of Natural History), Dr. Peter D. Ashlock (formerly of the Bernice P. Bishop Museum), Dr. Jean L. Laffoon (Iowa State University), Dr. Paul H. Arnaud, Jr. (California Academy of Sciences), Dr. Richard C. Froeschner (United States National Museum), Dr. Jon L. Herring (United States Department of Agriculture), Dr. Henry Dybas (Chicago Natural History Museum), Dr. G. W. Byers (Snow Entomological Museum, University of Kansas), Dr. De Santis (La Plata Museum), Dr. J. C. Schaffner (Texas A & M University), Dr. Howard E. Evans (Museum of Comparative Zoology, Harvard University), Dr. P. Wygodzinsky (American Museum of Natural History).

Special thanks are extended to Miss Karen Stoutsenberger for the preparation of the dorsal view illustrations.

LITERATURE CITED

ADAMS, A. L. AND J. C. GAINES. 1950. Sunflower insect control. J. econ. Ent. 43: 2: 181–184.

ASHLOCK, P. D. 1957. An investigation of the taxonomic value of the phallus in the Lygaeidae (Hemiptera—Heteroptera). Ann. ent. Soc. Amer. 50: 4: 407–426.

————. 1967. A generic classification of the Orsillinae of the World (Hemiptera—Heteroptera: Lygaeidae). Univ. Calif. Publ. ent. 48: 1–82.

BARBER, H. G. 1906. Hemiptera from southwestern Texas. Mus. News, Brooklyn 1: 9: 255–289.

————. 1914. Insects of Florida II. Hemiptera. Bull. Amer. Mus. nat. Hist. 33: Art. 31: 495–535.

————. 1918. A new species of *Leptoglossus*: A new *Blissus* and varieties. Bull. Brooklyn ent. Soc. 13: 35–39.

————. 1939. Scientific survey of Porto Rico and the Virgin Islands: Insects of Porto Rico and Virgin Islands: Hemiptera-Heteroptera (excepting the Miridae and Corixidae). Sci. Surv. P. Rico 14: 3: 263–441.

BARBER, H. G. AND S. C. BRUNER. 1947. The Coreidae of Cuba and the Isle of Pines with the description of a new species (Hemiptera-Heteroptera). Mem. Soc. cubana Hist. nat. 19: 76–88.

BERG, C. 1879. Hemiptera Argentina enumeravit speciesque novas. Bonariae: Pauli E. Coni pp. 1–316 (also 1878, An. Soc. cient. argent.).

————. 1892. Nova Hemiptera faunarum Argentinae et Uruguayensis. Bonariae: Pauli E. Coni et Filiorum pp. 1–112 (also An. Soc. cient. argent. 33: 65–72).

BERGROTH, E. 1894. Liste de quelques Hemipteres de la Plata. Rev. Ent., Caen 13: 164–167.

BLATCHLEY, W. S. 1926. Heteroptera or true bugs of eastern North America, with especial reference to the faunas of Indiana and Florida. Indianapolis: Nature Publishing Co. 1116 pp.

BLÖTE, H. C. 1936. Catalogue of Coreidae in the Rijksmuseum van Natuurlijke Historie. Part III. Coreinae, second part. Zool. Meded. 19:23–66.

BOSQ, J. M. 1940. List preliminar de los Hemipteros (Heteropteros), especialmente relacionados con la agricultura nacional. Rev. Soc. ent. argent. 10: 399–417.

BURGESS, P. S. AND R. S. HAWKINS. 1945. Fifty-fifth Annual Report. Arizona Agric. Exp. Sta. 54 pp.

BURMEISTER, H. 1835. Handbuch der Entomologie, Zweiter Band: II Ordnung Rhynchota. Berlin: Theod. Ehr. Friedr. Enslin i–iv, 1–400 pp.

CHITTENDEN, F. H. 1902. Some insects injurious to vegetable crops. Bull. U.S. Bur. Ent. (ns.) 33: 1–117.

————. 1925. Note on the behavior of *Leptoglossus oppositus* (Say). Bull. Brooklyn ent. Soc. 20: 148–149.

COCKERELL, T. D. A. 1905. (No title) Ent. News 16: 18.

COSTA LIMA, A. DA. 1940. Insectos do Brazil II. Hemipteros. Rio de Janeiro: Escola Nacional de Agronomia pp. 1–351.

DALLAS, W. S. 1852. List of the specimens of Hemipterous insects in the collection of the British Museum. Part II. London: Taylor and Francis Inc. 592 pp.

DEAY, H. O. 1928. The Coreidae of Kansas. Univ. Sci. Bull. 18: 371–415.

DISTANT, W. L. 1880–1893. Insecta Rhynchota. Hemiptera-Heteroptera. Vol. I. Biol. cent.-amer. London. 462 pp.

————. 1901a. Revision of the Rhynchota belonging to the Fam. Coreidae in the Hope collection at Oxford. Proc. zool. Soc. Lond. 1: 325–335.

————. 1901b. Rhynchotal notes. IX. Heteroptera: Fam. Coreidae. Ann. Mag. nat. Hist. (7): 7: 416–432.

————-. 1902. Fauna of British India, including Ceylon and Burma Rhynchota. Vol. I (Heteroptera). London: Taylor and Francis pp. 1–438.

DREW, W. A. AND K. SCHAEFER. 1963. The Coreidae of Oklahoma (Hemiptera). Proc. Okla. Acad. Sci. 43: 112–122.

DUPUIS, C. 1952. Priorite de quelques noms d' Heteropteres de Guerin Meneville (1831). Bull. Soc. Zool. France: 77: 447–454.

EBELING, W. 1959. Subtropical fruit pests. Univ. Calif. Div. Agric. Sci. 436 pp.

FABRICIUS, J. C. 1775. Systema entomologiae. Flensburgi et Lipsiae: Korte. 832 pp.

————. 1781. Species insectorum II. Hamburgi et Kilonii: Ernest Bohnii. pp. 1–517.

————. 1794. Entomologia systematica emendata et aucta IV. Hafniae: C. G. Proft. pp. 1–472.

FERNANDO, H. E. 1957. The biology and control of *Leptoglossus membranaceus* Fabricius. Trop. Agric. 113: 107–118.

FORSTER, J. R. 1844. Descriptions animalium quae itinere admaris australis terras per annon 1772, 1773, et 1774 suscepto collegit observait et delineavit J.R.F. Nunc demum editae . . . curante H. Lichtenstein. Berolini. 424 pp.

FROESCHNER, R. C. 1942. Contributions to a synopsis of the Hemiptera of Missouri, Part II. Amer. Midl. Nat. 27: 3: 591–609.

GIBSON, E. H. 1917. Key to the species of *Leptoglossus* Guer. occurring north of Mexico (Heteroptera, Coreidae). Psyche 24: 69–73.

GIBSON, E. H. AND A. HOLDRIDGE. 1918. The genus *Narnia* Stal, and a key to the genera of Anisoscelini A. and S. (Coreidae: Heteroptera). Psyche 25: 1–4.

GMELIN, J. F. 1788. Caroli a Linne systema naturae. 13th ed., Tom. I (IV) Lipsiae: Beer pp. 1517–2224.

GROSS, G. F. 1963. Insects of Micronesia: Coreidae (Alydini by J. C. Schaffner), Neididae, and Nabidae. Insects of Micronesia (B. P. Bishop Mus.) 7: (7): 358–390.

GUERIN, F. E. 1838. *In*: Duperrey, Voyage autour du monde execute par ordre du roi, sur la corvette de la majeste La Coquille, pendant les annes 1822, 1823, 1824, et 1825. Zoologie. (plates X–XII, 1831).

GUERIN-MENEVILLE, F. E. 1857. *In*: Sagra, Histoire physique, politique et naturelle de l'Isle de Cuba. Animaux articules a pieds articules. Paril: Arthus Bertrand.

HAHN, C. W. 1826. Icones ad monographiam Cimicum. Nurnberg: Lechner.

HEIDEMANN, O. 1909. New species of Tingitidae and descriptions of a new *Leptoglossus*. Bull. Buffalo Soc. Nat. Sci. 9: 231–238.

————. 1910. New species of *Leptoglossus* from North America (Hemiptera-Coreidae). Proc. ent. Soc. Wash. 12: 191–197.

HERBST, J. F. W. 1780–89. Gemeinnuzzige Naturgeschichte des Thierreichs. Berlin and Stralsund. Vol. 6.

HERRICH-SCHAEFFER, G. H. W. 1836. Die Wanzenartigen Insekten. Nurnberg: C. H. Zeh'schen Buchhandlung. 1836, Vol. 3; 1842, Vol. 7, 1853; Vol. 9.

HUSSEY, R. F. 1952. Food plants and new records for some Hemiptera in Florida. Florida Ent. 35: 3: 117–118.

————. 1953. Concerning some North American Coreidae. Bull. Brooklyn ent. Soc. 48: 29–34.

————. 1956. Additions to the United States list of Hemiptera. Florida Ent. 39: 2: 88.

KELSHEIMER, E. G. 1949. Control of insect pests of cucumber and squash. Bull. Fla. Univ. Agric. Exp. Sta. 465: 1–15.

KIRITSHENKO, A. N. 1935. Ueber Die Gattungen *Leptoglossus* Guer. und *Theognis* Stål (Hemiptera, Coreidae). Konowia 14: 191.

KIRKALDY, G. W. 1906. On the nomenclature of the genera of the Hemiptera. Entomologist 39: 253–257.

KOERBER, T. W. 1963. *Leptoglossus occidentalis* (Hemiptera: Coreidae). A newly discovered pest of coniferous seed. Ann. ent. Soc. Amer. 56: 229–234.

LETHIERRY, L. AND G. SEVERIN. 1894. General catalogue of the Hemiptera-Heteropteres. Brussels: F. Hayes, Imprimeur de l'Academie Royale de Belgique 2: 1–277.

LINNAEUS, C. 1767. Systema Naturae. 12th edition. Holmiae: Laurentii Salvii 1: (2): 533–1327.

————. 1771. Mantissa plantarum altera Generum editionis II. Holmiae, impensis direct. L. Salvi pp. 143–587.

MANN, J. 1969. Cactus-feeding Insects and Mites. U. S. Nat. Mus. Bull. 256: 1–158.

MAYR, G. L. 1865. Diagnosen neuer Hemipteren II. Verh. zool.-bot. Ges. Wien 15: 429–446.

————. 1866. Hemiptera *In*: Reise der Osterreicheschen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859. Zoologischer Theil 2, Abt. 1. Wien: Karl Gerold's Sohn 204 pp.

MCCULLOUGH, T. 1968. Acid and aldehyde compounds in the scent fluid of *Leptoglossus oppositus*. Ann. ent. Soc. Amer. 61: 1044.

MONTROUZIER, P. 1855. Essau sur la faune de l'ile de Woodlark ou Moiou. Ann. Soc. Agric. Lyon 2: 7: 1–114.

PAGDEN, H. T. 1928. *Leptoglossus membranaceous* F. a pest of Cucurbitaceae. Malay. Agric. Jour. 16: 387–403.

PARSHLEY, H. M. 1923. Family Coreidae: *In* Britton: Guide to the insects of Connecticut: Part IV. The Hemiptera or sucking insects of Connecticut. Bull. Conn. Geol. Nat. Hist. Surv. 34: 746–753.

PENNINGTON, M. S. 1922. Physis-Notas sobre coreidos Argentinos. Rev. de la Soc Ara de Ciencias Naturales, Buenos Aires pp. 125–170.

REED, E. C. 1900. Sinopsis de las Hemipteros de Chile. Valparaiso 107 pp.

SAY, T. 1831. Descriptions of new species of Heteropterous Hemiptera of North America. New Harmony Indiana. 1831: 310–368 (Leconte Edition, 1859).

SCHAEFER, C. W. 1965. The morphology and higher classification of the Coreoidea (Hemiptera-Heteroptera). Part III. The families Rhopalidae, Alydidae, and Coreidae. Misc. Pub. ent. Soc. Amer. 5: 1: 1–76.

————. 1968. The morphology and higher classification of the Coreoidea (Hemiptera-Heteroptera). Part IV. The *Acanthocephala*-group and the position of *Stenoscelidea* Westwood (Coreidae). Univ. Conn. Occas. Pap. (Biol. Sci. Ser.) 1: 153–199.

SCHAFFNER, J. C. 1967. The occurrence of *Theognis occidentalis* in the midwestern United States (Heteroptera:Coreidae). J. Kansas ent. Soc. 40: 141–142.

SCHOUTEDEN, H. 1907. Les types d'Hemipteres de Montrouzier. Ann. Soc. ent. Belg. 51: 106–118.

SIGNORET, V. 1863a. Hemiptera: *In* Maillard, Notes sur l'Ile de la Reunion. (Bourbon) Insects, Paris.

————. 1863b. Revision des Hemipteres du Chile. Ann. Soc. ent. Fr. 4: 3: 541–588.

SNAPP, O. I. 1948. Sucking insects causing deformed peaches. J. econ. Ent. 41: 555–557.

SPINOLA, M. 1837. Essai sur les genres d'insects appartenants a l'orde des Hemipteres Lin. ou Rhyngotes, Fab. et a la section Heteropteres, Dufour. Genes: Chez Yves Gravier Imprimeur-Libraire pp. 1–383.

————. 1852. Hemipteros: *In* Gay, Historia de Chile zoologica. 7: 113–320. Paris: Imprenta de Maulde y Renou.

STÅL, C. 1855. Nya Hemiptera. Ofvers. VetenskAkad Forh., Stockh. 12: 181–192.

————. 1859. Till Kannedomen om Coreida. Ofvers. VetenskAkad. Forh., Stockh. 16: 449–475.

————. 1860. Bidrag till Rio Janeiro-traktens Hemipter-fauna. K. svenska VetenskAkad. Handl. 2: 7: 1–84.

————. 1862. Hemiptera Mexicana enumeravit speciesque novas descripsit. Stettin ent. Ztg. 23: 81–118; 273–281, 289–325, 437–462.

————. 1868. Hemiptera Fabricana I. K. svenska VetenskAkad. Handl. 7: 11: 1–148.

————. 1870. Enumeratio Hemipterorum. Part I. K. svenska VetenskAkad. Handl. 9: (1): 1–232.

SZENT-IVANY, J. J. H. AND A. CATLEY. 1960. Observations on the biology of the black leaf-footed bug *Leptoglossus australis* (F.) of Papua and New Guinea. Papua New Guinea Agric. Jour. 13: 70–75.

TORRE-BUENO, J. R. DE LA. 1941. A synopsis of the Hemiptera-Heteroptera of America north of Mexico. Part II. Families Coreidae, Alydidae, Corizidae, Neididae, Pyrrhocoridae and Thaumastotheriidae. Ent. amer. 21: (ns.): 41–122.

UHLER, P. R. 1893. A list of the Hemiptera-Heteroptera collected in the Island of St. Vincent by Mr. Herbert H. Smith; with descriptions of new genera and species. Proc. zool. Soc. Lond. 1893: 705–719.

————. 1894. On the Hemiptera-Heteroptera of the island of Grenada, West Indies. Proc. zool. Soc. Lond. 1894: 167–224.

VAN DUZEE, E. P. 1917. Catalogue of the Hemiptera of America north of Mexico. Berkeley: Univ. Calif. Publ. Ent. 2: 1–902.

WALKER, F. 1871. Catalogue of Hemiptera-Heteroptera in the collection of the British Museum. London: Part IV.

WATSON, J. R. AND E. W. BERGER. 1932. Citrus insects and their control. Bull. Fla. Univ. Agric. Exp. Sta. 67: 3–140.

WESTWOOD, J. O. 1842. A catalogue of Hemiptera in the collection of the Rev. F. W. Hope, Part II. London: J. C. Bridgewater 26 pp.

WOLCOTT, G. W. 1948. The insects of Puerto Rico. J. Dep. Agric. P.R. 32: 1–224.

ENTOMOLOGICA AMERICANA

A TAXONOMIC AND BIOLOGICAL STUDY OF SPECIES OF ATTAGENINI (COLEOPTERA: DERMESTIDAE) IN THE UNITED STATES AND CANADA

RICHARD S. BEAL, JR.

PUBLISHED BY THE
NEW YORK ENTOMOLOGICAL SOCIETY
INCORPORATING THE BROOKLYN ENTOMOLOGICAL SOCIETY

Vol. 45, No. 3 October 26, 1970

The New York Entomological Society (incorporating the Brooklyn Entomological Society) publishes two journals: *Entomologica Americana* (irregularly, according to the availability of acceptable papers) and the *Journal of the New York Entomological Society* (quarterly). Monographs and papers too long to be published in other journals (minimum length approximately 70 manuscript pages) are published in *Entomologica Americana*. Shorter papers may be submitted to the *Journal*. Manuscripts should be sent to the Editor, *Entomologica Americana*, Department of Entomology, The American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024.

Entomologica Americana was first published by the Brooklyn Entomological Society in April, 1885. Publication was suspended after six volumes, resumed in 1926, again suspended in 1964 with Volume 44, and resumed in 1969 with Volume 45. The subscription rate to *Entomologica Americana* is $9.00 per volume. Correspondence regarding subscriptions and other non-editorial matters should be addressed to Publication Business Manager, New York Entomological Society, Department of Entomology, The American Museum of Natural History.

Mailed October 26, 1970

Entomologica Americana is published for the Society by Allen Press, Inc., 1041 New Hampshire, Lawrence, Kansas 66044.

Entomologica Americana
Vol. 45, 1970, pp. 141–235

A TAXONOMIC AND BIOLOGICAL STUDY OF SPECIES OF ATTAGENINI (COLEOPTERA: DERMESTIDAE) IN THE UNITED STATES AND CANADA

By
Richard S. Beal, Jr.[1]

Table of Contents

[1] Northern Arizona University, Flagstaff, Arizona 86001.

ABSTRACT: The following species and subspecies within the dermestid beetle tribe Attagenini are recognized from the United States and Canada: *Attagenus cyphonoides* Reitter, *A. megatoma megatoma* (Fabricius), *A. megatoma canadensis* Casey, *A. elongatulus* Casey, *A. schaefferi hypar* new subspecies, *A. schaefferi spurcus* LeConte, *A. pellio* (Linnaeus), *A. fasciatus* (Thunberg), *A. bicolor* Harold, *A. lobatus* Rosenhauer, *A. rufipennis* LeConte, *Novelsis athlophora* Beal, *N. perplexa* (Jayne), *N. varicolor* (Jayne), *N. aequalis* (Sharp), *N. uteana* Casey, *N. horni* (Jayne), *N. andersoni* Beal, *N. timia* Beal, *N. picta* Casey. Keys are provided to the adults and known larvae. Also included are diagnoses of adults, redescriptions of inadequately described adults, and descriptions of known larval forms. The species are placed in six groups according to degrees of morphological similarity, and criteria for determining the groups are discussed. It is found that during the larval stages most of the species feed on a wide variety of dried proteinaceous materials. The most common habitats for the larvae are noted as sheltered bird nests and rodent nests, but larvae may also be found in bee and wasp nests and in sheltered spider webbing. Adults commonly are observed to fly to flowers, probably to mate; however, mating may occur without flight and without feeding or drinking. The extent of depredations of stored food products and fabrics is discussed. Two species, *A. lobatus* and *A. cyphonoides*, are newly recorded as apparent recent introductions into the United States from the Old World.

INTRODUCTION

Members of the genus *Attagenus* of the family Dermestidae are well known to every entomologist as common pests of households and granaries. The name *Attagenus piceus* is probably memorized by every student enrolled in economic entomology at our American universities. Despite this familiarity, knowledge of the systematics of the New World members of the genus has seemingly regressed rather than advanced over the past seven or so decades. The last revisionary study of the American members of *Attagenus* was published in 1900 by Thomas L. Casey. This famous coleopterist was usually able to discriminate between the forms he studied, even if his species definitions cannot be accepted in the light of present knowledge. Nevertheless, his key and descriptions to the species of *Attagenus* are completely inadequate for sorting out the species. From the arrangement of the specimens in his collection, which is preserved intact at the United States National Museum, it is evident that he himself was unable to recognize the species. In several instances the specimens that stand behind a name include two or three different species. Since Casey's time, American entomologists, perhaps understandably frustrated, have quite generally designated

every more or less uniformly colored, mahogany, brown, or black specimen by the name *Attagenus piceus*. This practice has been followed without regard for some obvious morphological differences and in spite of the well-documented fact that the specific trivial name *piceus* is not applicable to any of the forms in question.

The problem of defining the limits of the genus has not been of concern to American students, since our Attagenini appear to fall very neatly into two groups, and the number of species is not large. H. F. Jayne, who revised the Dermestidae in 1882, placed members of both groups in *Attagenus*. Casey, however, separated the groups and erected the genus *Novelsis* to accommodate one of them. This separation has been a convenience, but, unfortunately, when members of the group from other zoogeographical areas are considered, the classification proves inadequate. Several European workers have arranged many members of *Attagenus* under the subgenera *Telopes* Redtenbacher (1843) and *Lanorus* Mulsant and Rey (1867). Both these names have priority over *Novelsis*, and probably a number of our American species should be assigned to them. The difficulty lies in knowing exactly what these subgeneric names represent. The greatest number of characters available for a generic classification seem to be found in the larvae; however, the larvae of the type species of *Lanorus* and *Telopes* have not been available for study. A fairly adequate classification might be worked out for the species of Attagenini, but until the type species of these genera have been investigated, the status of any generic names that are used will necessarily remain in doubt. In view of this uncertainty, I am not attempting in this paper to rename any of the generic groups within the Attagenini or to reassign any of the species to other genera. Current generic names are used throughout the paper, even though they do not correctly represent the natural groups within the Attagenini. A possible arrangement of the species into natural groups is proposed, but a determination of the names to be applied to the groups should await a more cosmopolitan study.

An alternative solution to the problem of reassigning the species of Attagenini to a number of different genera is to lump them all under *Attagenus*, as has been done by several European workers. Although this would be a convenience to cataloguers, it would also serve to delay growth in knowledge of the group. There are approximately 160 species of the tribe scattered throughout all the zoogeographic regions of the world. It is scarcely conceivable that these species do not fall into a number of smaller, definable groups.

The discovery of these groups will provide a framework around which biologists other than systematists can organize their data. Comparison of these data may in turn assist the systematist to confirm or to refine his classification. A reasonable degree of subdividing would better serve the needs of both the functional biologist and the systematist. Therefore, it seems uneconomical at present to reassign the species of *Novelsis* to *Attagenus*. Very possibly and hopefully in a short time most of the species will be given other generic assignments.

The primary purpose of this paper therefore is to define the Nearctic species of the tribe. A diagnosis of each species is given, together with a redescription of the adult when necessary and a description of the mature larva whenever possible. All available biological information that bears upon the definition of the species is also included. Keys for the identification of adults and known larval forms are provided to make the definitions more useful.

A second purpose of the paper is to present the biological data available for each species. Extensive data have been collected in the past for a few of the species. Unfortunately, in many instances the specimens studied were not deposited in a museum and there is no way of knowing their actual identity. Where there has been access to the specimens from which the data have been gathered, the information is related in the paper to the correct name of the species. Otherwise the data are ignored.

METHODS OF PREPARING LARVAE

The difficulty of using microscopic characters for studying and identifying the larvae is further aggravated by the fact that there seems to be no rapid way to prepare a slide mount of a specimen and leave all the useful characters visible. Most of the specimens used in this study were cleared in KOH, dehydrated in glacial acetic acid, cleared in beachwood creosote, and mounted in a balsam substitute. While the specimen was in the creosote the mouthparts were dissected out and the body cut open the entire length along the median suture. The body was then mounted spread out with the inside surfaces of the integument against the slide. Mouthparts were mounted on the same slide under separate 6 mm. coverslips. Some of the specimens studied were cut open the same way but mounted directly in Hoyer's medium. Although this method allows for rapid preparation, the terga tend to retain their curved shape, so that even if the specimen is generally well-flattened the edges

of the terga are usually bent under and the spiracles difficult to observe. Clearing in KOH seems to make the terga easier to flatten, leaving the spiracles and their associated sclerites flat against the slide. It was found that specimens of most species can be identified quickly by using iridectomy scissors to cut out a piece of an abdominal segment with the spiracle, a part of the tergum, and a part of the sternum included. This piece is then mounted on a slide in Hoyer's medium. Often the setae covering the spiracle need to be teased away first. However, to use the key, the entire specimen needs to be mounted.

CHARACTERS AND TERMS

SELECTION OF GENERIC CHARACTERS: The difficulty that arises when one attempts to split the tribe Attagenini into genera is that if one set of characters is used to segregate the genera, the groups are ordered differently than if another set of characters is used. There are a number of sets that might be used, and there are as many conceivably different ways of ordering the genera. This kind of problem is a familiar one in the animal kingdom. The taxonomist must apparently make an a priori decision that certain characters are of generic value and group the species accordingly. Some criterion such as "adaptive significance" or "phylogenetic stability" might be used to select the generic characters. However, if it were to be granted that one or another of these criteria had taxonomic significance, it would be of little use at this time in choosing characters for genera of the Attagenini. Not enough is known of the adaptive value of the characters present in the larval or adult stages or of the phylogeny of the group to make such judgments. Fortunately, there is a rational way out of the dilemma. The taxonomist can first determine the genera and afterward find generic characters to match. It is not necessary to have generic characters prior to dividing a larger taxon into its genera. A "natural" classification can be achieved if the species are first grouped on the basis of their over-all similarities and dissimilarities. This is exactly what the classical taxonomist did with his "eye." However, there are so many characters present among the species of Attagenini when both adult and larval stages are considered, the taxonomist cannot trust his mere impressions. It is necessary to tabulate and count the differences. Once this has been done, there is an objective basis for grouping the species. The species within each group are more likely to share a greater number of genetic similarities than with any species

of a different group. After the discovery of the groups, the generic characters are relatively easy to find. At least with the use of this procedure in the Attagenini the generic characters have not been difficult to identify. They are those characters that are common to all members of the group. No judgment is made as to their adaptive or phyletic value; no judgment is necessary. So far as their use in classification is concerned, they become the "key" characters by which the genera are recognized.

This is the procedure that has been followed in sorting the species of Attagenini into groups in the pages following. Those characters that are common to all members of a group are termed "generic," even though for the present no nomenclatural assignments to genera are made.

ADULT CHARACTERS: Previous workers have usually considered the relative sizes of the segments of the male antennal club of generic significance. Casey placed in *Attagenus* those species with the first two segments of the club extremely short in comparison with the third segment and in *Novelsis* those species with the first two segments elongated. However, if both adult and larval characters are tabulated and the species grouped as described above, the relative lengths of the segments of the club are seen to be of a low order of importance. On the other hand, a useful generic character is found in the shapes of the metacoxa and the metepimeron. In some species the ventral lamina of the coxa extends laterally to meet the metepimeron, which is somewhat curved behind the metepisternum, thus enclosing the metepisternum behind. In other species these do not meet behind the metepisternum, so that the metepisternum appears open behind. Each of these conditions is correlated with other characters common to the groups and accordingly is a useful generic character. The relative sparseness or density of the body setae and also the length of the setae on the antennal club are similarly correlated with other characters and are useful in recognizing the species groups. Most of the other adult characters used in the key are of significance at the species level only, including the number of segments in the antenna, the convexity or concavity of the hypomeron, and patterns in the elytral pubescence.

If there are significant differences in the genitalia, I have been unable to discover them. There are minor genitalic differences between some of the species, but none of such a nature that they would be of value in sorting the species into groups. Neither have I been able to find significant differences in the wing venation.

The length of the terminal segment of the male antenna is to some extent correlated with the combined length of the pronotum and elytra and a useful character for distinguishing between some of the species. A high correlation exists between the length of the terminal antennal segment and the length of the elytron alone, at least in the *megatoma* section (Group I in this paper). However, a regression line drawn for a number of measurements plotted on a graph passes relatively far to one side of the zero point. As a result, the correlation is difficult to use as well as to express. The regression line for correlations between the last antennal segment and the total length of the pronotum and elytron passes somewhat closer to the zero point. Accordingly, it is easier to use and has been used in the descriptions following, even if at some sacrifice of precision.

Many authors have described or figured the male antennal club as an aid in distinguishing the species, assuming that the relative lengths of the first two segments are closely correlated with the length of the terminal segment. However, there is no more than a moderately low correlation between these measurements. Although the ratio is of value in separating some groups of species, it is of little worth in distinguishing between "close" species, such as *A. elongatulus* and *A. megatoma*. Relatively poor correlations are found between the interocular width and the length of the terminal antennal segment or between the interocular width and the combined length of the pronotum and elytra.

LARVAL CHARACTERS: A number of characters useful both for distinguishing between the species and for grouping them into natural assemblages are found in the larvae. Unfortunately, most of the characters are so minute they cannot be easily observed except through a compound microscope. The body setae are usually longitudinally ribbed. They may be broad and flat with numerous ribs or they may be linear and more or less round in cross section with many or few ribs. The number of such ribs is often significant. Most of the setae are recumbent, but near the posterior margin of each tergum is a row of erect setae. Close to the margin of the socket of each of these erect setae is one or two pits, each roughly a fourth the diameter of the socket and presumably sensory in function. Whether there is one or two pits beside each socket and, if there is a single pit, whether it is on the medial or lateral side of the socket appear to be useful characters.

Since it is necessary to describe differences between setae inserted on different areas of the abdominal segments, the meaning of the following terms should be noted. By *tergum* is meant the entire

dorsal sclerotized area of each abdominal segment. Near the anterior margin of each tergum, except the ninth and occasionally the eighth, there is a transverse suture, the *antecostal suture*. That part of the tergum anterior to the suture is designated the *acrotergite*. The term *tergite* is used for the sclerotized part of the tergum posterior to the suture.

The shape and position of the spiracle and the nature of various structures associated with it are significant. The spiracle may be a simple, somewhat circular opening on the posterior margin of the tergum (Fig. 12) or it may be a narrow slit with thickened margins some distance in front of the posterior margin of the tergum (Fig. 11). Close to the spiracle at the lateral margin of the tergum is a small sclerite bearing several long setae. This structure is termed the spiracular sclerite in the key and descriptions that follow. The spiracle may be adjacent to the sclerite or may open a distance from it. If at a distance, there is a narrow suture-like slit between the sclerite and the spiracle. The sclerite may be almost completely enclosed by the tergum or may appear to be almost entirely free of the tergum. In the latter case there is a narrow sclerotized margin of the tergum along the anterior edge of the spiracular sclerite, but the part of the tergum in front of this margin is membranous, so that the margin appears at first glance to be part of the sclerite.

For many of the species only a limited number of larvae were available for study. As a result, I am not certain whether some of the observed differences are valid species characters or whether they are merely differences that vary within the species. Possibly there are a number of "good" characters associated with the shape and setation of the femora and tibiae. However, there is considerable variation in the pattern of setation in the species for which long series were available. Consequently, it has been difficult to make reliable comparisons with species for which only one or two specimens were at hand. Apparently there are also some secondary sexual differences in the shape of the larval tibia in some of the species. The sex was not known for many of the larval specimens studied, so the status of these characters has had to remain undefined. I have illustrated the protibiae of three species where the differences are quite marked and have noted some apparent differences in the descriptions of other species. However, I have made no use of these characters in the key or in grouping the species. The number of setae observed on the labial palps is described, but may be of little significance. The shapes of the glabrous areas on the pronotum

appear to differ from species to species, but the differences are not pronounced and are difficult to utilize.

The length of each antennal segment in relation to the lengths of the other antennal segments as well as the length of the antennal setae in relation to the lengths of the antennal segments provide useful characters for distinguishing between species in other tribes of dermestids. Little correlation was found between these measurements in these species. One character that appears to be of moderate value in distinguishing a few of the species is the length of the long seta at the apex of the third antennal segment in comparison with the length of the segment. Unfortunately, the seta is easily broken off in preparing a slide mount and is available for use with an occasional specimen only.

CHARACTERS FOR RECOGNITION OF THE ATTAGENINI

A single character that distinguishes adult members of the Attagenini from those of other tribes of Dermestidae is the short first segment of the tarsus of the hind leg. This segment is not more than half as long as the second segment. The following combination of characters will also serve to identify members of the tribe. The body is covered with subrecumbent to suberect hairs, never with scales. The head bears a distinct median ocellus. The pronotum does not have a distinct sublateral carina on each side. The hind wings are well developed. The antennal club is 3-segmented, with the segments moderately enlarged and in the male sometimes greatly elongate. The hypomeron may be broadly and deeply concave to slightly convex but, if concave, not forming a distinct cavity for the antenna and not margined behind. The prosternal process is long and narrow and is received in a shallow groove in the mesosternum. This groove becomes more shallow posteriad, so that the mesosternum is not completely divided and its hind margin is visible for its entire width. The abdomen has five free and externally visible sternites.

The larvae of the Attagenini are readily recognized by their shape, the body being elongate, gradually tapering posteriad from the metathorax, rounded dorsally, and flattened ventrally. The terminal segment is provided with a brush of long, slender setae. Setae of the body may be scale-like or long and slender with minute imbricate scales (spicisetae), but are never spear-headed (hastisetae), clavate, basket-shaped, or branched. The antenna consists of two

moderately long basal segments and a shorter terminal segment. The maxillary palp is 4-segmented, the first two segments being short, the third long and curved inward, and the fourth long but shorter than the third. Each notum and tergum, except the tergum of the ninth abdominal segment, includes at its lateroposterior angle a spiracular sclerite, which bears several long, slender setae. The ninth abdominal segment lacks urogomphi. The tenth segment is apparently unrepresented by any sclerotized parts, unless the small paired sclerites inserted in the sternum of the ninth segment represent part of the tenth. Additional descriptive details are given by Rees (1943).

RELATIONSHIPS

With the use of the procedures described for sorting species into groups, our American Attagenini fall into the following six groups.

Group I. *Attagenus cyphonoides*
Attagenus megatoma
Attagenus elongatulus
Attagenus schaefferi
Attagenus pellio
Attagenus fasciatus

The larvae of each of these species are characterized by having setae with smooth rather than serrulate or denticulate margins, spiracles that open a short distance in front of the posterior margin of the tergum rather than on the margin, and spiracular sclerites that are bounded anteriorly, medially, and usually laterally by the tergum, but not posteriorly. The tergum is entirely sclerotized in front of the spiracular sclerite. Characters common to the adults include the approximation of the metacoxa and the metepimeron, extremely short and fine setae on the male antennal club, and moderately short and dense, subrecumbent body setae. All except *A. fasciatus* have a male antennal club in which the first two segments combined are much shorter than the last segment. *A. fasciatus* could justifiably be placed in a group by itself: the adults differ noticeably in having much stouter legs and an absence of secondary sexual differences in the form of the antenna. The decision to include *A. fasciatus* here is more or less arbitrary. It is meant to show that in total characters it is closer to this group than to any of the following.

The type species of *Attagenus* is *Dermestes pellio* Linnaeus,

according to Hope (1840). Therefore, Group I would carry the name *Attagenus*, should the other groups be assigned generic names.

Group II. *Attagenus bicolor*
Novelsis athlophora

In general fascies, adults of *A. bicolor* are similar to members of Group I. They differ in the structure of the hypomeron, which does not enclose the base of the procoxa but leaves the base and the trochantin fully exposed. Species of each of the other groups have an auricular-like structure enclosing the trochantin and the base of the procoxa behind (except that it is somewhat reduced in *N. horni* of Group VI). Adults also possess long, sparse, usually wholly black body setae. The setae may be dark brown in immature specimens but otherwise are uniformly black. The larvae differ from members of Group I in many respects. The margins of the setae are microserrulate, a character shared with the groups that follow. The spiracular sclerite is completely enclosed behind by a broad area of the tergum. The spiracle, though associated with the spiracular sclerite by a narrow channel, is some distance from it and some distance from the posterior margin of the tergum. The setae on the pretarsus of *A. bicolor* are subequal in width and length, as they are in Group I, whereas the species in the groups following have one of the two setae twice as wide as the other. However, the setae in *A. bicolor* are four-fifths the length of the claw, whereas the setae in members of Group I are not over half the length of the claw. *N. athlophora* is tentatively included in Group II in view of its similarity in adult characters to *A. bicolor*. A further discussion of the similarities will be found in the section on *A. bicolor*.

Group III. *Attagenus lobatus*

This species seems quite obviously to belong to no other group of Nearctic species, although it has more characters in common with Group I than with any other group. The larvae are unique in having ten or more setae inserted in each spiracular sclerite and in having a row of long, stout, linear setae near the anterior margin of each abdominal sternum. Another remarkable larval character is found in the extremely long and fine setae inserted on the acrotergites. *N. uteana* of Group IV also has such long and fine setae on the acrotergites but, unlike *A. lobatus*, it also has a row of ensiform setae on the acrotergites. Unique characters in the adult include the fine, thread-like carina on the dorsal margin of the

anterior tibiae, the exceptionally fine dorsal pubescence, and the elongation of the basal lobe of the pronotum.

Group IV. *Novelsis varicolor*
Novelsis perplexa
Novelsis aequalis

Larval stages of *N. perplexa* are unknown, but it can be presumed on the basis of adult similarities that the species belongs in the same group as *N. varicolor* and *N. aequalis*. Although the latter two species differ in a number of larval characters, they share more characters with each other than with any other species. The most noticeable characters aligning them with each other are associated with the body setae. These are broadly oval and strongly ribbed, with serrulate or denticulate margins and ribs. In addition, the spiracular sclerite is enclosed by the tergum, although the tergum is not sclerotized in front of the sclerite in *N. aequalis*. Two distal sensory pits are present on the epipharynx, but are very minute. Adults of all three species are remarkably similar in the structure of the antennal club, the erect setae of the male antennal club, the dense, suberect setae of the dorsum, and the type of pattern formed by the tricolorous elytral setae.

Attagenus varicolor Jayne is the type species of the subgenus *Paranovelsis* Casey by monotypy. Should the members of Group IV not be found congeneric with one of the Palearctic genera, they should be arranged under this name. However, adults of the type species of *Lanorus, Dermestes vigintiguttatus* Fabricius = *Attagenus punctatus* (Scopoli), resemble members of this group in a number of respects. Without a study of the larvae of *A. punctatus* it would be hazardous to affirm the distinctiveness of our Nearctic species.

Group V. *Attagenus rufipennis*

Adults of this species superficially look very much like members of Group I, particularly in the shape of the male antennal club, which has the terminal segment many times longer than the two very short preceding segments. However, the separation of the coxal plate from the metepimeron is a character distinguishing the species from the members of Group I and suggesting some other fundamental differences. Numerous differences are found in the larvae, which are more like larvae of Group VI than those of any of the foregoing groups. They differ from members of Group VI in possessing a distal series of two small sensory pits on the epipharynx, two rather than one sensory pit adjacent to the sockets of the sub-

marginal erect setae of the terga, and two small sclerites in the sternum of the ninth abdominal segment.

Group VI. *Novelsis uteana*
Novelsis horni
Novelsis andersoni
Novelsis timia
Novelsis picta

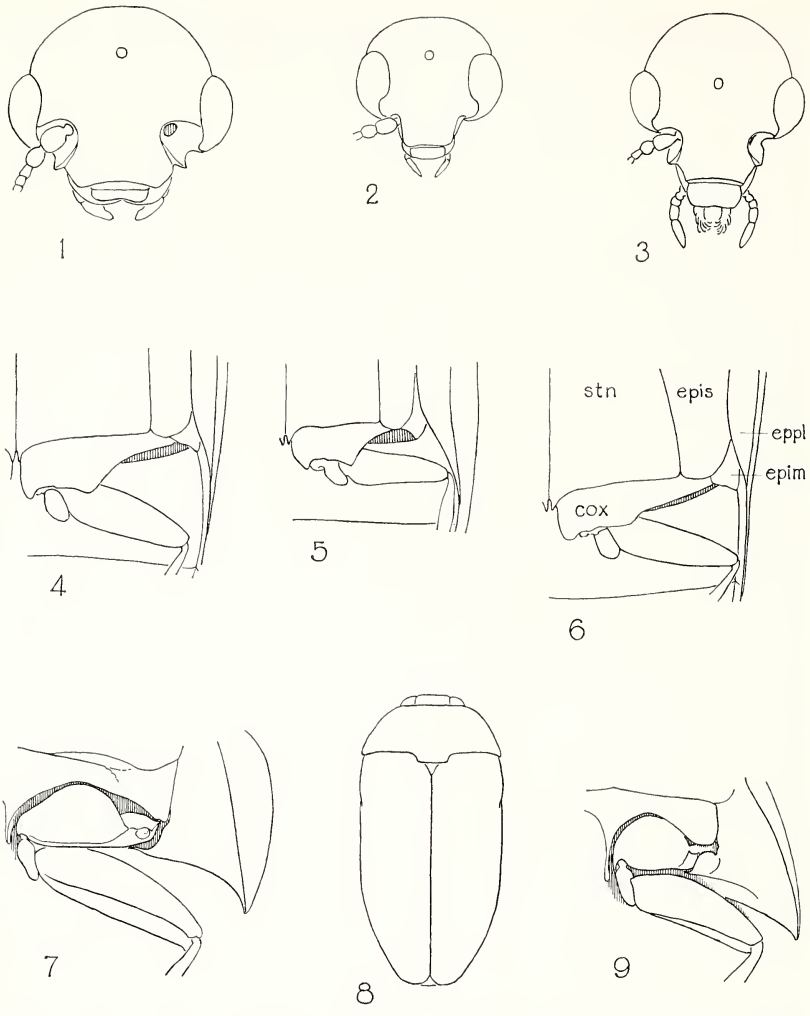
Unique characters among larvae of this group include the following: the lack of paired sclerites in the sternum of the ninth abdominal segment, the lack of a distal series of sensory pits on the epipharynx, no more than three setae on the dorsal side of each lobe of the ligula, and only one sensory pit adjacent to each socket of the submarginal erect setae of the terga. With reference to the last character, members of all other groups have two or occasionally three sensory pits adjacent to each socket, except that *A. bicolor* has some sockets with one and some with two adjacent sensory pits. Members of Group VI along with *A. rufipennis* (Group IV) have the tergum in front of the spiracular sclerite unsclerotized, so that the sclerite appears to project laterad somewhat peninsula-like. Larvae of *N. timia* and *N. picta* are unknown, but these species are included in the group because of adult similarities. The adults share a number of characters not found in other North American Attagenini. The front coxae are elongated relative to the length of the prosternal process, so that the coxae extend posteriad beyond the apex of the process. The epipleuron opposite the middle of the metepisternum lies in nearly the same plane as the incurved side of the elytron, instead of forming an angle with it of 90 to 120 degrees. The segments of the male antennal club are greatly elongated, so that the antenna in repose extends beyond the anterior margin of the metepisternum.

Attagenus horni Jayne is the type species of *Novelsis* (designated by Beal, 1954).

KEY TO THE NEARCTIC SPECIES OF ATTAGENINI

ADULT

1. Dorsal setae unicolorous, black or blackish brown; setae on disc of pronotum and elytra as long as combined length of antennal segments 3, 4, and 5, or longer. Setal punctures on disc of pronotum and base of elytra separated by two and usually three to four or more times diameter of single



FIGS. 1–9: Fig. 1. Head of adult of *Attagenus bicolor*. Fig. 2. Head of adult of *A. lobatus*. Fig. 3. Head of adult of *A. megatoma*. Fig. 4. Left metasternal coxa and associated sclerites of *A. elongatulus*. Fig. 5. Left metasternal coxa and associated sclerites of *Novelsis varicolor*. Fig. 6. Left metasternal coxa and associated sclerites of *A. bicolor* (stn = sternum, epis = episternum, eppl = epipleuron, epim = epimeron, cox = coxa). Fig. 7. Left prosternal coxa and associated sclerites of *A. bicolor*. Fig. 8. Outline of dorsum of *A. lobatus*. Fig. 9. Left prosternal coxa and associated sclerites of *A. megatoma*.

puncture. Hypomeron not forming lobe behind base of procoxa; base of procoxa and trochantin exposed (Fig. 7). ---- 2

Dorsal setae unicolorous, bicolorous or tricolorous; setae on disc of pronotum and elytra seldom longer than combined length of antennal segments 3 and 4, usually shorter, although setae on margins of elytra and pronotum may be longer, but if dorsal setae longer than length of antennal segments 3, 4, and 5 combined, then setae bicolorous or tricolorous. Setal punctures of disc of pronotum and base of elytra hidden by dense pubescence or, if visible, usually separated by one or two times diameter of single puncture. Hypomeron forming auricle-like lobe behind base of procoxa so that base of procoxa and trochantin largely hidden (Fig. 9). ---- 3

2. Antenna 11-segmented; male antenna with terminal segment of club five times as long as length of two preceding segments combined. ---- *Attagenus bicolor*

Antenna 10-segmented; male antenna with terminal segment no more than four-fifths as long as length of two preceding segments combined. ---- *Novelsis athlophora*

3. Elytron with black hairs except for prominent oval spot (about as broad as eye) of white hairs at middle of disc near suture and often also with two or three very small lateral white spots at about basal two-fifths. ---- *Attagenus pellio*

Elytral pubescence unicolorous or with bands of light pubescence or with several large spots of light pubescence, but not as described above. ---- 4

4. Lamina of hind coxa not meeting metepimeron; coxa and epimeron appearing separated by metepisternum (Fig. 5). ---- 5

Lamina of hind coxa extending behind metepisternum to meet metepimeron (Fig. 4). ---- 15

5. Antenna 10-segmented. ---- 6

Antenna 11-segmented. ---- 9

6. Dorsal pubescence tricolorous: black, golden-brown, and white; ventral pubescence light golden-yellow; setae on margin of fifth abdominal sternum dark brown or black. Male antennal club clothed with erect hairs about three-fourths as long as width of third antennal segment. ---- *Novelsis perplexus*

Dorsal pubescence unicolorous or bicolorous; ventral pubes-

cence whitish, including setae on margin of fifth abdominal sternum. Male antennal club clothed with closely appressed hairs not longer than one-fourth width of third antennal segment. ---- 7

7. Elytral integument brownish black to black with contrasting light tan or reddish yellow maculae; maculae forming oblique subbasal band, sutural line from base to apex or near apex, and marginal line from base or near base to apical fourth; whitish pubescence limited almost entirely to light-maculate areas. ---- Female of *Novelsis andersoni*

Integument brownish black without maculae or maculae, if present, more or less diffuse and difficult to see because of dense pubescence; setae on elytron unicolorous, whitish, or brown and whitish; if bicolorous then white setae forming two irregular bands on apical half or several longitudinal lines on apical half or white setae interspersed among dark setae on apical half. ---- 8

8. Hind tibia bearing on posterior side numerous erect setae more than three times as long as spines along shaft of tibia. Elytron with whitish setae forming irregular circle on basal half and two bands on posterior half. Male antenna in repose extending almost to hind margin of metepisternum. ---- *Novelsis picta*

Hind tibia without long, erect setae but with usual long, recumbent setae through which project short, stout spines. Elytron entirely covered with whitish hairs (females) or with dark hairs among which whitish hairs form basal band, subbasal oblique band, sutural line, and several somewhat distinct lateral lines on apical half (males and occasional females). Male antenna in repose extending about as far as hind margin of middle coxa. ---- *Novelsis uteana*

9. Pronotum with middle basal part prolonged backward to form broad, apically truncate lobe (Fig. 8). Anterior tibia with sharp, knife-like carina along dorsal margin; short, stout spines inserted in row along posterior side of carina and on posterior face of tibia but not on anterior face of tibia. ---- *Attagenus lobatus*

Pronotum produced only feebly backwards at middle basal part. Anterior tibia rounded on dorsal margin without knife-like carina; short, stout spines inserted irregularly along dorsal margin as well as on posterior face, with or without spines on anterior face of tibia. ---- 10

10. Male antennal club with terminal segment at least four times as long as length of two preceding segments combined; female antennal club with terminal segment one-eighth longer than length of two preceding segments combined. Integument of elytron colored black, mahogany, or mahogany with base black and with black sutural line; elytral setae entirely black or black with sparsely intermingled golden-yellow hairs or black with band of golden-yellow hairs at basal fourth. ..... *Attagenus rufipennis*

    Male and female antennal club with terminal segment equal in length or shorter than length of two preceding segments combined. Integument of elytron colored black, reddish yellow, or light brown with or without clearly defined maculae, but if black with suffused mahogany area on disc, then bands or patches of whitish pubescence present on apical as well as on basal area of elytron. 11

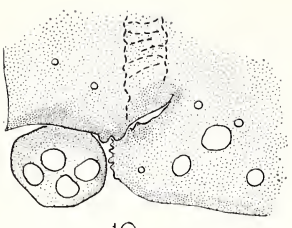
11. Hypomeron (ventrally inflexed side of pronotum) deeply concave, forming fossa for antenna. Male antennal club clothed with erect, white setae about three-fourths as long as width of third antennal segment. Pubescence of elytron consisting of black hairs and light colored hairs; light colored hairs forming thin band at base, semicircular subbasal band, irregular submedian band, and irregular subapical band. 12

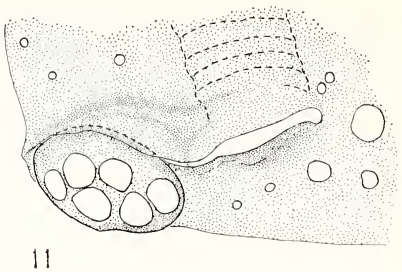
    Hypomeron flat or slightly convex. Male antennal club clothed with closely appressed setae about as long as one-fourth width of third antennal segment. Pubescence of elytron various. 13

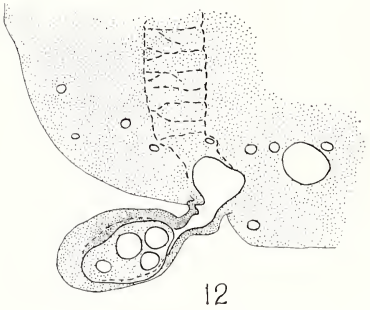
12. Elytral integument with poorly defined brown or reddish brown area on basal two-thirds and occasionally with reddish subapical spot. Plane of disc of prosternum and plane of lateral lobe of prosternum separated by step-like bend in prosternum. ..... *Novelsis aequalis*

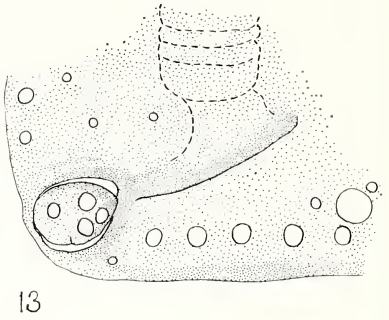
    Elytron with more or less sharply-defined reddish yellow or light tan macula occupying most of disc of elytron or with two or three distinct subbasal, median, and subapical maculae. Declivity in prosternum forming transition between plane of disc of prosternum and plane of lateral lobe. ..... *Novelsis varicolor*

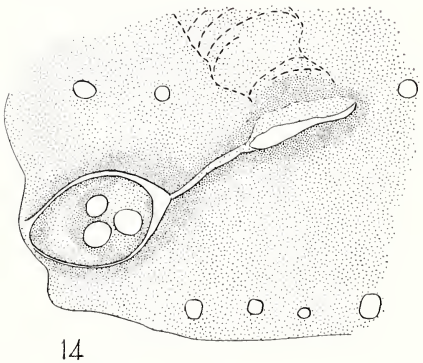
13. Elytral integument reddish yellow to brown, immaculate. Light-colored pubescence of elytron forming broad band at basal

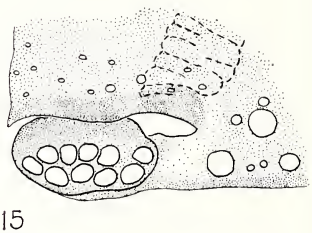












FIGS. 10–15: Spiracles and spiracular sclerites from first abdominal tergum of mature larvae of Attagenini. Sockets where setae are inserted are shown as circles, although the setae are not shown. In general the size of the seta is proportionate to the size of the socket. Fig. 10. *Attagenus cyphonoides*. Fig. 11. *A. megatoma*. Fig. 12. *A. rufipennis* (form from Santa Barbara, California). Fig. 13. *Novelsis varicolor*. Fig. 14. *A. bicolor*. Fig. 15. *A. lobatus*.

fourth, submedian band, and subapical band; submedian and subapical bands connected by sutural line of light pubescence. ---------- *Novelsis timia*

Elytral integument dark brown to black with contrasting light tan or reddish yellow maculae; light maculate areas forming oblique subbasal band and sutural line from base to apex or near apex; light line along lateral margin present or absent. Light-colored pubescence mostly limited to light maculate areas of elytron; no light pubescence present behind middle of elytron except on light maculate sutural and marginal lines. ---------- 14

14. Marginal line of light maculation present on elytron and extending from base to posterior third or fourth. ---------- Male of *Novelsis andersoni*

Marginal line of light maculation usually appearing as short spur on oblique subbasal band, but at most extending from base no further than middle of elytron. ---------- *Novelsis horni*

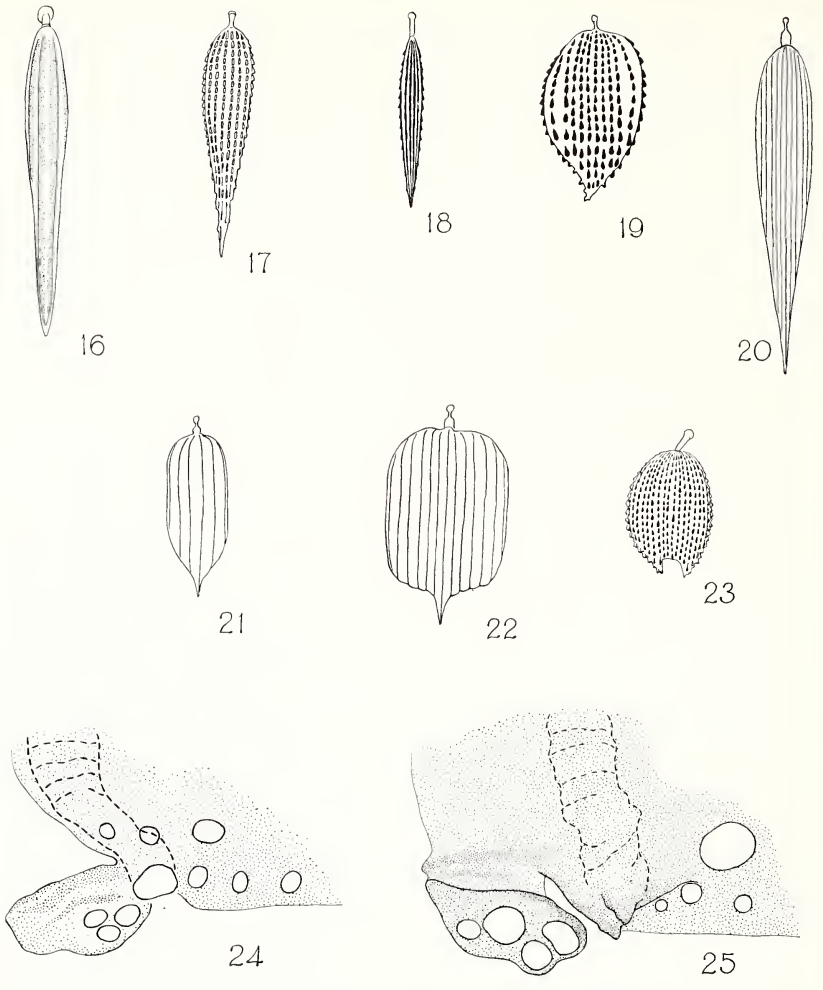
15. Elytron covered with dark hairs except for very well-defined, subbasal band of light pubescence; band usually broad and extending continuously to median suture but occasionally reduced to two light-colored narrow bands on middle of elytron at basal two-fifths and spot of light-colored hairs on median suture at basal fourth. ---------- *Attagenus fasciatus*

Elytron unicolorous or with diffuse subbasal or basal band of light-colored hairs; subbasal band, if present, not extending to median suture and no subbasal patch of light-colored hairs present on suture. ---------- 16

16. Antenna 10-segmented. Ultimate segment of antennal club more than 6.0 times as long as length of two previous segments combined. ---------- *Attagenus schaefferi*

Antenna 11-segmented. Ultimate segment of male antennal club less than 5.8 times as long as two previous segments of club combined. ---------- 17

17. Posterior margin of lateral lobe of prosternum bent almost vertically in front of coxa. Posterior ventral carina of middle femur much weaker than anterior ventral carina and on apical half of femur two-thirds as far from dorsal margin as anterior ventral carina. Elytral integument and hairs medium to dark brown with few light golden hairs forming indistinct lateral fascia at about basal fourth. ---------- *Attagenus cyphonoides*



FIGS. 16–25: Fig. 16. Seta from disc of first abdominal tergite of *Attagenus megatoma*. Fig. 17. Seta from second abdominal acrotergite of *Novelsis varicolor*. Fig. 18. Seta from disc of first abdominal tergite of *A. rufipennis*. Fig. 19. Seta from disc of first abdominal tergite of *N. varicolor*. Fig. 20. Lanceolate seta from eighth abdominal tergite of *A. pellio*. Fig. 22. Scale-like seta from disc of eighth abdominal tergite of *A. pellio*. Fig. 23. Apically bifurcated scale-like seta from first abdominal tergite of *N. aequalis*. Fig. 24. Spiracle and spiracular sclerite of sixth abdominal tergum of mature larva of *N. aequalis*. Fig. 25. Spiracle and spiracular sclerite of seventh abdominal tergum of *A. pellio*.

Posterior margin of lateral lobe of prosternum weakly reflected against base of procoxa with reflected portion extending ventrad at about thirty to forty degree angle. Posterior ventral carina of middle femur about as distinct as anterior ventral carina and almost in same plane. Elytral pubescense piceous to black; light-colored hairs, if present, forming fascia at base of elytron or limited to extreme lateral margin of elytron; integument of elytron mahogany to black. 18

18. Ratio of length of terminal segment of antenna of male to length of pronotum and elytra combined varying from 1:5.7 to 1:7.6. Pronotum with band of golden hairs along basal margin; greatest length of band (measured anteriorly to posteriorly) about equal to length of scutellum. Elytron with golden hairs absent or limited to scattered hairs or small patches of hair along basal margin and not extending posteriad beyond apex of scutellum except along extreme lateral margin. ..... *Attagenus elongatulus*

Ratio of length of terminal segment of antenna of male to length of pronotum and elytra combined varying from 1:7.9 to 1:11.4. Pronotum without band of golden hairs along basal margin, or band present and not longer than half length of scutellum, or latero-posterior angles and basal margin covered with golden hairs. Elytron without golden hairs or varying number of golden hairs present on basal fourth; if golden hairs present on base of elytron, these commonly extending from base well beyond scutellum. ..... *Attagenus megatoma*

KNOWN MATURE LARVAE

1. Some broad, scale-like setae with five longitudinal ribs between margins inserted on acrotergites; most setae of tergite of eighth abdominal segment either subrectangular in outline (Fig. 22) or ovate (Figs. 19, 23). 2

All setae of acrotergites slender and usually with not more than three longitudinal ribs visible between margins; setae of tergite of eighth abdominal segment either lanceolate or linear (Figs. 16, 18). 4

2. All setae with smooth margins; scale-like setae of anterior terga broadly lanceolate (Fig. 21); scale-like setae of posterior terga subrectangular (Fig. 22). ..... *Attagenus pellio*

All setae with denticulate margins; scale-like setae of all terga ovate-lanceolate and ovate in form (Figs. 19, 23). 3

3. No antecostal suture present on eighth abdominal tergum. Setae of terga consisting of scale-like hairs only, except for elongate marginal and submarginal erect setae; all setae of discs of terga with single acute apex. ..... *Novelsis varicolor*

Antecostal suture present on eighth abdominal tergum. Setae of terga consisting of scale-like hairs with some intermingled linear hairs in addition to elongate marginal and submarginal erect setae; some setae on discs of terga with single acute apex and some with two acute apices (Fig. 23). ..... *Novelsis aequalis*

4. No antecostal suture on eighth abdominal tergum. Spiracular sclerite closed behind by tergum; spiracle enclosed by tergum with distance between spiracle and posterior margin of tergum on first abdominal segment equal to more than one-fourth length of tergite (Fig. 14). ..... *Attagenus bicolor*

Antecostal suture present on eighth abdominal tergum. Spiracular sclerite closed behind by tergum or not, but if closed then distance between spiracle and posterior margin of tergum equal at most to one-sixth length of tergite at midline. 5

5. Setae of dorsum (excluding head) grayish white (transparent in cleared specimens) and contrasting sharply with brownish black setae of abdominal sterna. Integument of each notum with large blackish lateral spot and several smaller blackish spots. ..... *Novelsis uteana*

Setae of dorsum and setae of abdominal sterna quite similar in color (although setae of head and thoracic sterna sometimes lighter than other setae). Integument of nota not marked with darker spots or, if darker in middle, then not differing in appearance from terga. 6

6. Some setae of eighth abdominal sternum broadly lanceolate with as many as 7 ribs between margins. 7

All setae of eighth abdominal sternum linear or narrowly lanceolate with at most no more than 4 ribs between margins. 9

7. Disc of sterna with lanceolate setae only; row of stout linear setae one to two times as long as lanceolate setae near anterior margin of each abdominal sternum; numerous fine, long, simple setae present anterior to row of stout linear setae. Spiracular sclerite bearing 10 or more setae (Fig. 15). ..... *Attagenus lobatus*

Anterior abdominal sterna with linear and linear-lanceolate setae; seventh and eighth abdominal sterna with intermingled lanceolate setae and linear setae; setae becoming increasingly smaller toward anterior area of sternum without anterior row of stout linear setae. Spiracular sclerite bearing no more than 6 and usually fewer than 6 setae. ... 8

8. Broadest setae of first abdominal tergite with 4 ribs between margins; broadest setae of eighth abdominal sternum usually with no more than 9 ribs between margins. ... *Attagenus schaefferi*

Few broad setae of first abdominal tergite with 5 ribs between margins; broadest setae of eighth abdominal sternum in fully mature specimens with 11 or 12 ribs between margins. ... *Attagenus elongatulus*

9. Second antennal segment bearing 12 or more setae. ... *Attagenus fasciatus*

Second antennal segment bearing no more than 3 and often 2 setae. ... 10

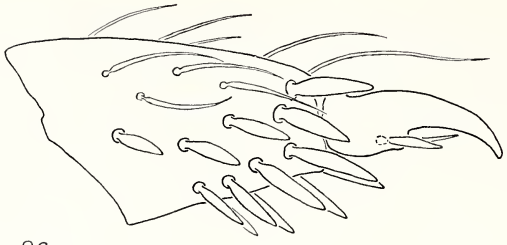
10. Tergum sclerotized continuously anterior to entire length of tergal margin of spiracular sclerite; spiracle closed behind by tergum, at least on anterior abdominal segments (Figs. 10, 11). Setae inserted on pretarsus subequal in width and length. ... 11

Tergum not sclerotized continuously anterior to spiracular sclerite, so that sclerite with associated tergal margin appears to project peninsula-like from postero-lateral angle of tergum. Spiracle opening on margin or at apparent margin of tergum (Fig. 12). Setae inserted on pretarsus unequal, one about twice as wide as other. ... 12

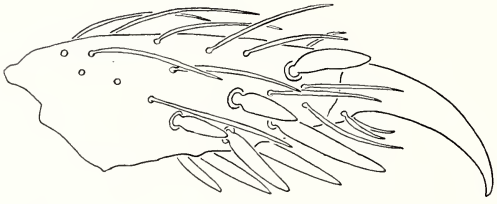
11. Setae of head identical in color with setae on disc of pronotum (although setae on lateral margins of pronotum may appear darker). Integument of dorsum dark reddish brown except for teneral specimens. All setae on disc of tergites lanceolate except for submarginal erect setae and marginal linear setae. ... *Attagenus megatoma*

Setae of head distinctly lighter in color than setae of nota and terga. Dorsal integument straw-colored. Disc of tergites with about equal number of lanceolate and linear setae. ... *Attagenus cyphonoides*

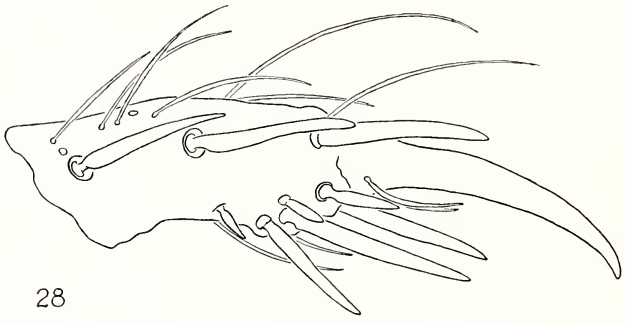
12. Setae of head brownish. Setae of disc of tergites linear and spindle-shaped; margins of setae minutely microserrulate



26



27



28

FIGS. 26–28: Posterior view of front tibiae and pretarsi of mature larvae. Fig. 26. *Attagenus rufipennis*. Fig. 27. *A. fasciatus*. Fig. 28. *A. lobatus*.

(serrations scarcely visible except under high powers of compound microscope) or smooth. One sensory pit close to socket of each submarginal erect seta on abdomen. Epipharynx with two distal sensory pits lacking. ---------- ---------- *Novelsis horni* and *Novelsis andersoni*

Setae of head black. Setae of disc of tergites lanceolate; margins of setae serrulate or denticulate (visible under low powers of compound microscope). Two sensory pits, one on each side, adjacent to socket of each submarginal erect seta on abdomen. Epipharynx with two minute sensory pits distal to median series of 6 sensory pits. ..... *Attagenus rufipennis*

Attagenus cyphonoides Reitter

Attagenus cyphonoides Reitter, 1880 (1881), p. 34.—Zhantiev, 1963b, p. 416.

Attagenus alfierii Pic, 1910, p. 17.—Hinton, 1943, p. 227; 1945, pp. 322–323.

Trogoderma cyphonoides: Arrow, 1915, p. 427.

ADULTS: Described adequately by Hinton (1945).

MATURE LARVAE: Dorsal integument straw-colored. Setae of head golden-yellow; setae of body and legs golden-brown.

Head: Terminal seta of antenna not observed; two setae present near apex of second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two setae on penultimate segment. Labium with five to six setae on dorsal (inner) surface of each side of ligula; middle two to three broadly ensiform; outer two to three narrowly ensiform to terete; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites all linear, widest with no more than one rib visible between margins. Disc of tergites with linear setae and lanceolate setae; widest lanceolate setae with no more than three ribs visible between margins. Sockets of most submarginal erect setae with two adjacent sensory pits, one on either side near anterior margin. First abdominal sternum with setae at midline longer than other setae of disc; longer setae covered with minute, sharply pointed, imbricate scales; similar setae present along midline of thoracic segments. Setae of sternum of eighth abdominal segment all linear-lanceolate; widest with no more than two ribs between margins; setae becoming smaller on anterior area of sternum; no anterior row of long, stout setae.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin more or less straight; posterior margin somewhat thickened. Spiracle somewhat separated from spiracular sclerite (Fig. 10). Spiracular sclerite subcircular to oval, bearing no more than six setae, not enclosed by tergum. Tergum sclerotized

anterior to tergal margin of spiracular sclerite and continuously with it.

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum about half as long as length of tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about one-half as wide as long; ventral margin about six-thirteenths as long as length of segment. Tibia of prothoracic leg with usual two ventral rows of spines, one subdorsal apical spine, and row of one to three spines parallel to and very near ventral row. Setae inserted at base of pretarsus subequal in width, extending about as far as middle of claw.

RECORDED DISTRIBUTION: The type locality for *A. cyphonoides* is southern Egypt. *A. alfierii* was also described from Egypt. It occurs as well in Tunisia and Morocco (Zhantiev, 1963a).

NEW RECORDS: *Alabama*: Brawley, August 27, 1954 (C. H. Rothe). *Arizona*: Buckeye, June 27, 1958 (W. B. Morrow); Chloride, July 16, 1957 ("L. L. G."); Elfrida, June 23, 1954 (K. S. Rohwer); Elgin, June, 1954 (J. F. Brantlinger); Gila Bend, June 13, 1957 (L. L. Garrison); Mayer, June 20, 1957 (R. A. Murphy); Mesa, May 8, 1957 (A. M. Mroczkiewicz); Phoenix, May 23, 1957 (A. M. Mroczkiewicz); Randolph (Pinal County), September 27, 1957 (D. A. Bercich); Safford, September 20, 1957 ("W. B. F."); Tucson, July 28, 1954 (R. S. Beal); Tucson, August 11, 1955 (J. R. Boyer). *Kansas*: Dodge City, August 26, 1954 (D. L. Matthew). *New Mexico*: Las Cruces, August 15, 1957 (D. Lucht). *Baja California*: Tecate, May 19, 1955.

DIAGNOSIS: The integument of the adults varies from yellowish brown to a dark chestnut brown. Most of the dorsal hairs are dark brown. The elytra appear unicolorous, but close inspection of each shows an oblique band formed by a few light, golden hairs on the lateral half at the basal fourth. The antenna is 11-segmented. The first two segments of the male antennal club are subequal, and the terminal segment is nearly five times as long as the first two combined. The prosternum has the lateral lobe bent almost vertically in front of the procoxa to form a narrow, transverse, razor-like edge. This character readily separates *A. cyphonoides* from all other species in Group I except *A. fasciatus*, from which it is readily distinguished by the pattern of dorsal pubescence. The middle and hind femora do not have the two ventral carinae on the same or nearly the same plane, as do the other species treated here. The

posterior ventral carina on the apical half of the middle femur lies about two-thirds as far from the dorsal margin as does the anterior ventral carina.

Larvae of *A. cyphonoides, A. megatoma,* and *A. fasciatus* are generally quite similar. They may be distinguished from others in Group I by the relatively narrow setae of the abdominal tergites and of the eighth abdominal sternum. The broadest setae in these three species have no more than three ribs between the margins. Mature larvae of *A. cyphonoides* differ from those of *A. fasciatus* in that there are two setae rather than 12 or more on the second segment of the antenna. They differ from larvae of *A. megatoma* in having two rather than no setae on the second segment. They differ from larvae of both *A. megatoma* and *A. fasciatus* in having the setae of the head distinctly lighter in color than the setae of the nota and terga, rather than having the setae of head and dorsum nearly the same color.

Attagenus megatoma (Fabricius)

ADULT MALES: Integument of dorsal and ventral surfaces immaculate, reddish brown to black; antennal club usually with all segments piceous; legs and flagellar shaft of antenna reddish brown to yellowish brown. Pubescence of head and dorsal surfaces subrecumbent, entirely black or black with varying numbers of light golden-brown hairs on pronotum and base of elytra; ventral pubescence recumbent, light golden-brown except for black hairs on posterior half of fifth visible sternum. Eye slightly emarginate over base of antenna. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:2.8 to 1:3.4; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:9.00 to 1:11.77; club clothed with fine, erect hairs about one-third as long as width of third antennal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina visible from front of head (Fig. 3); carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral carina continued around anterolateral angle; basal lobe feebly rounded to slightly truncate and not distinctly produced backward; setae on posterior margin of lobe not appreciably longer than other setae of pronotum. Punctures of pronotal disc varying in diameter from width of one to width of two diameters of facet of eye; punctures nearly contiguous laterally,

especially on anterior half of pronotum, with anterior margins more sharply defined than posterior margins so that pronotum somewhat transversely rugose. Elytron with punctures of disc about twice diameter of facet of eye and separated by one to two diameters of single puncture. Hairs of disc about as long as combined length of fourth and fifth segments of antenna. Hypomeron slightly concave; forming lobe behind trochantin so that trochantin visible only through narrow slit (Fig. 9). Prosternum with posterior margin of lateral lobe reflected against procoxa; reflected part about as long as length of horizontal part of lobe and forming angle of about 45° with horizontal part; prosternal process slightly wider at apex than between coxae; ventral surface of process thin and knife-like; no thread-like carina extending from process onto disc, but disc longitudinally elevated at middle and broadly carina-like; no transverse thread-like carina present near anterior margin of disc, but denticle present at middle near anterior margin. Epipleuron terminating a little behind hind margin of metepimeron. Ventral plate of hind coxa forming more or less acute tooth lateral to insertion of trochanter; plate extending laterad behind posterior margin of metepisternum and meeting metepimeron (actually extending beneath inner margin of metepimeron). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and nearly on same plane. Length (of pronotum and elytra combined): 2.8 mm. to 4.0 mm.

ADULT FEMALES: Antennal club with first two segments usually reddish brown and terminal segment piceous; terminal segment subequal to one and one-half times length of ninth and tenth segments combined; tenth segment about five-sixths as long as ninth segment. Length (of pronotum and elytra combined): 3.9 mm. to 5.0 mm.

MATURE LARVAE: Integument of head and dorsum dark reddish brown. Setae of head and body dark golden-brown.

Head: Antenna with terminal seta subequal in length to length of terminal segment; second segment without setae. Epipharynx with distal series of two sensory pits, each subequal in diameter to diameter of sensory pits of middle series. Maxillary palp with two and occasionally three setae on third segment. Labium usually with six setae on dorsal (inner) surface of each lobe of ligula; three inner setae ensiform; three outer setae slender; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Acrotergites with small, linear-lanceolate, indistinctly ribbed setae and numerous

simple setae. Setae on tergites linear-lanceolate with two or three ribs between margins (Fig. 16). Sockets of submarginal erect setae usually with two adjacent sensory pits, one on each side. Sterna with linear-lanceolate setae with two ribs between margins and occasionally some with three ribs between margins; setae becoming smaller on anterior area of each sternum without row of stouter setae near anterior margin; first and second abdominal sterna with several setae along midline much longer than other setae of disc.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin more or less straight; posterior margin somewhat thickened; spiracle slightly removed from spiracular sclerite. Spiracular sclerite oval, not enclosed by tergum, bearing six or fewer setae. Tergum sclerotized anterior to tergal margin of spiracular sclerite and continuous with it (Fig. 11).

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about two-thirds as long as tergite of eighth segment. Two small sclerites in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg half as wide as long; ventral margin two-fifths as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical spine and row of five to seven subventral spines above posterior row of ventral spines. Setae inserted at base of pretarsus subequal in width and length, extending almost to middle of claw.

INTERNAL ANATOMY: Details of the digestive tract, Malpighian tubules, bands of oenocytes, and reproductive systems have been described by Dunkel and Boush (1968a). The internal anatomy of no other species in the tribe has been investigated, so no comparative data are available for evaluating the significance of the interesting structures which these authors found.

NOMENCLATURE: Although the name *A. piceus* has been applied to several species in the United States, it properly applies to this species alone. However, the name is unavailable, since *Dermestes piceus* Olivier (1790) is a primary junior homonym of *Dermestes piceus* Thunberg (1781) and was treated as such by early authors.

The oldest available name is *Dermestes unicolor* Brahm (1791). This name was not used by any subsequent author until Mroczkowski (1968) recognized the identity of Brahm's type and listed the name in his catalogue. It is unfortunate that it was not treated by Mroczkowski as a *nomen oblitum*. A request is currently before the International Commission on Zoological Nomenclature to suppress the name and to conserve the name used here.

The next available name for the species is *Dermestes megatoma* Fabricius (1798). Latreille erected the genus *Attagenus* in 1802, and after that almost all authors used the combination *A. megatoma* for the species until Mulsant and Rey in 1868 resurrected the name *A. piceus*. Lacking a code, many nineteenth century authors simply accepted the authority of Mulsant and Rey, and the propriety of the name was not subsequently questioned by any American writer. Nevertheless, the name *A. megatoma* has been used by a number of recent European workers, as can be seen from the table of synonymy for *A. megatoma megatoma*.

DISTRIBUTION IN NORTH AMERICA: This is a polytypic species, probably originally Holarctic in distribution but now nearly cosmopolitan as a result of introductions by commerce. Two geographically distinct forms are clearly present in the Nearctic region: one occurring mostly in Canada and in the northern tier of states but dipping as far south as Utah and Iowa, the other widespread throughout the remaining states. The latter (southern) form is indistinguishable from the nominate European subspecies and may represent an early introduction to the United States. The northern form resembles the Far Eastern *A. megatoma japonicus* Reitter and possibly originated from it, migrating across the former land bridge between Alaska and northeastern Asia. In spite of the resemblances, however, there appear to be enough differences between the forms that they should be regarded as distinct subspecies.

Casey (1916) named the northern form *A. canadensis*, considering it a distinct species. I believe it deserves no more than subspecific status, because intergrades are frequently found in areas where it comes together with the southern form and because crossbreeding experiments seem to show that gene exchange between the two forms is possible. In several experiments first generation hybrids were readily formed between a stock culture of "*megatoma*" obtained from Prescott, Arizona, and a stock culture of "*canadensis*" from Vancouver, British Columbia. When the hybrids were mated, second generation progeny were produced and developed into adults in several, but not all, of the experiments. The failures in the second generation crosses do not necessarily mean there is reduced fertility between the hybrids, since I was compelled to move my laboratory during the experiments, and the cultures were not kept in an adequately moist atmosphere for some length of time. At any rate, the ability of some hybrids to mate and produce viable progeny seems

established and indicates the probability of the same thing taking place in the wild state.

The accompanying map (Fig. 29) shows the distribution of the two forms. Most specimens of *A. megatoma megatoma* have no golden-brown hairs inserted on the elytra. Most specimens of *A. megatoma canadensis* have golden-brown hairs inserted in some numbers on the base of the elytra back to a distance at least equal to three lengths of the scutellum. First generation hybrids between such forms have golden-brown hairs inserted on the base of the elytra no further back than one length of the scutellum. Using the hybrids as a rough standard, I have designated as an "intergrade" any specimen with golden-brown hairs on the base of the elytra where the hairs are inserted no further back than one and one-half times the length of the scutellum. Localities where such intergrades have been found are shown on the map with a triangle, even though one or both of the other forms may have been found in the same locality. The pattern of distribution exhibits a less regular line of demarcation between the forms than might be expected, but this irregularity is probably explained by the movement of the forms through commerce. If *A. megatoma megatoma* is an indigenous subspecies, I doubt that western Oregon and Washington are within its original range.

ECOLOGY AND LIFE HISTORY: Hinton (1945) summarized the immense amount of work done on the life history, habits, and economic importance of the species. Regrettably, there is no way of knowing which of the studies listed refer to *A. megatoma* and which to *A. elongatulus*. Probably the life histories are very similar. Nevertheless, it would be unsafe to assert that any of the facts cited are true of *A. megatoma* without access to the specimens used in the experiments or without replicating the experiments with accurately identified and unmixed cultures. It is particularly unfortunate that the experiments of Griswold and Greenwald (1941) on the life history of "*A. piceus*" cannot at present be assigned definitely to one species or the other.

Most of the reliable available information on the ecology of the species has been gathered for *A. megatoma megatoma*. The information that follows refers to this subspecies, unless otherwise noted. In each instance the identity of the species and subspecies has been verified. Out-of-doors the species is not uncommonly found in various bird nests. It was taken by E. G. Linsley at Madera, California, in the nests of cliff swallows, by Mrs. K. B. Wetherbee in a

tree swallow nest in Connecticut, by W. L. McAtee in a starling nest at Bell, Maryland, and by A. T. McClay in an English sparrow nest at Medford, Oregon. J. A. Payne collected one larva in owl pellets at Clemson, South Carolina. In addition to these records, Ellis A. Hicks (1959) has assembled a long list of references to the occurrence of the species in various kinds of bird nests. Probably most of the references apply to this species, but very likely some refer to *A. elongatulus* or other similar-appearing species. The species is not limited to bird nests and possibly may occur as commonly in some other out-of-door situations that up to the present have not been as thoroughly canvassed. I collected the species in a *Sceliphron* mud dauber nest at Chino Valley, Arizona. Johansen and Eves (1966) published a report of *A. megatoma canadensis* (under the name *A. piceus*) as an occasional pest in the Pacific Northwest in nests of the alfalfa leafcutting bee, *Megachile rotundata* (Fabricius). E. S. Ross found a specimen in a *Geomys* (pocket gopher) burrow in Somerset, Texas.

The species is not uncommonly found in human habitations, although probably not as frequently now since the advent of synthetic fibers in the manufacture of rugs, overstuffed furniture, and the like. It is probably best known as an inhabitant of granaries, seldom in any numbers in the grain bulk, unless the store is fairly old, but rather in grain dust on the stringers and on old spilled grain in corners and under floor boards. Triplehorn (1965) carried out a survey of insects in Ohio grain elevators and feed mills and found it in 110 out of 118 establishments investigated, a far higher rate of occurrence than found for any other insect. *A. megatoma canadensis* was found by Chao (1954) to be similarly prevalent in grain elevators at Albion and Pullman, Washington. Following a survey he assigned five categories of frequency to the insects found and rated this species (under the name *A. piceus*) in the most frequently occurring group.

The feeding habits of the larvae have been investigated in the laboratory, though not in comparison with other species. Hence, such questions as whether this species or *A. elongatulus* is the more important depredator of woolens and other animal fibers remain unanswered. Mallis, Miller, and Hill (1958) found that the species will feed extensively on wool and on various combinations of wool and synthetic fabrics. It will feed to a slight extent on silk crepe and on nylon but little or not at all on dynel, dacron, orlon, vicara, acetate rayon, viscose rayon, linen, and cotton percale. It will feed more extensively on nylon stained with human perspiration, but

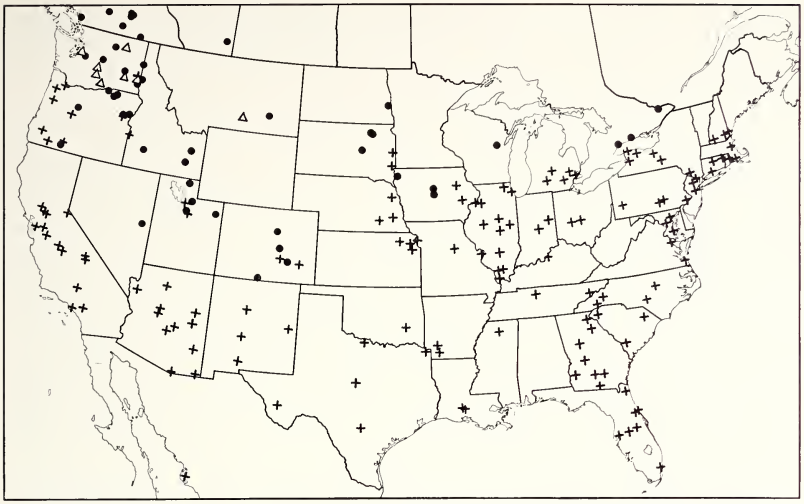


FIG. 29. Nearctic distribution of subspecies of *Attagenus megatoma*: + = *A. megatoma megatoma*, ● = *A. megatoma canadensis*, △ = intergrades between subspecies. See text for further explanation.

not on nylon stained with human urine or tomato juice (Mallis, Miller, and Hill, 1959). I have been able to rear the larvae successfully on dried dog food and on oatmeal. The species has been found infesting cereal products including bran, barley, ground Indian corn, in-shell peanuts, cake mix, and alfalfa meal. The species was found infesting stored raisins in Fresno, California, but may have been feeding on the remains of other insect pests rather than on the raisins. Little accurate information is available on the kinds of food that will permit maturation of the organism or that might govern the rate of maturation. Boush, Dunkel, and Burkholder (1969) have found that sorbic acid incorporated in the diet does not affect larval or adult weight, survival to adult stage, or pupal or adult longevity. However, mated pairs fed the chemical produced progeny unable to survive the first larval instar. The significance of this finding is not clear at the present time.

Mallis, Burton, and Miller (1962) experimented with the extent to which the larvae might be attracted to various food stains, including minerals, proteins, B vitamins, cholesterol, vitamin D, vitamin A, and cottonseed oil, and found them relatively unattracted to any. There was some positive attraction to stains made by glucose, orange juice, and tomato juice. Small but not large larvae were

attracted definitely to stains made by human urine, tomato juice, and beer, but only at times to stains made by human perspiration, milk, black coffee, and beef gravy (Mallis, Miller, and Hill, 1959). No larvae were attracted to tea, cola syrup, or butter stains.

Adults reared in the laboratory regularly mate and lay fertile eggs without the opportunity of flying and without being provided with water or food other than the cereal on which the larvae are reared. Out-of-doors adults have been taken on flowers of *Spiraea* (Mroczkowski, 1958), *Achillea*, and *Castanea*. Adults of *A. megatoma canadensis* have been collected on alsike clover and on sweet clover. Whether adults feed on the pollen or nectar of the flowers has not been ascertained. It is possible that attraction to flowers is a mechanism bringing individuals together for purposes of mating. Yokoyama (1932, cited in Hinton, 1945) noted that mating usually takes place on a flower or some other place exposed to the sun.

SYMBIONTS: The eugregarine *Pyxinia frenzeli* Laveran and Mesnil has been found within cells of the midgut epithelium of the larvae (Dunkel and Boush, 1968b). The protozoan is not found in the adult, except that newly emerged adults contain what is presumed to be a remnant of the larval midgut in the form of an elongated tube, closed at both ends, within which spores and encysted forms are found (Dunkel and Boush, 1968a). The tube is probably eliminated in the first defecation of the adult. In all probability the protozoan should be considered a commensal rather than a parasite. Heavily infested individuals do not show differences in weight, survival, or length of life cycle compared with non-infested individuals (Dunkel and Boush, 1968b). No survey has been made of the extent to which populations are infested in different parts of the range of the species. The specimens studied by Dunkel and Boush were from a laboratory strain maintained at the University of Wisconsin.

The muscardine fungus *Beauveria bassiana* (Bals.) Vuill. has been recorded as a parasite of the species (Charles, 1941). This is a generalized parasite best known from its occurrence on the chinch bug and the European corn borer. The identity of the species of *Attagenus* on which it was described might be questioned. Possibly it attacks all species in the group to which *A. megatoma* belongs, but this theory should be verified.

Attagenus megatoma megatoma (Fabricius)

Dermestes piceus Olivier, 1790 (*non* Thunberg, 1781), p. 10, pl. 1, fig. 4.
Dermestes unicolor Brahm, 1791, p. 144.

Dermestes megatoma Fabricius, 1798, p. 313.

Attagenus megatoma: Dahl, 1823, p. 30.—Laporte, 1840, p. 35.—Erichson, 1846, p. 441.—Wollaston, 1854, p. 204.—LeConte, 1854, p. 109.— Chevrolat, 1863, p. 616.—Howe, 1952, p. 40.—Mroczkowski, 1954, p. 7; 1958, p. 4; 1962, p. 6; 1965, p. 668.—Zhantiev, 1963b, p. 421.

Attagenus piceus: Mulsant and Rey, 1867 (1868), p. 69.—Jayne, 1882, p. 355.—Casey, 1900, p. 146.—Ganglbauer, 1904, p. 24.—Lutz, 1911, p. 152.—Mutchler and Weiss, 1927, pp. 10–11.—Moore and Moore, 1942, p. 288.—Rees, 1943, pp. 14–17.—Hinton, 1943, p. 227; 1945, pp. 309–319.—Korschefsky, 1944, p. 147.—Armstrong, 1945, p. 48.—Zinkernagle, 1952, p. 844.—Zinkernagle and Muller, 1952, p. 156.—Hatch, 1962, p. 283.

Attagenus cylindricornis Casey, 1900 (*?non cylindricornis* Say, 1825), p. 147 (New synonymy).

Attagenus deficiens Casey, 1900, p. 146 (New synonymy).

ADULT MALES: Dorsal pubescence black except for few golden hairs at basal third along extreme lateral margin of pronotum and narrow band of short golden to golden-brown hairs along basal margin of pronotum; pronotal band not always distinguishable but when visible not more than half length of scutellum at longest point; often few dark golden hairs scattered among black hairs of pronotum, particularly at sides; rarely dorsal pubescence entirely black. Ratio of length of last segment of antennal club to combined length of pronotum and elytra varying from 1:7.9 to 1:9.9.

DISTRIBUTION: The distribution of the subspecies in the United States in shown in Figure 29.

DIAGNOSIS: This subspecies is easily recognized by its almost entirely black dorsal pubescence. Some golden-brown or golden hairs may be scattered among the black hairs of the pronotum, particularly on the sides, but they do not form patches that contrast with the dark discal area. The last segment of the antennal club of the male tends to be a little longer in proportion to the length of the body than does the last segment of the club in *A. megatoma canadensis.*

Attagenus megatoma canadensis Casey, new status

Attagenus canadensis Casey, 1916, p. 183.

Attagenus piceus: Spencer, 1947 (1948), p. 7.

Attagenus piceus ab. *sordidus* Hatch, 1962 (*non* Heer, 1841), p. 283.

ADULT MALES: Dorsal pubescence black except for concentration of golden to golden-brown hairs on posterior margin and latero-posterior angles of pronotum and on base of elytra; light-colored

hairs of pronotum occasionally covering most of sides of pronotum; light-colored hairs of elytra quite dense at base but intermingled with increasing numbers of black hairs posteriad; light-colored hairs inserted posteriad two to four lengths of scutellum from base. Ratio of length of terminal segment of antennal club to length of pronotum and elytra combined varying from 1:9.0 to 1:11.4.

TYPE LOCALITY: Ottawa, Canada. The specimen that has been labeled as the type in the Thomas L. Casey Collection at the United States National Museum bears a somewhat illegible locality label that might possibly be read "Ott." Since Ottawa is one of the localities Casey indicated for the species, it is reasonable to limit it as the type locality. I herewith formally designate the specimen, which is a female, as the lectotype.

DISTRIBUTION: The known distribution is shown in Figure 29. Additional collecting is needed to establish the range of distribution of the subspecies northward in Canada and to clarify its points of contact with the nominate subspecies.

DIAGNOSIS: Adults of the subspecies may be distinguished from the nominate subspecies by the golden to golden-brown hairs that occupy the lateroposterior angles of the pronotum and form patches with almost no intermingled dark hairs. The light-colored patches stand out in contrast to the dark disc of the pronotum. In addition, there is a band of light-colored hairs on the base of the elytra. Posteriad it may be broken into somewhat irregular lines or may be intermixed with increasing numbers of dark hairs. Usually no light-colored hairs are inserted further back from the base than four times the length of the scutellum, often no further back than two times the length of the scutellum. Forms with light-colored hairs no further back than one and one-half times the length of the scutellum appear to occur only in the zones of intergradation between the two subspecies. No differences have been observed between larval forms of the two subspecies.

Attagenus elongatulus Casey

Attagenus elongatulus Casey, 1900, p. 147.
Attagenus extricatus Casey, 1900, p. 146 (New synonymy).
Attagenus bicolor Casey, 1900 (*non bicolor* Harold, 1868), p. 147.

ADULT MALES: Integument of body yellowish or reddish brown to black; elytra often somewhat lighter in color than pronotum; legs and antenna yellowish brown except for darker brown terminal antennal segment. Pubescence of head and dorsal surfaces sub-

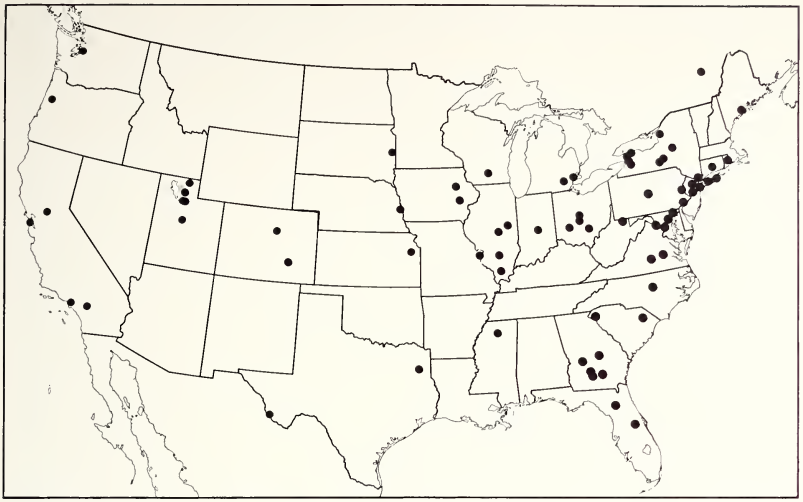


FIG. 30. Nearctic distribution of *Attagenus elongatulus*.

recumbent, black except for band of light golden-brown hairs along basal margin of pronotum; length of light-colored band at widest point (i.e., longest anterior-to-posterior distance) four-fifths to one and one-fourth times as long as scutellum; additional light golden-brown hairs either present or not along lateral margins of pronotum, along anterior margin of pronotum, along lateral margins of elytra at basal fourth, and at base of elytra; if golden brown hairs present at base of elytra these intermingled with black hairs and not inserted posteriad beyond length of scutellum; ventral pubescence recumbent, light golden-brown except for numerous black hairs on posterior half of fourth and on fifth visible sterna. Head with eye slightly emarginate over base of antenna. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:3.2 to 1:4.2; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:6.2 to 1:7.6; club clothed with fine, erect hairs about one-third as long as width of third antennal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina; margin of carina barely visible from front of head; carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral carina continued as well-defined carina around anterolateral angle; basal lobe feebly

rounded and not distinctly produced posteriad; setae on posterior margin of lobe about twice as long as light-colored setae on basal margin on either side of lobe. Punctures of pronotal disc varying in diameter from width of one to width of two facets of eye; anterior margins more sharply defined than posterior margins with punctures nearly contiguous laterally, especially on anterior half of pronotum, so that pronotum somewhat transversely rugose. Elytron with punctures of disc about twice diameter of facet of eye and separated by one to two diameters of single puncture. Hairs of disc of elytron no longer than combined length of third and fourth segments of antenna. Hypomeron moderately concave. Posternum with posterior margin of lateral lobe reflected against procoxa; reflected part about as long as horizontal part of lobe and forming angle of about 45° with horizontal part; prosternal process slightly wider at apex than between coxae; carina extending from apex of process onto disc and terminating at denticle near anterior margin of disc; carina broad and granulate on disc but thread-like on process; lateral carina present near anterior margin separating disc from anterior declivity. Epipleuron terminating little behind hind margin of metepimeron. Ventral plate of hind coxa somewhat expanded laterad to insertion of trochanter to form obtusely angled or somewhat rounding tooth; plate extending laterad behind posterior margin of metepisternum and meeting metepimeron (actually extending beneath inner margin of metepimeron) (Fig. 4). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and nearly on same plane. Length (of pronotum and elytra combined): 2.9 mm. to 3.9 mm.

ADULT FEMALES: Antennal club with first two segment yellowish brown to dark brown; all segments usually same color but occasionally terminal segment darker; terminal segment subequal to one and one-half times as long as ninth and tenth segments combined; tenth segment about five-sixths as long as ninth segment. Length (of pronotum and elytra combined): 3.6 mm. to 5.0 mm.

MATURE LARVAE: Integument of head and dorsum light brown. Setae of head and body golden-brown.

Head: Antenna with terminal segment subequal in length to length of third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two setae on penultimate segment. Labium with six to seven setae on dorsal (inner) side of each lobe of ligula; medial setae narrowly

ensiform with setae becoming progressively narrower laterad; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites all linear, most with no more than one rib between margins but some with two and rarely with three ribs between margins. Disc of tergite with linear and linear-lanceolate setae; linear-lanceolate setae with as many as five ribs between margins. Sockets of submarginal erect setae with two adjacent sensory pits, one on each side near anterior margin. First abdominal sternum with setae along midline longer than on remainder of disc. Setae of sternum of eighth abdominal segment consisting of linear-lanceolate and lanceolate hairs; lanceolate setae with eight to twelve ribs between margins (Fig. 20); setae becoming smaller on anterior area of sternum without anterior row of stouter setae.

Spiracle and associated structures: Anterior abdominal segments with spiracle closed behind by tergum; anterior margin of spiracle more or less straight; posterior margin somewhat thickened; spiracle adjacent to spiracular sclerite. Spiracular sclerite oval, not enclosed by tergum; five or fewer setae inserted on sclerite. Tergum sclerotized anterior to tergal margin of spiracular sclerite and continuous with it (similar to Fig. 11).

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum more than half as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about 9/20 as wide as long; ventral margin about 9/20 as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical seta and longitudinal row of three setae along middle of segment; most proximal seta in row inserted little before middle of segment. Setae inserted at base of pretarsus subequal in width, extending about as far as middle of claw.

TYPE LOCALITY: Recorded as "Nebraska to Utah." A female in the Thomas L. Casey Collection at the United States National Museum has been labeled the type. This specimen is herewith formally designated the lectotype. It bears a locality label with the word "Utah," so the type locality should be restricted to this state.

NOMENCLATURE: Casey quite evidently did not understand the limits of this species. On the one hand, a second specimen from Utah that stands under this name in his collection is actually *A. bicolor*. On the other hand, two specimens standing under *A. bicolor*

and a number of specimens standing under *A. cylindricornis* in his collection belong to this species. The type of *A. extricatus* appears to belong here, although the specimen is rubbed and identification is difficult. However, five other specimens that Casey arranged under *A. extricatus*, apparently after the original description, belong unquestionably to *A. megatoma*. *A. elongatulus* is quite similar to the European *A. brunneus* Faldermann. Nevertheless, the specimens of *A. brunneus* I have had available for study seem vaguely different, and I am unwilling to place *A. elongatulus* in synonymy without an opportunity to compare longer series and preferably to compare immature stages.

DISTRIBUTION: The species has an irregular distribution, suggesting that it is introduced and tending to confirm the suspicion that it is a synonym of *A. brunneus* or some other inadequately described, exotic species. Because the distribution is so widespread, it seems adequate to exhibit it on a map (Fig. 30) without detailing every locality.

DIAGNOSIS: This species is very clearly distinct from *A. megatoma*, although doubtless much of the American economic literature on "*A. piceus*" refers to it. Adult males can be distinguished by the relatively longer terminal segment, as indicated in the key, although this is a character requiring careful measurement. Females as well as males may be distinguished from *A. megatoma megatoma* by the presence of a band of light-colored hairs along the base of the pronotum, the band being about as long at its longest point as the length of the scutellum. If such a band is present in *A. megatoma megatoma*, at its longest point it is no more than half as long as the scutellum. *A. elongatulus* often has a few scattered golden-brown hairs at the base of the elytra but usually has no golden-brown hairs on the pronotum other than those mentioned. *A. megatoma canadensis* ordinarily has a large number of golden-brown hairs on the pronotum, particularly at the lateroposterior angles, and has a number of golden-brown hairs on the base of the elytra. Nonetheless, some adult female specimens of *A. megatoma canadensis* or intergrades between it and *A. megatoma megatoma* may be nearly impossible to distinguish from *A. elongatulus*. *A. elongatulus* also closely resembles some adult forms of *A. schaefferi* but may be distinguished from them by the 11- rather than 10-segmented antenna. Adults of *A. elongatulus* somewhat resemble those of *A. cyphonoides*, but careful inspection of the latter will always reveal the presence of at least a few lighter hairs forming a subbasal oblique band on

the elytron. No such band is found on the elytron of *A. elongatulus*. Furthermore, the pronotum of *A. cyphonoides* is covered with lighter golden-brown hairs instead of the lighter hairs being limited to a band along the basal margin. Little difficulty should be encountered in distinguishing adults of this species from other Nearctic Attagenini.

The larvae of this species are easily separated from all other known Nearctic species except those of *A. schaefferi*. Both *A. elongatulus* and *A. schaefferi* have, inserted on the eighth abdominal sternum, a number of distinctively broad, lanceolate setae, each with eight to twelve ribs between the margins. With the exception of *A. lobatus* all other species have either subrectangular or ovate setae on this sternum or have linear or narrowly lanceolate setae with no more than four ribs between the margins. *A. lobatus* is easily distinguished from *A. elongatulus* by having a row of stout linear setae near the anterior margin of each sternum, in front of which are numerous fine, long, simple setae. No such row of stout setae is found on the sterna of *A. elongatulus*. No completely definitive characters have been found by which larvae of *A. elongatulus* and *A. schaefferi* may always be distinguished. Possibly last instar larvae of the two can always be separated by the broader tergal and sternal setae of *A. elongatulus*. However, it is often impossible to know whether the specimens one is comparing are fully mature.

ECOLOGY: The following rather limited data are all I have been able to refer with certainty to this species. Adults have been collected from flowers of the catclaw, *Acacia greggii* A. Gray, in Presidio, Texas, on *Spiraea* in Ithaca, New York, and by sweeping celery and beets in Utah. Adults have occasionally been taken at lights. Larvae have been found feeding on woolens in Urbana, Illinois, by Carl Weinman and in Tifton, Georgia, by J. A. Payne. Adults and larvae have been taken quite frequently in homes, amounting on occasions to pests of minor importance, but no records have been kept of the materials on which they were feeding. L. F. Hoyt found the species infesting dried buttermilk in Buffalo, New York, and it has been found as a pest in dried milk in Omaha, Nebraska. J. A. Payne found the species infesting in-shell peanuts that had been in storage for four years at Douglas, Georgia.

LIFE HISTORY: Nothing has been published, unless this species is indeed a synonym of another species. H. S. Barber left a note in the collection of the United States National Museum indicating that a specimen he reared to maturity passed through 24 larval instars.

That this species is incapable of crossbreeding with *A. megatoma*

was demonstrated by Moore and Moore (1942). The "yellow" larvae of the Moores' experiments were this species and the "black" larvae were *A. megatoma.* W. E. Burkholder (*in litt.*) has verified these results in recent experiments.

Attagenus schaefferi (Herbst)

ADULT MALES: Integument of dorsal and ventral surfaces immaculate, light brown to black; legs and antennae light brown to dark brown; terminal segment of antennal club brown to black. Pubescence of head and dorsal surfaces subrecumbent, golden-yellow to black, with or without intermingled lighter-colored hairs; ventral pubescence recumbent, black with intermingled light golden-brown hairs on legs to entirely light golden-brown. Head with eye not at all emarginate to shallowly but clearly emarginate over base of antenna. Antenna 10-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:4.7 to 1:7.1; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:4.4 to 1:5.7; club clothed with fine, erect hairs about one-third as long as width of third antennal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina; margin of carina visible from front of head; carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral carina continued well-defined around anterolateral angle; basal lobe feebly rounded and not distinctly produced backward; setae on posterior margin of lobe as long as to not more than one-third longer than other setae of pronotum. Punctures of pronotal disc as small as or smaller than facet of eye, separated by one to three diameters of single puncture but sometimes feebly joined laterally so that pronotum somewhat transversely rugose. Elytron with punctures of disc one to one and one-half times diameter of facet of eye and separated by one to one and one-half times diameter of single puncture. Hairs of disc of elytron about as long as or slightly longer than third segment of antenna. Hypomeron slightly concave. Prosternum with posterior margin of lateral lobe reflected against procoxa; reflected part not as long as horizontal part and curving to form angle of about 30° with horizontal part; prosternal process slightly wider at apex than between coxae; carina of process not extended onto disc of prosternum; anterior declivity of prosternum sometimes separated from disc by thin transverse thread-like carina; denticle at anterior margin

of disc present or not. Epipleuron terminating gradually about middle of first abdominal sternum. Ventral plate of hind coxa forming obtuse or acute tooth lateral to insertion of trochanter and extending laterad beneath inner margin of metepimeron (i.e., appearing to meet metepimeron behind metepisternum). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and nearly on same plane. Length (of pronotum and elytra combined): 3.2 mm. to 4.2 mm.

ADULT FEMALES: Terminal segment of antennal club 1.3 to 1.7 times length of eighth and ninth segments combined; ninth segment subequal in length to eighth segment. Length (of pronotum and elytra combined): 3.8 mm. to 5.3 mm.

MATURE LARVAE: Integument of head and dorsum light brown. Setae of head and body golden-brown.

Head: Antenna with terminal seta subequal in length to length of third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two or three setae on penultimate segment. Labium with five to six setae on dorsal (inner) side of each lobe of ligula; middle setae narrowly ensiform with setae becoming progressively narrower laterad; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites all linear, most with no more than one rib between margins but few sometimes present with two ribs between margins. Disc of tergite with linear and linear-lanceolate setae; linear-lanceolate setae with as many as four ribs between margins. Sockets of submarginal erect setae with two adjacent sensory pits, one on each side near anterior margin. First abdominal sternum with longer setae along midline than on remainder of disc. Setae of sternum of eighth abdominal segment consisting of linear-lanceolate and lanceolate hairs; lanceolate setae with seven to nine ribs between margins; setae becoming smaller on anterior area of sternum without row of stouter setae near anterior margin.

Spiracle and associated structures: Anterior abdominal segments with spiracle closed behind by tergum; anterior margin of spiracle more or less straight; posterior margin somewhat thickened; spiracle adjacent to spiracular sclerite. Spiracular sclerite oval, not enclosed by tergum; five or fewer setae inserted on sclerite. Tergum sclerotized anterior to tergal margin of spiracular sclerite.

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum more than two-thirds as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg half or slightly more than half as wide as long; ventral margin about two-fifths as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical seta and longitudinal row of three setae along middle of segment; most proximal seta in row inserted slightly before middle of segment. Setae inserted at base of pretarsus subequal in width, extending about as far as middle of claw.

SYSTEMATICS: Varieties of *A. schaefferi* (Herbst, 1792) have long been known to exist in the United States but have been considered by all previous workers as no more than accidental introductions of the species from Europe. A careful study of the populations in the United States seems to indicate that this assumption is incorrect. The Nearctic forms are seldom found as pests in stored products or houses, yet occur commonly in the most remote areas of the West, often far from human habitation. If the forms had been introduced, they would be expected in centers of commerce or human activity. Furthermore, a number of geographic segregates are discernible in different areas of the West, a phenomenon not expected in a recently introduced species. Finally, the forms that are present in most areas of the United States appear to be distinguishably different from forms that have been described for the Palearctic region.

A measurable difference between European and Nearctic forms is found in the ratio of the length of the last antennal segment of the male to the total length of the pronotum and elytra. A large number of Nearctic specimens has been measured and the ratio found always to vary within the range of 1:4.67 to 1:5.67. Only four European males were available for study, but these all fell outside this range, varying from 1:4.40 to 1:4.65. These differences are small and, if a large number of European forms should be measured, no doubt it would be found that some overlap occurs in the ranges of variation. Another difference, but one difficult to measure, appears to be the degree of concavity of the epipleuron. In the Palearctic specimens I have examined the epipleuron is quite concave, but in most Nearctic specimens it is nearly flat or only slightly concave. These differences, taken with the evidence that the Nearctic forms are indigenous,

make it desirable to recognize the Nearctic forms as taxonomically distinct. Accordingly, I am designating the American forms as subspecies of the Palearctic form. The subspecies category preserves the apparent relationship with the Palearctic form while providing suitable names for reference to the American forms.

The various Nearctic populations of the species, so far as visible differences are concerned, are distinguished principally by the color of the setae of the adults. Specimens from British Columbia south along the Sierra Nevada are uniformly clothed with dark hairs on the dorsal surfaces and on the abdomen. Within this range specimens from the north tend to be more chocolate brown, and from the south darker, almost black. Specimens collected in the Upper Sonoran zone across Northern Arizona have elytra covered with dark, golden-brown hairs with somewhat lighter golden-brown hairs scattered about the basal area of the elytra and on the pronotum. The type of *A. spurcus* LeConte from Santa Fe, New Mexico, is covered with light golden-yellow hairs. A series from Bakersfield, California, resembles the Arizona forms more than those from the higher elevations of the adjacent Sierra Nevada. A short series from Tooele County, Utah, is covered with golden-brown hairs but has a band of lighter golden hairs on the basal margin of the pronotum that makes it very similar in appearance to *A. elongatulus*.

Possibly the color differences between the forms could be described without resorting to subspecific names, except that there appears to be some kind of reproductive barrier between the Arizona forms and those from the Sierra Nevada. Five experiments were conducted to obtain crosses between specimens collected in Sequoia National Park and specimens collected near the eastern edge of the Grand Canyon in Arizona. All resulted in failure. Under identical conditions, as far as these could be regulated, specimens from the original cultures reproduced freely. Unfortunately, specimens from one culture for the most part did not mature at the same time as specimens from the other culture. As a consequence few members of the opposite sex were available from the different cultures for mating and the experiment could not be replicated as many times and under as many different conditions as would have been desirable.

Assuming that the experiments are conclusive in establishing a reproductive barrier between the two populations, two explanations are possible. It might be that an absolute barrier exists and that each population should be considered a distinct species. On the other hand there might be continuous crossbreeding between adjacent

populations and the extremes only might be intersterile. Of course, there is always the possibility that specimens available for crossbreeding happened to be defective in one way or another and were not representative of the populations. Obviously a great deal more study is needed to elucidate the relationships. However, until further evidence is available, it seems best to take a middle ground and designate two subspecies, one including the forms from the Sierra Nevada north to British Columbia and the other including the Arizona and New Mexico forms.

Tentatively the forms from Bakersfield are placed with the Arizona subspecies. Some specimens from Little Granite Mountain, Tooele County, Utah, taken February 3, 1955, as larvae and pupae (D. M. Allred), are not assigned to a subspecies. They seem quite distinct from either of the other two subspecies and probably deserve a separate name. Nevertheless, it would be inadvisable to name them without more extensive collections from the state of Utah.

Whether the nominate subspecies occurs in North America is a question that at present cannot be answered with certainty. Two specimens might be assigned to it, one collected in Atlanta, Georgia, in 1944 by P. W. Fattig and the other labeled simply "Ill." from the Stromberg collection of the Illinois Natural History Survey.

DIAGNOSIS: *A. schaefferi* is obviously more closely related to *A. elongatulus* than to any other Nearctic species. Adults can always be distinguished from *A. elongatulus* by the 10-segmented antenna, but otherwise some forms of the two species are almost impossible to separate. Usually, however, *A. schaefferi* lacks a band of light-colored setae along the base of the pronotum, a character always present in *A. elongatulus.* Larvae of comparable size of the two species can usually be distinguished by the wider tergal and sternal setae of *A. elongatulus*, but a character that will absolutely separate all larval specimens has not been found. The same differences that distinguish *A. elongatulus* from the somewhat similar *A. cyphonoides, A. megatoma,* and *A. fasciatus* serve to distinguish *A. schaefferi* from them. These differences are discussed under *A. elongatulus.*

ECOLOGY: The species is apparently a general scavenger on a variety of protein materials. Specimens from Little Granite Mountain, Tooele County, Utah, were taken in a *Neotoma* nest. I collected larvae in an unidentified rodent's nest in a feed storage shed at Sequoia National Park Headquarters, California. Linsley (1944) recorded it in the nests of the English sparrow and the house finch.

He also collected the species in a black phoebe's nest at Fresno, California, where I collected it a few years later. I collected larvae in insect-infested barley and on an old deer hide in a ranch granary 20 miles west of Cameron, Arizona.

To my knowledge the species has not previously been recorded as a pest of stored products. It was taken at Chloride, Arizona, by "L. L. G." in bran and barley, but may have been feeding in grain badly infested with other insects. It seems surprising that it has not been more commonly found as a pest of stored cereals, since I have been able to rear it quite successfully in the laboratory on a diet of oatmeal.

Attagenus schaefferi hypar, new subspecies

Attagenus schaefferi: Casey, 1900, p. 146.—Hatch, 1962, p. 284.

ADULT MALES: Integument dark brown. Dorsal pubescence brownish black; pubescence of abdomen chocolate brown. Ratio of length of terminal antennal segment to combined length of pronotum and elytra 1:4.8. Epipleuron slightly inflated at base becoming slightly concave for most of length.

RANGE OF OBSERVED VARIATIONS: Integument black to dark brown. Dorsal pubescence uniformly black to dark brown. Pubescence of abdomen black to chocolate brown, occasionally with few intermingled dark golden-brown hairs. Ratio of length of terminal antennal segment to combined length of pronotum and elytra varying from 1:4.7 to 1:5.7. Females like males except for much shorter length of antennal club.

PRIMARY TYPES: Holotype male: Fallen Leaf, El Dorado County, California, July 19, 1935 (F. E. Blaisdell); allotype female: Strawberry Valley, El Dorado County, California, August 6, 1912 (Van Dyke Collection). Specimens deposited in the collection of the California Academy of Sciences.

PARATYPES: *British Columbia*: Genoa Bay, Duncan, July 10, 1928 (W. Mathers); Mara Lake, July 20, 1932 (A. C. Thrupp); Midday Valley, Merritt, July 24, 1924 (K. F. Auden); Robson, August, 1949 (H. R. Foxlee); Salmon Arm, May 9, 1936 (D. H. Leech); Salmon Arm, July, 1932 (O. R. Leech); Salmon Arm, July, 1935 (D. H. Leech); Taft, August 2, 1932 (A. C. Thrupp); Trinity Valley, July 1, 10, 11, 12, 1928, July 10, 18, 21, 23, 1929, July 27, 1927, August 18, 1929, August 24, 1930 (J. R. L. Howell); Trinity Valley, July 27, 1927 (E. A. Rendell); Vernon, June 28, 1920 (Ralph Hopping). *California*: Calaveras County: Big Trees,

July 19, 1907 (F. E. Blaisdell). El Dorado County: Fallen Leaf, July 1, 3, 11, 28, 1935 (F. E. Blaisdell); Fallen Leaf, July 10, 1915 (R. Hopping); Kirkwood Lake, July 18, 1946 (A. T. McClay); McKinneys, July, 1906 (Van Dyke Collection); Strawberry Valley, August 5, 1912 (Van Dyke Collection); Tallac, July 7, 1925 (F. E. Blaisdell). Fresno County: Badger Flat, Huntington Lake, August 8, 1939 (A. T. McClay); Bubb's Creek, 8,000 ft. elev., July 29 (Wickham Collection); Bubb's Creek, Kings River, 9,700 ft. elev., July 7, 1910 (Van Dyke Collection); Camp Greeley, 2,800 ft. elev., May 22, 1910 (R. Hopping); Fresno, July 2, 1942; Home Creek, Huntington Lake, July 21, 1936 (A. T. McClay); Huntington Lake, 7,000 ft. elev., July 20, 1919 (F. E. Blaisdell); Huntington Lake, June 21, July 21, 1936, July 22, 1937 (A. T. McClay); Kaiser Pass, Huntington Lake, July 21, 1937 (A. T. McClay); Paradise Valley, Kings River, 7,000 ft. elev., July 17, 1910 (Van Dyke Collection). Inyo County: Independence, May 26, 1919, June 19, 1918 (L. L. Muchmore); Lone Pine, June 18, 1937 (C. A. Hamsher). Lassen County: Blue Lake, July 19–20, 1947 (T. F. Leigh); Butte Creek, July 26, 1948 (A. T. McClay); Facht, July 17, 1921, August 2, 1921 (J. O. Martin); Martin Springs, Sec. 14, T31N, R9E, July 23, 1922 (J. O. Martin); Susan River Camp, July 4, 9, 10, 1949 (A. T. McClay); Susan River Camp, July 10, 1949 (J. E. Gillaspy). Madera County: Biledo Meadow, July 27, 1946 (H. Chandler); Buck Camp, August 1, 3, 1958 (M. E. Irwin); Upper East Fork, Chiquito Creek, August 24, 1958 (M. E. Irwin). Mono County: Cottonwood Creek, July 11, 1961 (J. S. Buckett); Mono Lake, July, 1922 (Coriane Hilton); 7 miles east of Tioga Pass, July 15, 1961 (J. S. Buckett). Modoc County: Buck Creek, July 21, 1922 (C. L. Fox); Cedarville, July 9, 1946 (P. D. Hurd and Ray F. Smith); Warner Mountains, July 10, 11, 1919 (R. Hopping). Nevada County: 3 miles north of Boca, July 23, 1961 (F. D. Parker). Placer County: Brockway, July 2 (George Mansfield); Lake Tahoe, August 21. Plumas County: Meadow Valley, 4,500 to 5,000 ft. elev., June 13, 1924. San Bernardino County: Barton Flats, July 6, 1938 (E. Herald); Camp Baldy, June 14 to 21, 1926 (L. J. Muchmore). Shasta County: Dry Lake, June 24, 1947 (T. F. Leigh); Hat Creek, July 17, 1952 (G. Pronin); Mount Lassen National Park, July 27, 1945, July 28, 1941 (A. T. McClay). Sierra County: Gold Lake, July 8, 1934 (L. S. Ross); Yuba Pass, July 30, 1958 (A. A. Grigarick). Trinity County: Scott Mountain, 5,358 ft. elev., July 14, 1949 (A. T.

McClay). Tulare County: Dorset Creek, August 2, 1917 (R. Hopping); Kern River, 7,000 ft. elev., July 27, 1899; Kern River, 6,000 ft. elev., July 29, 1899; Rattlesnake Creek, July 26, 1917 (R. Hopping); Round Meadow, Giant Forest (Sequoia National Park), August 7, 1903 (R. Hopping); Sequoia National Park, 7,000 to 9,000 ft. elev., July 2, 1929 (A. T. McClay); Park Headquarters, Sequoia National Park, as larvae August 6, 1960 (R. S. Beal). Tuolumne County: Eleanor Lake, July 2, 1951 (S. M. Kappos); Pine Crest, July 3, 1951 (A. T. McClay); Strawberry, June 20, 1951 (S. M. Kappos); Strawberry, June 30, 1951 (R. W. Morgan). Yosemite National Park: Beehive, July 25, 1937 (E. Herald); Boot Trail, July 26, 1936 (A. T. McClay); Givens Creek, August 20, 1958 (M. E. Irwin); Miguel Meadows, 5,300 ft. elev., July 21, 1937 (E. Herald); Yosemite, 3,880 to 4,000 ft. elev., June 7, 1931 (E. O. Essig); Yosemite, 8,000 ft. elev., July 26, 1936 (A. T. McClay); Yosemite Valley, July 12, 1921 (E. C. Van Dyke). *Idaho*: Beaver Canyon (Hubbard and Schwartz). Coola, Priest Lake, July 24, 1927 (E. C. Van Dyke). Bonner County: Sagle, July 2, 1950 (N. M. Downie). Wardner, July 18, 1929 (R. A. Flock). *Nevada*: Gardnerville, 15 miles south, July 21, 1962 (E. J. Montgomery); Lake Tahoe, June 25, 1953 (G. F. Knowlton); Yerington, June, 1909. *Oregon*: Ashland Mountain Road, 4,500 to 5,000 ft. elev., August 10, 1953 (M. C. Lane); Crater Lake National Park, Sun Creek Meadows, 6,500 to 7,000 ft. elev., August 8, 1930 (H. A. Scullen); Crater Lake National Park near Headquarters, 6,400 to 6,600 ft. elev., August 4, 1930 (H. A. Scullen); The Dalles (Wickham Collection); Deming Creek, 11 miles north of Bly (Klamath County), August 12, 1956 (Joe Schuh); Elgin, June 20, 1922 (A. L. Lovett); Klamath Falls, February 18, 1956 (Joe Schuh); Lake of the Woods (Klamath County), July 10, 1934 (Van Dyke Collection); McMinnville, July 26, 1938 (K. M. and D. M. Fender); Medford, August 8, 1946 (A. T. McClay); Mount Ashland, July 18, 1951 (M. F. McClay). *Washington*: Easton (A. Koebele); North Fork Cipsus River (Skamania County), June 25, 1934 (J. L. Wilson); King County, July 14, 1928 (M. H. Hatch); Kooskooskie, Walla Walla, August 1, 1932 (M. C. Lane); Lewis and Clark State Park, June 12, 1938 (M. H. Hatch); Mount Adams, West Klickitat, July 8, 1925 (L. A. Morky); Quilcene, July 27, 1915; Seattle, April 5, 1929; same locality, May 3, 1931 (M. H. Hatch); Sullivan Lake, July 23, 1934 (G. H. and R. Hopping);

Tacoma, May 23, 1948 (N. Fuhr); Vaughn, May 17, 1940 (F. Bjorkmann); Whidby Island, July 30, 1898.

Attagenus schaefferi spurcus LeConte, new status

Attagenus spurcus LeConte, 1854, p. 109.
Attagenus schaefferi: Crotch, 1873, p. 41.
Attagenus piceus: Jayne, 1882, p. 355.
Attagenus cylindricornis: Casey, 1916, p. 183 (see section at end on species described but unrecognized).

ADULT MALES: Integument light brown to dark brown; when elytra light brown, pronotum usually darker. Dorsal pubescence piceous with light golden-brown hairs along lateral and basal margins of pronotum and scattered through basal area of elytra to uniformly light golden-yellow. Ratio of length of terminal antennal segment to combined length of pronotum and elytra varying from 1:4.8 to 1:5.3. Epipleuron flat at base becoming slightly concave along most of length.

TYPE LOCALITY: Santa Fe, New Mexico. Type No. 6868, Museum of Comparative Zoology, Cambridge, Massachusetts.

NEW RECORDS: *Arizona*: Coconino County: Basin Camp, 77 Bar Ranch, 20 miles west of Cameron, as larvae September 27, 1964 (R. S. Beal). Mohave County: Chloride, July 16, 1957 (L. L. G.). Navajo County: Linden, as larvae August 20, 1962 (R. S. Beal). *California*: Bakersfield, April 12, 1944 (E. G. Linsley); Bakersfield, as larvae April 13, 1963 (R. S. Beal).

Attagenus pellio (Linnaeus)

Dermestes pellio Linnaeus, 1758, p. 355.—Panzer, 1795, p. 96.
Dermestes bipunctatus DeGeer, 1774, p. 197.
Attagenus pellio: Latreille, 1807, p. 32.—Dahl, 1823, p. 30.—Stephens, 1830, p. 126.—Kirby, 1837, p. 114.—Laporte, 1840, p. 35.—LeConte, 1854, p. 109.—Wollaston, 1864, pp. 155–156.—Mulsant and Rey, 1867 (1868), pp. 68, 77–80.—Jayne, 1882, p. 355.—Reitter, 1889, p. 557.—Casey, 1900, p. 146.—Ganglbauer, 1904, p. 24.—Lutz, 1911, p. 152.—Wradatsch, 1914, p. 152.—Kempers, 1923, pp. 87–88.—Mutchler and Weiss, 1927, p. 10.—Lepesme and Paulian, 1939, p. 165.—Hinton, 1943, p. 227.—Korschefsky, 1944, p. 147.—Armstrong, 1945, p. 48.—Hinton, 1945, pp. 306–309; 1946, p. 485.—Kalík, 1948, Mroczkowski, 1954, p. 22.—Hatch, 1962, p. 284.—Zhantiev, 1963, p. 421.
Megatoma ater Herbst, 1792, p. 95.
Megatoma schrankii Kugelann, 1792, p. 480.

Megatoma pellio: Illiger, 1798, p. 316.—Brullé, 1832, p. 137.—Reitter, 1887, p. 47.

ADULTS: Adequately described by Hinton (1945).

MATURE LARVAE: Integument of head and dorsum brown. Setae of head dark golden-brown; setae of body consisting of intermingled dark golden-brown narrow hairs and light golden-brown broad hairs.

Head: Antenna with terminal seta subequal to or slightly longer than third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with two apical setae on penultimate segment. Labium with four to five setae on dorsal (inner) side of each lobe of ligula; medial two setae narrowly ensiform; lateral setae nearly terete; first segment of palp without setae.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergite of first abdominal segment consisting of linear and broadly lanceolate hairs; widest lanceolate hairs with three to six ribs between margins (Fig. 21); broad setae becoming increasingly wide on acrotergites of succeeding segments; broad setae on acrotergites of posterior segments with as many as twelve ribs between margins. Disc of tergite of first abdominal segment with intermingled linear-lanceolate setae with two or three ribs between margins and ovate to subquadrate setae with as many as six ribs between margins; setae of succeeding tergites similar except scale-like setae becoming more rectangular although retaining acutely produced apices; scale-like setae on eighth segment with six to 14 ribs between margins (Fig. 22). Sockets of submarginal erect setae with two sensory pits, one on either side near anterior margin. First abdominal sternum with setae along midline longer than other setae of disc. Setae of sternum of eighth abdominal segment identical with setae of tergite.

Spiracle and associated structures: Anterior abdominal segments with spiracle closed behind by tergum; anterior margin of spiracle projecting ventrad over posterior margin and bearing acute denticle (Fig. 25); spiracle adjacent to spiracular sclerite. Spiracular sclerite irregularly oval, not enclosed by tergum. Tergum sclerotized continuously with tergal margin of spiracular sclerite.

Abdomen: Eighth abdominal tergum with well-defined antecostal suture. Ninth abdominal tergum about one-half as long as

tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about 8/17 as wide as long; ventral margin about 4/11 as long as length of segment. Tibia of prothoracic leg with usual two rows of ventral setae; posterior face with subdorsal apical seta and longitudinal row of four seta along middle of segment; most proximal seta of row inserted at about basal third of segment. Setae inserted at base of pretarsus subequal in width and extending about as far as middle of claw.

RECORDED DISTRIBUTION: Widespread throughout Palearctic Region; in North America in Nova Scotia, New Hampshire, Massachusetts, Michigan, New Jersey, New York, Rhode Island, British Columbia.

NEW RECORD: Rockhaven, Kentucky (H. Soltau).

DIAGNOSIS: Adults are easily recognized by the two small patches of white or light golden-yellow hairs on the middle of the elytra near the suture. These contrast sharply with the dark brown to black hairs covering most of the dorsal surface. The male antennal club has the first two segments short and subequal. The terminal segment is four to five times as long as the combined length of the first two.

The larvae are dark golden-brown. They may be distinguished from all other species described here by the smoothly margined, more or less rectangular setae inserted on the posterior abdominal terga and sterna. On the eighth abdominal segment these scale-like setae have six to 14 ribs between the margins. Setae of the anterior segments are ovate to subquadrate. All other species with scale-like setae have ovate or ovate-lanceolate setae, and the setae have denticulate instead of smooth margins.

ECOLOGY: Larvae of this species, like larvae of most other species of the genus, appear to be general scavengers on dried protein materials. Out-of-doors they are commonly found in swallow nests, where they feed on feathers and the remains of other insects (Hinton, 1945). In England Woodroffe (1953) found them to be regular inhabitants of dry bird nests, particularly of pigeon nests and of jackdaw nests in hollow trees. Hicks (1959) has collected numerous additional references to the occurrence of the species in bird nests, which include, in addition to those above, nests of the house martin, swift, owl, English sparrow, titmouse, flycatcher, and white wagtail.

Hinton (1945) summarizes the reported occurrences of this

species as an economic pest, listing the following products on which it has been found, presumably feeding: furs, skins, woolens, carpets, grain, flour, maize, meal, cattle food, rye bran, and sugar. Whether it can mature feeding on cereal products alone has not been determined. Probably it maintains itself in cereal products, at least to some extent, on the remains of other insects. It also attacks dried insects in museums.

R. W. Howe (1962) states that the species shows diapause, but the factors that initiate it are unknown.

PARASITES: The larvae have been found parasitized by the gregarine, *Pyxinia mobuszi* Leger and Duboscq (Foerster, 1938, Eichler, 1939), a parasite also found in *Anthrenus verbasci* (Linnaeus).

Attagenus fasciatus (Thunberg)

Anthrenus fasciatus Thunberg, 1795, p. 105.
Anthrenus gloriosae Fabricius, 1798, p. 76.—Fabricius, 1801, p. 107.
Dermestes fasciatus: Schönherr, 1808, p. 88.
Attagenus fasciatus: Dejean, 1837, p. 139.—Mroczkowski, 1964, pp. 179–180.
Attagenus annulifer Laporte, 1840, p. 36.
Attagenus gloriosae: Lacordaire, 1854, p. 464.
Aethriostoma gloriosae: Motschulsky, 1858, p. 146.
Trogoderma subfasciatum Chevrolat, 1863, p. 617.
Attagenus plebeius Sharp, 1885, p .47.
Attagenus gossypiatus Fauvel, 1903, p. 335.
Attagenus gloriosae: Arrow, 1915, p. 427.—Hinton, 1943, p. 224; 1945, pp. 320–322.—Armstrong, 1945, p. 48.—Hinton, 1946, p. 19.—Kalík, 1955, pp. 307–308.

ADULTS: Adequately described by Hinton (1945) under the name *A. gloriosae*.

MATURE LARVAE: Dorsal integument reddish-brown. Setae on dorsal and ventral surfaces dark golden-brown except for light golden-brown setae on legs.

Head: Antenna with terminal seta one and one-eighth times as long as terminal segment; second segment bearing 12 or more setae. (Epipharynx not observed.) Maxillary palp with two setae on third segment. Labium with series of two medial lanceolate setae and three or four slender ensiform lateral setae on dorsal (inner) side of each lobe of ligula; first segment of palp without seta.

Body setae: Margins and ribs uniformly smooth. Acrotergites with some linear setae with one rib between margins and some simple

setae. Tergites with linear setae with two to five ribs present between margins. Sockets of submarginal erect setae usually with two adjacent sensory pits, one on each side. Sterna with linear setae; setae of disc with two ribs between margins; setae smaller and without ribs on anterior area of each sternum; anterior margin without row of stouter, longer setae; setae at midline of first two abdominal sterna not appreciably longer than other sternal setae.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin of spiracle slightly curved; width of spiracle less than one-third width of spiracular sclerite; spiracle removed from spiracular sclerite by distance equal to about two-thirds its width. Spiracular sclerite oval, bearing six or fewer setae, not enclosed by tergum; area of tergum in front of spiracular sclerite well sclerotized and continuous with tergal margin overlying anterior margin of spiracular sclerite.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about five-ninths as long as tergite of eighth segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg half as wide as long; ventral margin little less than half as long as length of segment. Tibia of prothoracic leg as illustrated (Fig. 27). Pretarsus with setae narrowly ensiform, subequal in width and length.

DISTRIBUTION: The species occurs nearly throughout the tropical and subtropical areas of the world. In the continental United States it is apparently established only in Florida, although it has been taken infesting stored products in Buffalo, New York, and Indianapolis, Indiana. Records for the species in Florida are the following: Deland, April 21, 1960 (G. W. Desin); Miami, March 3 and April 14, 1960 (E. M. Collins); Orlando, May 27, 1935, July 10, 1935, December 1, 1936; Tampa, May 20, 1960 (E. M. Collins, Jr.).

DIAGNOSIS: Adults are immediately distinguished from all other Nearctic species by the distinct subbasal elytral band of light golden hairs. The remainder of the elytra is covered with brownish black hairs, which contrast sharply with the color of the elytral band. Usually the band is fairly broad and extends from the lateral margin of each elytron to the median suture. At the median suture it is narrower and projects a little basad. Rarely the band is discontinuous, but when it is there is always a distinct spot of light-colored hairs on the median suture posterior to the scutellum. Any other species

of *Attagenus* or *Novelsis* in the United States that has a distinct subbasal elytral band also has a light-colored line along the entire basal three-fourths of the median suture, or has more than one elytral band, or the subbasal band does not extend to the median suture and there is no distinct spot of light-colored hairs on the suture just posterior to the scutellum. A number of other differences seem to make this species unique among the Nearctic Attagenini, one of which is the short terminal segment of the male antennal club. Males of the species cannot be distinguished from the females unless the genitalia are exposed. It is also relatively broader than other Nearctic species, has stouter front coxae, and stouter femora. Because of these traits it was placed in the genus *Aethriostoma* by Motschulsky. Nevertheless, larval characters show it to be much more closely allied to *Attagenus* and to the cluster of species designated Group I.

The larvae are quite similar to larvae of *A. megatoma.* The one distinctive character that separates them from larvae of *A. megatoma*, as well as from larvae of all other Nearctic species, is the number of setae on the second segment of the antenna. Twelve or more are present on this segment in mature specimens. Mature larvae of *A. megatoma* lack setae on the second segment, and no other species I have studied has more than three setae on the segment.

ECOLOGY AND LIFE HISTORY: Hinton (1945) has collected and published information on these aspects of the species. If there is additional published information, I am unaware of it. In addition to those products which it has been recorded as infesting, it was found in dried buttermilk in Buffalo, New York (L. F. Hoyt) and in crude drugs in Indianapolis, Indiana (J. J. Favinger). The species also has been intercepted at Tampa, Florida, in *Caesalpinia coriaria* imported from Columbia.

Attagenus bicolor Harold

Attagenus dichrous LeConte, 1854 (*non dichrous* Roth, 1851), p. 110.
Attagenus bicolor Harold, 1868, p. 104.—Reitter, 1880 (1881), p. 34.
Attagenus piceus: Jayne, 1882, p. 355.
Attagenus schaefferi: Dalla Torre, 1911, p. 57.
Attagenus sparsus Casey, 1916, p. 184 (New synonymy).

ADULT MALES: Integument of dorsal and ventral surfaces immaculate; head dark brown to black; pronotum reddish brown to dark brown; elytra reddish brown; venter reddish brown to dark brown; legs and antennae yellowish to reddish brown; terminal seg-

ment of club not darker than preceding segments of club. Pubescence of head and dorsal surfaces subrecumbent to suberect; pubescence of ventral surfaces subrecumbent; all hairs black or hairs black on dorsum and reddish brown on venter and legs. Head with eye entire. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:3.6 to 1:5.2; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:6.7 to 1:8.8; club clothed with very fine subrecumbent hairs less than one-fourth as long as width of third antennal segment; hairs slightly longer at apex of terminal segment. Channel below eye for reception of flagellar shaft of antenna concave with anterior margin forming carina visible from front of head (Fig. 1); carina projecting knife-like beneath head, curved very little behind base of maxilla and not meeting gular suture. Pronotum with lateral carina continued around anterolateral angle; basal lobe feebly rounded to slightly truncate and not distinctly produced backward; setae on posterior margin of lobe subequal in length to other setae of pronotum. Punctures of pronotal disc varying in width from two-thirds as wide to equal to width of facet of eye and separated by two to five diameters of single puncture. Elytron with hairs of disc about as long as combined length of antennal segments three through seven. Hypomeron nearly flat at middle, sometimes slightly concave toward base; without auricle-like lobe covering trochantin so that trochantin fully exposed (Fig. 7). Prosternum with posterior margin of lateral lobe flat and not reflected against middle of coxa but reflected against lateral part of coxa and against trochantin; reflected part short, about one-third as long as length of horizontal part of lateral edge of lobe; anterior margin of prosternum with distinct thread-like lateral carina but without denticle at middle of anterior margin; posterior process scarcely wider at apex than between coxa and without median carina extending onto disc. Epipleuron terminating at or little before hind margin of metepimeron. Ventral plate of hind coxa not forming distinct tooth lateral to insertion of trochanter but becoming gradually narrower laterally; plate terminating laterally behind metepisternum at inner margin of metepimeron (appearing to meet metepimeron behind metepisternum) (Fig. 6). Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and on same plane. Length (of pronotum and elytra combined): 3.8 mm. to 4.4 mm.

ADULT FEMALES: Antennal club with terminal segment one and one-fifth to one and one-fourth times as long as length of ninth and tenth segments combined; tenth segment equal in length to ninth segment. Length (of pronotum and elytra combined): 4.9 mm. to 5.3 mm. (based on reared specimens alone).

MATURE LARVAE: Dorsal integument brown. Setae of head golden-brown; setae of body black except for few dark golden-brown hairs on nota intermingled with black hairs; setae of ventral thoracic segments and legs golden-brown; setae of ventral abdominal segments black; terminal abdominal setae dark brown and black.

Head: Antenna with terminal seta subequal in length to third segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each subequal in diameter to sensory pits of middle series. Maxillary palp with three setae on penultimate segment. Labium with four to six setae on dorsal (inner) side of each lobe of ligula; medial two setae narrowly ensiform; lateral setae nearly terete; first segment of palp with two setae.

Body setae: Very minutely serrulate along ribs (serrulations visible only under high power of compound microscope). Setae inserted on acrotergites all more or less terete and linear, with as many as six ribs distinguishable between margins (ribs visible only in specimens treated to remove pigments from setae and then difficult to demonstrate except under oil immersion lens). Disc of tergite with setae similar to those on acrotergite but with as many as eight ribs distinguishable between margins of larger setae. Three submarginal erect setae on each side of each abdominal segment; sockets usually with one adjacent sensory pit on either medial or lateral side but rarely with two adjacent sensory pits, one on each side. First abdominal sternum with few setae somewhat longer than other setae of disc. Eighth abdominal sternum with setae nearly identical to setae of tergum; setae becoming smaller anteriad without row of longer, stouter setae near anterior margin of segment.

Spiracle and associated structures: Abdominal segments with spiracle enclosed by tergum; anterior abdominal segments with distance from posterior margin of tergite to spiracle about one-fifth length of tergite; anterior margin of spiracle more or less straight; posterior margin somewhat thickened; spiracle separated from spiracular sclerite by distance about equal to width of trachea entering spiracle (Fig. 14). Spiracular sclerite oval, completely enclosed by tergum; three setae inserted on sclerite of each segment.

Abdomen: Eighth abdominal segment without antecostal suture

on tergum. Ninth abdominal tergum about five-sevenths as long as eighth abdominal tergum. Two small sclerites present within sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about half as wide as long; ventral margin about half as long as length of segment. Setae inserted at base of pretarsus subequal in width and extending to about apical third of claw.

TYPE LOCALITIES: The type locality for *A. dichrous* is New Mexico (type specimen No. 6870 in the Museum of Comparative Zoology, Cambridge, Massachusetts). The type locality for *A. sparsus* is Jemez Springs, New Mexico (holotype in the Casey Collection, United States National Museum).

NEW RECORDS: *Arizona*: North Rim of the Grand Canyon, 8,150 ft. elev., as larvae August 30, 1964 (R. S. Beal). *Colorado*: Colorado Springs, 6–7,000 ft. elev., June 15–30, 1896 (H. F. Wickham); Rico, May 22, 1950 (Hopkins U. S. No. 34216-W). *New Mexico*: Fort Wingate (J. D. Sherman); Jemez Mountains, June 11, 22, 27, July 3 (John Woodgate); Santa Fe (Boyle). *Nevada*: Baker, Sec. 15, T13N, R69E. Mt. Diablo Meridian, May 23, 1939 (T. O. Thatcher). *Utah*: Callao, June 2, 1922 (specimen in the Casey Collection at the United States National Museum standing under the name *elongatulus*); Circleville, June 27, 1933 (G. F. Knowlton); South Creek, Beaver County, June 22. *Wyoming*: Cokeville, April 20, 1952 (William May).

Dead larvae and adults have also been found in matted vegetation and fill in the Mesa Verde Ruins in southwestern Colorado. Although the adults were badly fragmented, enough remained for positive identification. The larvae that were found were surprisingly well-preserved, with most of the setae intact. They had apparently died in ecdysis, a phenomenon often associated with starvation. All were recovered in Site No. 1285 (S. A. Graham).

DIAGNOSIS: *A. bicolor* and the allied *N. athlophora* are readily distinguished from all other Nearctic Attagenini by a number of characters. The most noticeable distinguishing feature is the long, sparse, completely black pubescence of each. Almost all other members of the tribe have light golden-brown or whitish ventral pubescence, and many have light-colored dorsal hairs. *A. schaefferi hypar* has predominately chocolate-colored or blackish ventral setae, but it does have at least a few golden-brown hairs on the front coxae, the setae are moderately dense and short, the dorsal setae are subrecumbent, and the ventral setae are recumbent. *A. bicolor* and

N. athlophora also share the following combination of characters not found in other species treated here: the hind coxa lacks a definite tooth lateral to the insertion of the trochanter and is wider at the base of the trochanter than at any point lateral to it; the epipleuron terminates at about the hind margin of the metepimeron; the hypomeron is more or less flat or very slightly concave; the lateral lobe of the prosternum is somewhat longitudinally concave and reflected ventrad in front of the trochantin but lies mostly in a horizontal plane and is not reflected in front of the middle of the procoxa.

Both males and females of *A. bicolor* are separable from *N. athlophora* by the number of segments in the antenna: *A. bicolor* has 11 and *N. athlophora* 10 segments. The male antennal club of *A. bicolor* is that of a typical *Attagenus*. The terminal segment is about five times as long as the two preceding segments combined. The male antennal club of *N. athlophora* has all segments elongated so that the terminal segment is no more than four-fifths as long as the two preceding combined. The dorsal integument of *A. bicolor* is a medium reddish brown with the pronotum and head often a dark brown. The known specimens of *N. athlophora* are a very dark brown, except that one has a light brown sutural line.

The larvae of *A. bicolor* are relatively sparsely clothed with linear black hairs. They are easily distinguished from other larval Attagenini by the nearly completely enclosed spiracular sclerite and the remarkable position of the spiracle, which is some distance from the posterior margin of the tergum. Only *N. varicolor* has a similarly enclosed sclerite with the spiracle so remotely separated from the posterior margin of the tergum. However, *N. varicolor* is densely covered with ovate setae, which obscure the structures so that they cannot be seen without first teasing the setae away. Possibly *N. athlophora* will prove to have similar larval structures, but at present the immature stages of this species are unknown.

ECOLOGY: I collected numerous larvae of this species in an insect-infested mixture of grain and straw in an unidentified rodent's nest (probably chipmunk) in a small granary at the North Rim of the Grand Canyon of Arizona. Adults breed in the laboratory without the necessity of flying or of feeding on nectar or pollen. Larvae mature to adults on dried dog food or on oatmeal, as well as on grain trash. Adults emerged in the laboratory in summer, fall, and winter months and have been collected in the field in April, May, and June, suggesting that emergence is not controlled by

photoperiodicity. Further study might reveal some interesting differences in the physiological responses of this and other members of the tribe.

Novelsis athlophora Beal

Novelsis athlophora Beal, 1954, pp. 81, 89.

ADULTS: Male described by Beal (1954).

MATURE LARVAE: Unknown.

TYPE: Type locality: Beaver Canyon, Idaho. Holotype in the collection of the United States National Museum. No other localities recorded in description.

NEW RECORDS: *British Columbia*: Aspen Grove, June 17, 1931 (H. Richmond); Midday Valley, Merritt, June 4, 1924 (K. F. Auden). *Idaho*: Rocky Point, Benewah County. *Washington*: Dayton, July (L. Turner).

DIAGNOSIS: This is a dark brown species sparsely clothed with long, suberect, black hairs. There are no golden-brown or other light-colored hairs on the dorsal or ventral surfaces. Both male and female antennae are 10-segmented, a character that distinguishes the species from all other Nearctic species with uniformly dark dorsal pubescence, except *A. schaefferi*. The shape of the antennal club of the male, in which the length of the first two segments combined exceeds the length of the terminal segment by at least a fourth, separates the species from *A. schaefferi*, as also does the long, sparse setae of the body.

Attagenus lobatus Rosenhauer

Attagenus lobatus Rosenhauer, 1856, p. 108.—Jacquelin du Val, 1859, p. 254.—Mulsant and Rey, 1868, pp. 100–101.—Hinton, 1945, pp. 323–324.—Zhantiev, 1963b, p. 415.

Attagenus byturoides Solsky, 1876, pp. 272–273.—Reitter, 1889, p. 557.—Solodovnikova, 1938, pp. 1–20.

Attagenus sericeus Reitter, 1880 (1881) (*non sericeus* Guérin, 1829), p. 79.—Reitter, 1887, p. 51.

ADULTS: Adequately described by Hinton (1945). Adult head shown in Figure 2; dorsal outline in Figure 8.

MATURE LARVAE: Dorsal integument light brownish yellow. Setae uniformly light golden-brown.

Head: Antenna with terminal seta about twice as long as length of terminal segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each slightly larger in diameter than diameter of sensory pits of middle series.

Maxillary palp with two setae on penultimate segment. Labium with about four ensiform and four slender setae on dorsal (inner) side of each lobe of ligula; palp without seta on first segment.

Body setae: Margins and ribs uniformly smooth. Setae inserted on acrotergites about half as long as length of tergum or longer and gradually becoming extremely fine (almost beyond point of resolution except with oil-immersion lens); proximal part of shaft with very fine ribs (also difficult to observe except with high magnification). Setae on tergites consisting of linear marginal and submarginal hairs and of lanceolate hairs with five to seven ribs between margins; only lanceolate setae present on disc of tergite. Submarginal setae suberect, inserted nearly at same level as marginal setae. Sockets of submarginal, suberect setae usually with two adjacent sensory pits. Sterna with lanceolate setae only on disc; lanceolate setae with seven to eight ribs between margins; anterior margin of each sternum with row of stout linear setae one to two times as long as lanceolate setae; numerous fine, long, linear, simple setae inserted anterior to row of stout setae.

Spiracle and associated structures: Spiracle closed behind by tergum; anterior margin of spiracle more or less straight; spiracle adjacent to spiracular sclerite. Spiracular sclerite elongate-oval, bearing eight to 10 or more setae, closed behind by narrow margin of tergum, but often not appearing so, since spiracular sclerite may overlap margin; area of tergum in front of spiracular sclerite well-sclerotized and continuous with tergal margin overlying anterior edge of sclerite (Fig. 15).

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about half as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about three-sevenths as wide as long; ventral margin about two-thirds as long as length of segment. Tibia and pretarsus as illustrated (Fig. 28); setae at base of pretarsus slender, subequal in width and length.

DISTRIBUTION: The Palearctic distribution extends from Spain to Mongolia including Bulgaria and Uzbek, U.S.S.R., on the north and Tunisia, Egypt, Arabia, and Afghanistan on the south (Mroczkowski, 1968). It is apparently established in the cities of Detroit, Michigan (February 2, 1960; J. G. Hunter) and New York, New York (May 15, 1964; Jack Lipes).

DIAGNOSIS: Adults of *A. lobatus* are uniformly clothed with

golden-brown pubescence. The pubescence is quite short except for noticeably longer tufts of hairs on the margin of the basal lobe and each lateroposterior angle of the pronotum. The integument of the elytra is reddish brown. The integument of the pronotum is similarly colored, or at most only a little darker. The most distinctive character of the adults and one that immediately distinguishes it from all other Nearctic species is the elongated and truncated basal lobe of the pronotum (Fig. 8). The species is also unique among Nearctic forms in possessing a carina along the dorsal margin of the front tibia. The antenna is 11-segmented. The form of the antennal club is somewhat similar to that of *N. uteana*, with the terminal segment subequal in length to the combined length of the first two segments.

Superficially the adults resemble some females of *N. uteana* more than any other Nearctic species. However, the dorsal pubescence of *N. uteana* is definitely lighter in color, the pronotal integument is brownish black and contrasts sharply with the reddish yellow elytral integument, the dorsal hairs are much longer, particularly along the margins of the pronotum and elytra where many hairs are as long as the width of the eyes, the front tibia lacks a dorsal carina, and the antenna is 10-segmented.

Mature and semi-mature larvae are easily distinguished from all other known larval forms by the fact that there are no linear or linear-lanceolate setae intermingled with the broad lanceolate setae of the sterna. *A. elongatulus, A. schaefferi,* and *A. pellio* have similarly broad sternal setae, but each has linear setae inserted among the lanceolate setae, at least on the sides of each sternum. *N. varicolor* and *N. aequalis* both have lanceolate setae with as many ribs as are found in the setae of *A. lobatus*, but the margins of the setae and the ribs are strongly serrulate or denticulate and do not at all resemble the smoothly margined setae of *A. lobatus.* A further distinguishing character is the presence of a row of moderately stout linear setae inserted on each sternum in front of the lanceolate setae. The linear setae are longer than the lanceolate setae. Anterior to these a number of fine simple setae is inserted on each sternum. No other Nearctic species has a row of stout linear setae near the anterior margin of each sternum. In other species the sternal setae become gradually smaller toward the anterior end of the segment. The larvae of *A. lobatus* are also unique in that the spiracular sclerite bears eight to ten or more setae instead of six or fewer.

ECOLOGY: Zhantiev (1963a) found this species in nests of

desert owls (*Athene noctua bactriana* Hutt.), Old World jumping rats or gerbils (Gerbillinae), long-clawed ground squirrels (*Spermophilopsis leptodactylus* Licht.), and various predatory mammals such as foxes and badgers in sandy and clayey desert regions of Turkmenia and Tadzhikistan in the U.S.S.R. He observed there is a tendency for this species to select nests of desert owls found at the base of cliffs, while other species of Dermestidae more commonly occupy nests constructed in crevices higher on the cliffs and still different species occupy nests in sandy holes.

Hinton (1945) summarizes reported occurrences of this species as an economic pest, listing the following products on which it feeds or in which it has been found: skins, furs, feathers, woolen goods, museum specimens, grain and refuse in granaries, and red pepper. In the United States the species has been found in buildings. Larvae were reported by J. G. Hunter to bite the skin of humans and the bites were followed by a slight itching.

Novelsis perplexa (Jayne)

Attagenus perplexus Jayne, 1882, p. 35.
Novelsis perplexa: Casey, 1900, p. 194.—Beal, 1954, p. 77.—Hatch, 1962, p. 284.

ADULTS: Redescribed by Beal (1954). Other stages remain unknown.

RECORDED DISTRIBUTION: The type locality is Nevada. Other records include scattered localities from Southern California north to British Columbia.

ADDITIONAL RECORDS: *British Columbia*: Vernon, August 2, 1929 (R. Hopping). *California*: Fresno County: Tollhouse, June 30, 1961 (C. D. Johnson). Madera County: North Fork, July 19, 1963 (C. D. Johnson). Nevada County: 3 miles north of Boca, September 4, 1960 (F. D. Parker). Plumas County: Meadow Valley, July 22, 1961 (T. Gantenbein). Riverside County: San Jacinto Mountain Trail, July 1, 1952 (J. F. Powers). San Diego County: Mount Palomar, June 21, 1959 (M. E. Irwin). Tulare County: Kern River, 6,000 ft. elev., July 29, 1899 (probably L. L. Muchmore). Yolo County: Winters, August, 1961 (J. L. Campbell). *Idaho*: Krassel Ranger Station, Martin Creek, July 26, 1956 (S. Stevens). *Oregon*: Klamath County: Bly, July 20, 1956 (M. Wasbauer); Swan Lake, August 8, 1953 (Joe Schuh).

TAXONOMIC POSITION: Judging by similarities of adult characters, this species is closely related to *N. varicolor* and *N. aequalis*. The allopatric pattern of distribution of the three species further

suggests their relatively recent divergence from a common origin. Whether a mechanism for reproductive isolation exists between the forms is a question that remains unanswered.

DIAGNOSIS: The following characters are common to adults of *N. perplexa, N. varicolor,* and *N. aequalis.* The dorsal pubescence consists of black, golden-brown, and white hairs. The light-colored hairs form a thin basal band or basal patches, a semicircular subbasal band, an irregular and often interrupted submedian band, and an irregular subapical band or patch. The hairs are subrecumbent on the disc but suberect on the lateral margins. The hairs are also much longer than for most other Attagenini, the longest being longer than the scutellum, giving the specimens a somewhat shaggy appearance. The segments of the male antennal club are densely clothed with very fine, erect pubescence with the individual hairs about two-thirds as long as the width of the third segment of the antenna.

N. perplexa may be distinguished from *N. varicolor* and *N. aequalis* by the following characters. The antenna is 10-segmented. The first two segments of the male antennal club combined are about one-sixth longer than the terminal segment. The other two species have an 11-segmented club and the first two segments of the male club combined are about one-third longer than the terminal segment. The elytral integument of *N. perplexa* is entirely black or black with reddish maculae corresponding in pattern to the areas of light pubescence. *N. aequalis* may rarely have the elytral integument entirely black, but ordinarily it has a suffused reddish macula near the middle of the elytra. *N. varicolor* has yellowish brown maculae that may correspond to areas of light-colored pubescence or that may coalesce to varying degrees. Occasionally each elytron may have one large yellowish macula that extends over the entire elytron except for the black margins.

ECOLOGY: Virtually nothing is known of the ecology of the species. Adults have been collected at light and on flowers of yarrow (*Achillea*) and milkweed (*Asclepias*). An adult has also been collected on Douglas-fir (*Pseudotsuga Menziesii* (Mirb.) Franco).

Novelsis varicolor (Jayne)

Attagenus varicolor Jayne, 1882, p. 357.
Novelsis varicolor: Casey, 1900, p. 149.—Beal, 1954, pp. 78–80.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Dorsal integument brown. Setae of head and dorsal surfaces brownish black; setae of ventral surfaces chocolate brown.

Head: Antenna with terminal seta five-ninths as long as length of terminal segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each with diameter about half diameter of sensory pits of middle series. Maxillary palp with nine to 14 setae inserted on third segment. Labium with six setae on dorsal (inner) side of each lobe of ligula; medial two setae narrowly ensiform with lateral setae becoming nearly terete; first segment of palp without seta.

Body setae: Margins and ribs serrulate to denticulate. Acrotergites of anterior abdominal segments with lanceolate and ovate-lanceolate setae with three to six ribs between margins (Fig. 17). Disc of tergites with setae regularly or irregularly ovate with acute to obtuse apices and with as many as 11 to 13 ribs between margins (Fig. 19). Sockets of submarginal erect setae with two adjacent sensory pits, one on each side. Setae of sterna lanceolate and ovate-lanceolate with elongated apices. First abdominal sternum with setae at midline not appreciably longer than other setae of disc. Eighth abdominal sternum with broadest setae having six to eight ribs between margins; setae becoming slightly smaller toward anterior margin of sternum without row of longer linear setae.

Spiracle and associated structures: Spiracle enclosed by tergum; anterior margin more or less straight and usually projecting over posterior margin; distance between spiracle and spiracular sclerite roughly equal to width of trachea (Fig. 13). Spiracular sclerite nearly round, enclosed by tergum; tergum on lateroposterior side of sclerite reduced to narrow margin.

Abdomen: Eighth abdominal tergum without antecostal suture. Ninth abdominal tergum about two-sevenths as long as eighth abdominal tergum. Two small sclerites present in sternum of ninth abdominal segment.

Legs: (Ratio of length to width of femur not observed); tibia of prothoracic leg with usual two rows of stout ventral setae; posterior face with stout subdorsal apical seta and submedian group of irregularly arranged four or five stout setae and several slender setae. Pretarsus with posterior seta inserted at base about twice as wide as anterior seta.

DISTRIBUTION: Previously described (Beal, 1954) as extending from El Centro, California, to Presidio, Texas; on the south from

Carr Canyon in the Huachucha Mountains, Arizona, north to Hoover Dam and to Globe, Arizona. New records outside this range are the following: *Arizona*: Sedona, Coconino County, June 20, 1964 (R. S. Beal). *California*: Indian Wells, Riverside County, April 19, 1961 (G. H. Nelson); Mitchell's Cavern, San Bernardino County, April 16, 1962 (G. H. Nelson). *Sonora, Mexico*: Masiaca Huatabampo, May 28, 1955 (F. Pacheco M.).

DIAGNOSIS: The following characters distinguish adults of *N. varicolor* from those of *N. perplexa* and *N. aequalis*. The integument of the elytra is black or piceous and marked with yellowish tan or yellowish brown maculae. The maculae rarely correspond in extent to the subbasal, submedian, and subapical areas of light pubescence, but commonly the subbasal and submedian maculae coalesce to form one spot. At times there is a single large macula that occupies the entire elytron except for a narrow margin of black. The pubescence is always tricolorous, although the light-colored hairs are predominately white and the golden-yellow hairs may be limited to a few near the margins of the bands of light-colored pubescence. The species may be distinguished definitely from *N. perplexa* by its 11-segmented rather than 10-segmented antenna.

Characters that adults of this species have in common with *N. perplexa* and *N. aequalis* and that distinguish them as a group from other groups within the tribe are discussed under the diagnosis of *N. perplexa*.

Larval characters shared by this species and *N. aequalis* are listed under Relationships, Group IV. Characters distinguishing larvae of *N. varicolor* and *N. aequalis* are discussed under the diagnosis of the latter.

ECOLOGY: Larvae have been found in *Sceliphron* mud dauber nests (Beal, 1951), in pigeon droppings, in hens' nests, in nests of English sparrows, in a cactus wren's nest, and in the nest of an unidentified spider in a chicken house. I collected the species in Tucson, Arizona, in moderate numbers from sacks of feed in a granary. The feed was infested with a number of other insects, and it was probably feeding on their dead remains rather than on the grain. It was also collected by Gus A. Amado in a seed and feed mill in Nogales, Arizona. I have reared the species through several generations on dried dog food. Adults have been collected on mesquite [*Prosopis juliflora* (Swartz) DC.] and on catclaw (*Acacia greggii* A. Gray).

At room temperatures the species matures in a year. Out-of-doors adults appear from May through July. In the laboratory adults

may emerge as early as February and March but not after June. This pattern suggests that emergence is governed by photoperiodicity but may be accelerated by warm temperatures.

Novelsis aequalis (Sharp)

Genattus aequalis Sharp, 1902, p. 646.
Attagenus aequalis: Hinton, 1945, p. 306.
Novelsis aequalis: Beal, 1954, p. 80.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Dorsal integument brown. Setae of all surfaces black except for some golden hairs on legs.

Head: Antenna with terminal seta subequal in length to length of terminal segment; one or no seta present on second segment. Epipharynx with distal series of two sensory pits, each with diameter about half diameter of sensory pits of middle series. Maxillary palp with two setae inserted on third segment. Labium with six setae on dorsal (inner) side of each lobe of ligula; medial four or five setae narrowly ensiform; lateral one or two setae terete; first segment of labial palp without seta.

Body setae: Margins and ribs serrulate to denticulate. Acrotergites of anterior abdominal segments with linear and ovate-lanceolate setae; largest setae with 10 to 11 ribs between margins. Tergites with linear and irregularly rounding to ovate setae on disc; rounding and ovate setae terminating in single acute apex or two acute apices with as many as 15 to 16 ribs between margins of widest setae (Fig. 23); setae on posterior margins broadly linear with acute apices and eight to 10 ribs present between margins on dorsal side and 16 to 22 ribs present between margins on ventral side. Sockets of submarginal erect setae with two adjacent sensory pits, one on either side. Sterna with linear and linear-lanceolate setae; linear-lanceolate setae with as many as nine ribs present between margins; setae becoming smaller toward anterior margin of each sternum; setae on midline of first abdominal sternum longer than other setae of disc.

Spiracle and associated structures: Spiracle closed behind by tergum, removed from spiracular sclerite by distance equal to about half width of spiracle; opening simple, somewhat oval. Spiracular sclerite rhomboidal to ovate, encircled by rim-like extension of sclerotized part of tergum; area of tergum immediately anterior to front margin of rim unsclerotized; entire structure appearing to project peninsula-like from posterolateral margin of tergum (Fig. 24).

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about one-third as long as tergite of eighth abdominal segment.

Legs: Femur of prothoracic leg about 10/17 as wide as long; ventral margin about 8/17 as long as length of segment. Posterior face of front tibia with stout subdorsal apical seta and subventral row of four stout setae a little above ventral two rows of stout setae; most proximal stout seta at about basal two-fifths. Pretarsus with posterior seta about twice as wide as anterior seta.

RECORDED DISTRIBUTION: Lee and Kerr counties in Texas south to Veracruz, Mexico. The type locality is Mexico without being further specified.

NEW RECORDS: *Maryland*: Baltimore, July 10, 1940 (H. Howden); College Park, as larvae October 11, 1963 (J. H. Fales). *Pennsylvania*: One specimen with locality not further specified (Horn Collection). *Texas*: Burnett County, June 4, 1953 (D. J. and J. N. Knull); Randall County, July 7, 1950 (D. J. and J. N. Knull).

DIAGNOSIS: Both adult and larval characters associate the species with *N. varicolor* and *N. perplexa.* Characters grouping these three species are discussed under Relationships. Adults may be separated from *N. perplexa* by the 11-segmented rather than 10-segmented antenna. Adults are sometimes difficult to separate from *N. varicolor*, although usually *N. aequalis* lacks a clearly defined light maculate spot on the elytron, having only a suffused reddish spot at about the basal third, in contrast to the more or less sharply defined, yellowish tan maculae of *N. varicolor.* Occasional specimens of *N. aequalis* have a completely black or brown elytral integument. Some specimens of *N. varicolor* have a yellowish brown macula that occupies most of the elytron, making them appear quite similar to *N. aequalis.* However, the elytra of these specimens have definitely dark margins and a sutural line. Adults may also be distinguished by the differences in the form of the prosternum described in the key, but the prosternum is often difficult to observe without relaxing the specimen and moving the antennae and legs out of the way.

In contrast to the adults, the larvae of the two species are marked by a number of obvious differences. The maxillary palp of *N. aequalis* has but two setae on the third segment in contrast to the nine or more of *N. varicolor.* The spiracular sclerite of *N. aequalis* appears detached from the tergum, since the tergum is unsclerotized in front of the rim surrounding the spiracular sclerite. Conversely,

the spiracular sclerite of *N. varicolor* appears to be completely imbedded within the lateroposterior corner of the tergum. The setae of the acrotergites of *N. aequalis* consist of both broad, ovate-lanceolate hairs and very long and narrow, almost simple hairs. The setae of the acrotergites of *N. varicolor* are all linear-lanceolate to ovate-lanceolate, with three or more ribs present between the margins. An interesting although perhaps not invariable difference between the species is found in the shape of some of the dorsal setae of *N. aequalis*. The ovate hairs of this species, instead of tapering to a single acute point, frequently terminate in two acute apices (Fig. 23).

ECOLOGY: Almost nothing is known of the ecology of this species. Specimens have been intercepted at the Brownsville, Texas, port of entry on tomatoes and on orchid flowers, but these are no doubt accidental associations. A single specimen was found at Brownsville in milled wheat flour from Mexico. The species has apparently become established in Maryland, where it is probably able to survive in heated buildings.

Attagenus rufipennis LeConte

Attagenus rufipennis LeConte, 1859, p. 71.—Casey, 1900, p. 147.
Attagenus nigripes Casey, 1916 (*non nigripes* Fabricius, 1792), p. 184 (New synonymy).
Attagenus atrolucens Casey, 1916, p. 183 (New synonymy).

ADULT MALES: Integument of head and pronotum brownish black to black; elytra reddish, reddish brown, or black and if reddish or reddish brown usually but not invariably with blackish base and diffused blackish sutural line; ventral surfaces dark reddish brown to black; legs and flagellar shaft of antennae usually somewhat lighter than ventral surfaces; antennal club brownish black to black. Pubescence of head and dorsal surfaces subrecumbent, entirely black, or black with oblique subbasal band of silver or golden-yellow hairs, or black with silver or golden-yellow hairs scattered among black hairs on lateral margins of pronotum and on posterior four-fifths of elytra. Eye emarginate over base of antenna. Antenna 11-segmented; ratio of combined length of first two segments of club to length of terminal segment varying from 1:3.7 to 1:4.8; ratio of length of terminal segment to length of pronotum and elytra combined varying from 1:6.5 to 1:7.9. Channel below eye for reception of flagellar shaft of antenna deeply concave with anterior margin forming carina; margin of carina visible from front

of head; carina projecting knife-like beneath head and curved behind base of maxilla to meet gular suture. Pronotum with lateral margin continued around anterolateral angle; basal lobe gradually rounding or truncate but not produced abruptly posteriad. Punctures of disc about three times diameter of facet of eye and separated by one to one-half times diameter of single puncture; punctures toward sides becoming larger and contiguous. Setae on basal lobe and latero-posterior angles of pronotum subequal in length to setae of disc. Elytron with hairs of disc about as long as combined length of third and fourth segments of antenna. Hypomeron a little inflated or flat on anterior half, occasionally slightly concave on posterior half. Posternum with posterior margin of lateral lobe slightly reflected against lateral half of procoxa; reflected part less than one-third as long as length of horizontal part of lobe and forming angle of 45° or less with horizontal part; prosternal process slightly wider at apex than between coxae; thread-like carina present on process but not extending onto disc of prosternum; thread-like transverse carina separating anterior declivity of prosternum from disc; no denticle present at middle of anterior margin of disc. Epipleuron terminating gradually behind middle of first sternum. Ventral plate of hind coxa forming distinct tooth lateral to insertion of trochanter; plate terminating at posteromedial angle of metepisternum and not meeting metepimeron behind metepisternum. Protibia not carinate on dorsal margin. Mesofemur with anteroventral and posteroventral margins of crural cavity about equally produced and on same plane. Length (of pronotum and elytra combined): 3.0 mm. to 4.1 mm.

ADULT FEMALES: Antennal club with terminal segment subequal to one and two-fifths as long as combined length of two preceding segments; tenth segment equal in length to ninth segment. Length (of pronotum and elytra combined): 3.5 mm. to 4.9 mm.

MATURE LARVAE: Dorsal integument brown. Setae of head golden-brown; setae of nota and terga black; setae of venter of thorax and legs golden-brown; setae of abdominal sterna black to brownish black.

Head: Antenna with terminal seta subequal in length to length of terminal segment; no setae present on second segment. Epipharynx with distal series of two sensory pits, each with diameter about half diameter of sensory pit of middle series. Maxillary palp with two setae on penultimate segment. Labium with four to five narrowly ensiform setae on dorsal (inner) side of each lobe of ligula; setae becoming narrower laterad; first segment of labial palp without seta.

Body setae: Margins and ribs denticulate (Fig. 18). Acrotergite of first abdominal segment with linear and linear-lanceolate setae; widest setae with three ribs between margins. Disc of tergite with intermingled linear and lanceolate setae; widest lanceolate setae usually with four but sometimes five ribs between margins. Sockets of three medial submarginal erect setae with two adjacent sensory pits, one one either side; socket of most lateral erect seta often with one, occasionally two, adjacent sensory pits. First abdominal sternum without longer setae along midline. Sternum of eighth abdominal segment with setae all linear; widest with three, occasionally four, ribs between margins; setae becoming smaller on anterior area of sternum without row of stouter, longer setae near anterior margin.

Spiracle and associated structures: Anterior abdominal segments with spiracle not closed behind by tergum; anterior margin of spiracle rounding; spiracle adjacent to spiracular sclerite (Fig. 12). Spiracular sclerite oval, not enclosed by tergum; four setae ordinarily inserted on sclerite. Tergum forming sclerotized ridge overlying anterior margin of sclerite but tergum not sclerotized in front of ridge, so that sclerite and ridge appear to project peninsula-like beyond lateral margin of tergum.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about two-sevenths as long as tergite of eighth abdominal segment. Two small sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about half as wide as long; ventral margin about three-eights as long as length of segment. Tibia with spines arranged as illustrated (Fig. 26). Base of pretarsus with lateral seta twice as wide as medial seta; medial seta extending to about middle of claw.

TYPE LOCALITY: Fort Tejon, California (Lebec, Kern County). The type locality for *A. nigripes* is Milpitas, Santa Clara County, California. The type locality for *A. atrolucens* is Indiana. The type specimen of *A. atrolucens* was from the Levette Collection, which contained many erroneously labeled specimens. I can find no differences between the type specimen of *A. atrolucens* and many individual specimens from California. Since the species has not subsequently been collected in the Midwest, it must be concluded that the locality is in error.

NEW RECORDS: *Arizona*: Cochise County: Cave Creek, Chiricahua Mts., as larva January 5, 1963 (Vincent Roth). Coconino County: Basin Camp, Bar 77 Ranch, 20 miles west of Cameron,

as larvae September 27, 1964 (R. S. Beal); Williams (Barber and Schwarz). Gila County: Globe, April 2, 8, 10, 23, 1933, April 7, 1948 (F. H. Parker); base of Pinal Mt. (D. K. Duncan). Maricopa County: Canyon Lake, upriver, March 31, 1959 (Ivan Jennings); Wickenburg, March 5, 1958 (G. G. Gose). Navajo County: Linden, as larvae August 27, 1957 and August 20, 1962 (R. S. Beal). Yavapai County: Cottonwood, as larvae March 30, 1963 (R. S. Beal). *California*: Alameda County: Hills back of Oakland, April 12, 1908 (Van Dyke Collection). Butte County: Oroville, March 7, 1928 (H. H. Keifer). Calaveras County: Murphys, 2,500 ft. elev., May 14, 1937 (F. E. Blaisdell). Colusa County: Arbuckle, March 30, 1962, April 2, 6, 9, 1962 (P. M. Marsh). Contra Costa County: Berkeley, January 27, 1947 (A. J. Walz); Berkeley, February 27, 1932 (R. P. Allen); Danville, March 23, 1952 (F. X. Williams); Orinda, March 15, 1955 (R. H. Goodwin); Walnut Creek, April 13, 1932 (F. E. Blaisdell); Vine Hill, November 25, 1910 (F. E. Blaisdell). El Dorado County: Fallen Leaf, 6,500 ft. elev., July 3, 1935 (F. E. Blaisdell); Placerville, February 23, 1916 (E. T. Armstrong); Pyramid Ranger Station, July 12, 1948 (P. D. Hurd). Fresno County: Fresno, March 9, 1936 (H. C. Donohoe); Huckleberry Meadow, 6,500 ft. elev., May 10, 1910 (Hopping). Humboldt County: Greenpoint, June 14, 1916 (F. E. Blaisdell). Inyo County: Argus Mountains, April, 1891 (A. Koebele); Independence, April 30 and May 8, 11, 1918 (L. L. Muchmore); Gray's Camp, Independence, May 3, 1919 (L. L. Muchmore); Lone Pine, May 23, 1930 (R. Hopping); Westgard Pass, June 18, 1955 (M. E. Irwin). Lake County: Anderson Springs, May 27, 1951 (W. R. Bauer); Kelseyville, May 15, 1922 (E. P. Van Duzee). Los Angeles County: Crystal Lake, June 29, 1950 (A. T. McClay); Lancaster, April 7, 1927 (L. L. Muchmore); Los Angeles (Coquillett); Mount Wilson, April 30, 1916 (J. O. Martin collection); Pasadena (A. Fenyes); Tujunga, May 20, 1944 (L. R. Gillogly); Whittier, March 26, 1916, and March 26, 1919 (L. L. Muchmore). Marin County: Mill Valley, March 25, 1957, April 5, 1959, April 6, 1954, May 4, 1959, May 13, 1956, May 28, 1951, June 5, 1949 (H. B. Leech); Novato, September 22, 1959 (T. R. Haig). Mariposa County: Yosemite National Park (probably Yosemite Valley), May 16, 20, 1934 (O. Bryant); same locality, May 22, 1908 (E. T. Cresson, Jr.); same locality, May 31, 1952 (R. Schuster); same locality, June 7, 9, 1930 (F. E. Blaisdell). Mendocino County: locality not further specified, October 20, 1918 (E. R. Leach). Modoc County:

Warner Mountains, July 10, 1919 (R. Hopping collection). Monterey County: Carmel, November 8, 1911 (L. S. Slevin collection); Paraiso Springs, April 24, 1914 (L. S. Slevin collection). Nevada County: Truckee, June 17, 1927 (E. P. Van Duzee). Plumas County: Chester, June 25, 1951 (D. J. and J. N. Knull); Meadow Valley, 4–5,000 ft. elev., June 4, 1924 (E. C. Van Dyke); Onion Valley, July 6, 1952 (E. I. Schlinger); Sunnyside near Seneca, June 1, 1923 (V. S. Barber). Riverside County: Banning, April 6, 1933 (R. Hopping); 4 miles west of Forest Home, as larva September 16, 1951 (Ray Ryckman); Hemet, March 30, 1937 (L. D. Christenson); 7 miles north of Idyllwild, San Jacinto Mountains, 5,500 ft. elev., May 8, 1954 (G. H. Nelson); Keen Camp, June 6–12, 1917 (E. P. Van Duzee). Sacramento County: Folsom, May 7, 1941 (A. T. McClay). San Benito County: Pinnacles National Monument, April 24, 1948 (W. W. Middlekauff); Pinnacles National Monument, April 28, 1914 (L. S. Slevin). San Bernardino County: Camp Baldy (Mt. Baldy), June 26, 1950 (M. J. Stebbins); 20 miles northeast of Redlands, 9,000 ft. elev., June 26, 1954 (G. H. Nelson); Victorville, May 2, 1953 (G. A. Marsh and R. O. Schuster). San Diego County: San Diego, February (F. E. Blaisdell); Poway (F. E. Blaisdell). San Francisco County: San Francisco, April 24, 1959 (MacNeill). San Luis Obispo County: Paso Robles, as larvae August 2, 1960 (R. S. Beal). Santa Barbara County: San Marcos Pass northwest of Santa Barbara, as larvae August 1, 1960 (R. S. Beal). Santa Clara County: Pacheco Pass, April 14, 1949, and as larvae August 2, 1960 (R. S. Beal); San José, April 29, 1928 (L. S. Slevin). Santa Cruz County: Santa Cruz Mountains (Koebele collection). Sonoma County: Petaluma, April 2, 1961 (G. M. Trenam); Santa Rosa (Lois B. Stiles). Stanislaus County; Newman, March 9, 1955 (C. G. Moore). Tehama County: Red Bluff, May 1, 1922 (V. S. Brown). Tulare County: Kaweah (R. Hopping); Lodgepole Camp, Sequoia National Park, June 24, 1945 (A. T. McClay); Marble Fork Bridge, Sequoia National Park, June 11, 1929 (Van Dyke); Wolverton, Sequoia National Park, June 25, 1929 (Van Dyke). Ventura County: Ozena Station (Cuyama River at State Route 33), as larvae April 13, 1963 (R. S. Beal). Yolo County: Davis, March 15, 1950 (A. T. McClay); same locality, April 22, 1947 (Brad Stevens); Davis, May 2, 1949 (E. I. Schlinger); Davis, June 7, 1949 (R. C. Bechtel); Putah Canyon, March 26, 1960 (M. E. Irwin); Rumsey, March 31, 1962 (C. G. Moore); Winters, March 30, 1962 (P. M. Marsh). Yuba County:

10 miles south of Marysville, April 19, 1956 (W. W. Middlekauff). *New Mexico*: Hidalgo County: Granite Pass, April 6, 1965 (F. D. Parker). *Oregon*: Jackson County: Green Spring Pass, June 15, 1938 (M. H. Hatch); Griffin Creek, June 6, 1957 (C. Fitch); Medford, as larvae January 12, 1947 (A. T. McClay); Medford, February 9, 1946 (A. T. McClay); Medford, March 1, 1936 (Lawrence); Medford, May 2, 1941, May 2, 1945, May 6, 1945 (C. Fitch); Medford, as larvae October 1, 1946 (A. T. McClay); Talent, March 15, 1932, May 13, 1932 (L. G. Gentner). Josephine County: Grants Pass, April 12, 1934 (Frank M. Beer). Wasco County: Bear Springs (nine miles west of Pine Grove), July 20, 1940 (K. M. and D. M. Fender); Bear Springs Ranger Station, September 6, 1952 (P. W. Orr); Maupin, June 6, 1937 (K. M. Fender). Yamhill County: Dayton, April 24, 1945 (K. M. Fender). *Utah*: Washington County: May 21, 1951 (G. F. Knowlton). *Washington*: Kittitas County: Vantage, May 13, 1956 (H. M. Hatch). *Baja California*: Tecate, March 12, 1957 (Burciaga and Valdez).

A specimen collected at San Antonio, Texas, by H. Soltau is deposited at the United States National Museum. This locality appears to be outside the natural range of the species. The species was probably introduced into the area by commerce, and there is at present no evidence that it has become established there.

DIAGNOSIS: In size and shape and often in dorsal coloration adults of this species resemble *A. megatoma.* Males further resemble *A. megatoma* in the general form of the antennal club, in which the terminal segment is much longer than the first two segments combined. However, the fact that the hind coxa and the metepimeron do not join behind the metepisternum distinguishes this species from *A. megatoma* and all other members of Group I. Adults are separated from species of other groups by the form of the male antennal club and by one or several of the following characters: the antenna is 11-segmented; a small auricle-like lobe is present on the hypomeron behind the base of the procoxa; there is no knife-like carina along the dorsal margin of the anterior tibia; although there may or may not be a subbasal elytral band of light pubescence, there are no distinct submedian or subapical spots, lines, or bands of light pubescence on the elytra.

Differences between the larvae of this species and those of somewhat similar species are listed under Relationships, Group V.

INFRASPECIFIC FORMS: This is a highly polytypic species that

cannot conveniently be divided into a few manageable subspecies. A consistent treatment would require that either the subspecies be ignored or that a considerable number of subspecies be designated. If only the color of the elytra were to be considered, the species could easily be separated into the black northwestern form that Casey (1900) named *A. nigripes*, the nominate southern California form with red elytra, and an Arizona and New Mexico form with mahogany elytra. However, there is no reason why the presence or absence of a subbasal elytral fascia of light-colored hairs and the presence or absence of light-colored hairs on the pronotum should not be given equal weight in determining subspecific limits, since these characters are also geographically ordered. The difficulty is that they are not geographically concordant with the distribution of color variations in the elytra. Black specimens from Merced County, California, and northward generally lack light-colored hairs on the pronotum and elytra. Southward through central and coastal California the black forms commonly have a short subbasal elytral fascia of silvery hairs. However, around San Diego, California, black forms are again found without light-colored hairs. Forms with red elytra occur in the California desert areas, but are also found on the east side of the coastal ranges as far north as San Benito County and along the coast from Los Angeles south to San Diego. One red specimen has been taken at Berkeley, California, and two red specimens in Wasco County, Oregon. Ordinarily the red California specimens have at least a few silvery hairs forming a subbasal elytral fascia. Intermediates between the red and the black forms are not uncommon. A long series from Ozena Station on the north side of the San Rafael Mountains in Ventura County includes numerous intermediates between the red and the black forms as well as specimens with and without elytral fasciae. So also does a shorter series from Lancaster in Los Angeles County. No collections of the species have been made between Victorville, California, and Wickenburg, Arizona. Nevertheless, the species is probably continuous; the single specimen from Wickenburg is identical to many Mojave Desert specimens. A moderate number of specimens has been taken in the neighborhood of Globe, Arizona, and at Linden in Navajo County, Arizona. These all have mahogany elytra with a broad subbasal elytral fascia of golden-yellow hairs. Another long series collected a relatively short distance north near the eastern end of the Grand Canyon but separated from the southern Navajo County population by an intervening stretch of desert has mahogany elytra but no elytral fasciae.

In view of this somewhat confusing picture, it seems inadvisable to name any of the infraspecific forms until much more extensive collections have been made and until the population dynamics are better understood.

ECOLOGY: Larvae have been taken in nests of the wood rat (*Neotoma*), in webs of the spider *Physocyclus tanneri* Chamberlin, and in insect-infested grain trash in a granary. Linsley (1944, 1946) has recorded it in nests of the English sparrow, house finch, black phoebe, barn swallow, and cliff swallow. It is evidently a general scavenger on dried protein materials, as are most other members of the genus. H. B. Leech found adults emerging from stems of dead *Ceanothus thrysiflorus* Eschscholtz, but in all probability they were feeding on the dead remains of other insects in burrows in the stems. The species has been found on one occasion infesting an insect collection. Specimens from Talent, Oregon, are labeled by L. G. Gentner as "breeding in casein."

Probably adults ordinarily fly to flowers, where they feed on nectar and pollen. They have been collected on apple blossoms, lupine, *Ceanothus cordulatus* Kellogg and *Ceanothus divaricatus* Nuttall. Flying to flowers does not appear to be necessary for reproduction for Arizona forms of the species, since I have been able to carry them through several generations without it. On the other hand, although I have been able to rear larvae of the black forms to maturity in the laboratory, the adults have never produced a second generation in the laboratory. It may be that in contrast to the Arizona forms they need to feed on nectar or pollen before being able to mate.

Novelsis uteana Casey

Novelsis uteana Casey, 1900, p. 148.—Beal, 1954, pp. 82–84.
Novelsis byturoides Casey, 1900, p. 148.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Integument of head brownish black; integument of nota and terga light reddish brown with prominent blackish brown macula on side of each notum and smaller, somewhat diffused, blackish brown macula on side of each tergum. Setae of head dark brown; setae of dorsal surfaces white except for dark brown setae on spiracular sclerites, dark brown setae on margins of eighth and ninth terga, and dark brown terminal setae; setae of ventral surfaces black; setae of legs light golden-brown; stout setae of legs brownish black.

Head: Antenna with terminal seta about one-fourth longer than length of terminal segment; second segment without setae. Epipharynx with usual proximal series of about 16 sensory pits and middle series of six sensory pits but without usual distal sensory pits. Maxillary palp with two setae inserted on third segment. Labium with two ensiform setae only on dorsal (inner) surface of each lobe of ligula; palp with or without two setae on first segment.

Body setae: Long, fine setae of acrotergites smooth; setae of dorsal surfaces denticulate on margins and ribs; setae of ventral surfaces mostly smooth but some setae with extremely finely serrulate margins (visible only under high magnification). Acrotergites with setae of two types: (1) row of ensiform setae with denticulate margins and two or three ribs between margins and inserted close to antecostal suture, (2) number of simple setae nearly as long as half length of tergite and gradually becoming extremely fine (almost beyond resolution except with oil-immersion lens) and inserted anterior to ensiform setae. Tergites with linear to lanceolate setae with one to five ribs between margins but most commonly with four ribs between margins; lateral areas of nota and anterior tergites also with few long simple setae. Sockets of submarginal erect setae with one lateral adjacent sensory pit except that submarginal seta nearest spiracle may have two adjacent sensory pits. Sterna with linear setae only; these with two to three ribs between margins except for slender setae on anterior area of sternum; anterior area of sterna without row of longer, stouter, linear setae; first abdominal sternum with somewhat longer setae at midline.

Spiracle and associated structures: Spiracle close to margin of tergum but closed by tergum and adjacent to spiracular sclerite; anterior margin more or less straight. Spiracular sclerite somewhat rhomboidal, not enclosed by tergum. Tergum forming sclerotized margin along anterior edge of sclerite but area anterior to margin not sclerotized; sclerite appearing to project laterad and somewhat posteriad of tergum.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about two-sevenths as long as tergite of eighth abdominal segment. No sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about 9/16 as wide as long; ventral margin about one-half as long as dorsal margin. Tibia with five stout setae in subdorsal row on posterior face. Setae at base of pretarsus ensiform, subequal in length; seta on posterior side a third wider than seta on anterior side.

DISTRIBUTION: Ranging from Independence, Inyo County, California, south throughout Mojave and Borego deserts to northern Baja California, eastward into Clark County, Nevada, Washington County, Utah, all desert areas of Arizona south of the Mogollon Rim, Hidalgo County, New Mexico, and southeast along the Rio Grande River to Brewster County, Texas. The species probably extends well into Mexico, but I have seen no collections of it from Mexico outside Baja California.

DIAGNOSIS: Males of this species have a distinctive color pattern on the elytra. Contrasting with the dark brown hairs of the elytron are white hairs which form a basal patch or short band, a diagonal band extending from the humeral angle to the median suture at about the basal two-fifths, and a number of lines extending from the diagonal band nearly to the apex of the elytron. Some females, particularly those from Pima and Santa Cruz counties in Arizona, resemble the males, but females from other Arizona areas, California, Nevada, and Utah are covered dorsally with white pubescence alone. No other Nearctic Attagenini are likely to be confused with it, except perhaps *A. lobatus*, which is uniformly covered with light golden-brown pubescence. However, *A. lobatus* has an 11-segmented antenna, while *N. uteana* has a 10-segmented antenna. Other distinguishing features of *A. lobatus* are discussed under the diagnosis of that species.

The color of the setae of the larvae distinguishes them at once from known larvae of all other Nearctic species. Those on the head are dark brown, on the dorsum predominantly grayish white, on the ventral surfaces black, and on the legs light golden-brown. The larvae are likewise unique in that the hairs of the acrotergites consist of a row of ensiform setae near the antecostal margin and of numerous, extremely long and fine, simple setae. The former have denticulate margins with two or three ribs between the margins. The simple setae are tapering, the ends becoming exceedingly fine, visible only under the high powers of a compound microscope.

DISCUSSION: Casey treated the light-colored females and the forms marked with light and dark hairs as separate species. In my previous revision of *Novelsis* (1954) I synonymized the forms on the basis of the geographic distribution of museum specimens. Subsequently I have been able to obtain live adults from near Peoria, Arizona. These bred readily in the laboratory, and from them I have been able to rear several generations of the species. Observations on the breeding of the forms confirmed my supposition that

the forms are no more than sexually dimorphic variants of one species.

ECOLOGY: The habitats of the larvae have not yet been discovered. The larvae have been reared to maturity in the laboratory on dried insects, but an effort to rear the species on dried dog food, which is suitable for most dermestids, was a failure. Adults mate and oviposit in the laboratory without the necessity of food or water. Adults are ordinarily collected out-of-doors on flowers and have been taken on mesquite [*Prosopis juliflora* (Swartz) DC.], catclaw (*Acacia greggii* A. Gray), ironwood (*Olneya tesota* A. Gray), French tamarix (*Tamarix gallica* L.), sandpaper-plant (*Petalonyx thurber* A. Gray), heliotrope (*Heliotropum curassavicum* L.), and willow. The species was collected once on a farm near Casa Grande, Arizona, in the course of inspections for the khapra beetle. However, the situation in which it was found was not recorded.

Novelsis horni (Jayne)

Attagenus horni Jayne, 1882, p. 356.—Sharp, 1902, p. 645.
Attagenus byturodes Jayne, 1882, p. 356.
Novelsis horni: Casey, 1900, p. 148.—Rees, 1943, p. 15.—Beal, 1954, pp. 85–86.

ADULTS: Redescribed by Beal (1954).

MATURE LARVAE: Integument of head and dorsal surfaces yellowish brown. Setae of head dark golden-brown, sometimes with black hairs around occiput; setae of dorsal and ventral surfaces of body black; setae of legs golden-brown.

Head: Antenna with terminal seta about one and one-half times as long as length of terminal segment; second antennal segment without setae. Epipharynx with proximal series of about 24 sensory pits and middle series of six sensory pits but without usual distal sensory pits. Maxillary palp with two setae inserted on third segment. Labium with three ensiform setae on dorsal (inner) surface of each lobe of ligula; medial seta wide with lateral setae progressively narrower; palp without seta on first segment.

Body setae: Margins of setae on disc of pronotum smooth; margins of setae of mesonotum, metanotum, and terga minutely serrulate (serrulations visible only under high power of compound microscope); anterior setae on each tergum with coarser serrulations than posterior setae; setae of sterna smooth or extremely minutely serrulate. Acrotergites with small, linear setae with one rib between margins and larger, linear-lanceolate setae with one, two, or rarely

three ribs between margins. Tergites with most setae spindle-shaped but some linear; widest setae usually with two, sometimes three ribs distinctly visible between margins. Sockets of submarginal erect setae with one sensory pit near lateral margin. Sterna with linear setae only; widest setae usually with no more than two ribs distinctly visible between margins but three ribs occasionally visible. First abdominal sternum with setae along midline somewhat longer than other setae of disc. Setae of each sternum becoming smaller toward anterior margin without anterior row of longer, stouter setae.

Spiracle and associated structures: Spiracle opening on margin of tergum, not closed by tergum, and adjacent to spiracular sclerite; anterior margin curved. Spiracular sclerite subrectangular, weakly sclerotized, bearing six or fewer setae, not enclosed by tergum. Tergum forming sclerotized margin along anterior edge of sclerite but area of tergum anterior to margin not sclerotized. Sclerite appearing to project laterad and somewhat posteriad of tergum.

Abdomen: Eighth abdominal tergum with antecostal suture. Ninth abdominal tergum about half as long as tergite of eighth abdominal segment. No sclerites present in sternum of ninth abdominal segment.

Legs: Femur of prothoracic leg about half as wide as long; ventral margin about 5/12 as long as length of segment. Tibia with six or seven stout setae on posterior face below dorsal margin; setae arranged more or less in two rows. Setae inserted at base of pretarsus subequal in length, not extending beyond basal fourth of claw; posterior seta ensiform, about twice as wide as anterior seta.

DISTRIBUTION: The species is recorded from southern California, southern Arizona, New Mexico, southwestern Texas, Wills Point, Louisiana, Mexico City and Tabasco, Mexico. New records extending the periphery of the known distribution are the following. *Arizona*: Cottonwood, Yavapai County, as larva March 30, 1963 (R. S. Beal); Flagstaff, Coconino County, as larva January 11, 1963 (R. S. Beal). *New Mexico*: Tucumcari, Quay County, May 23, 1957 (R. M. Eads). *Texas*: Clear Fork, Brazos River, Jones County, September 29, 1957 (R. S. Beal). MEXICO: Basuchil, 6–7,000 ft. elev. (Mrs. Y. Mexia).

DIAGNOSIS: Adults of this species and *N. andersoni* are readily distinguished from all others in the tribe by the cross-shaped, light yellowish brown marking on the blackish elytra. The longitudinal part of the cross is formed by a narrow line that extends along the suture from the base nearly to the apex. A somewhat broader transverse band intersects this line at the basal third. In *N. horni*

the transverse band is somewhat expanded laterally, often into a short, posteriorly directed spur near the lateral margin. In no case does the spur extend posteriorly beyond the middle of the elytron. In *N. andersoni* the transverse band is also expanded laterally, but there is always a light colored line extending from the humerus along the margin of the elytron to the apical third or beyond. Females of *N. horni* may also be distinguished from those of *N. andersoni* by the 11-segmented antenna. Females of *N. andersoni* have a 10-segmented antenna. Males of both species have an 11-segmented antenna.

Larvae of *N. horni* and *N. andersoni* are apparently indistinguishable from each other. They may be separated from larvae of other Attagenini by the following combination of characters. The color of the setae of the head is dark golden-brown, of the dorsal and ventral surfaces black, and of the legs golden-brown. The setae of the acrotergites are linear and linear-lanceolate, those of the tergites mostly spindle-shaped with two or three ribs visible between the margins. The spiracular sclerite, which is difficult to observe because of the dense, black setae, appears to be separated from the tergite, but is actually inserted within a narrow ring of the tergite that extends peninsula-like from its lateroposterior angle. The two setae inserted on the pretarsus of each leg are unequal, one being twice as wide as the other.

ECOLOGY: The species occurs in a wide variety of habitats and is obviously a general scavenger on dried protein materials. It has been collected in *Sceliphron* mud dauber nests in Arizona (Beal, 1951) and in Texas. I found it in Flagstaff, Arizona, on a dead bat in an attic and in large numbers in Cottonwood, Arizona, in nests of the spider *Physocyclus tanneri* Chamberlin. It was reared from larvae found by John LeCave in an English sparrow nest in Tucson, Arizona. H. G. Hubbard recorded in his dairy (deposited at the United States National Museum) on April 15, 1897, that he took the species at Tucson "in bunch of curled leaves of cottonwood with aphis."

The adults reproduce readily in the laboratory without the necessity of drinking or of flying. However, the adults probably regularly fly out-of-doors to flowers. The species has been taken at Nogales, Arizona, on blossoms of mesquite (*Prosopis juliflora*).

The species can be considered a negligible pest of stored products. K. S. Rohwer collected it in a feed and seed store in Willcox, Arizona. R. M. Eads found it on cotton seed in a warehouse at Tucumcari, New Mexico. Occasional specimens are found in homes.

I reared it through a number of generations on dried dog food and through at least one complete generation on oatmeal.

Novelsis andersoni Beal

Novelsis andersoni Beal, 1954, pp. 86–88.

ADULTS AND LARVAE: Adults were described by Beal (1954). No characters have been found by which the larvae differ from larvae of *N. horni*.

RECORDED DISTRIBUTION: The type locality is forty miles west of Mexicali, Baja California. It has also been recorded twenty miles west of Mexicali and twenty miles south of Palacio, Baja California, at Fort Yuma, Imperial County, California, and at Phoenix, Arizona.

NEW RECORDS: *Arizona*: Maricopa County: Fort McDowell, May 12, 1962 (R. S. Beal); Gillespie Dam, as larva November 13, 1958 (R. S. Beal); Komatke, April 9, 1960 (R. S. Beal); Maricopa, adults, pupa, and larva November 8, 1956 (R. S. Beal); Tempe, April 16, 1959 (E. O. Johnson); same locality, April 24, 1962 (R. K. Weaver). Yuma County: Parker, January 22, 1958 (G. H. Spitler); Roll, April 18, 1958 (N. Berry and E. F. Pittman); Yuma, April 13, 1955 (Butler and Tuttle); same data (Butler and Werner); same locality, April 6, 20, 1959 (D. Muse). *California*: Indio (Fall).

DIAGNOSIS: Adults of this species are strikingly similar to those of *N. horni* and were confused with them by earlier authors. Specimens of this species stand in both the LeConte and the Fall collections at the Museum of Comparative Zoology under the name *horni*. Nevertheless, the species are readily distinguished by differences in the pattern of elytral maculation. In *N. horni* there is a subbasal band at the basal third that is expanded laterally, sometimes forming a short lateral line along the margin of the elytron in the basal fourth. Occasionally there is a lateral spur extending a short distance posteriad. In no instance does the spur extend beyond the middle of the elytron. On the other hand, *N. andersoni* has a lateral line on the elytron that extends to the apical third or fourth. The line may be broad or very narrow and interrupted so far as the colors of the integument are involved, but it is always plainly indicated by the pattern of white hairs. The two species are also distinguished by the number of segments in the antennae of the females. *N. horni* females have 11 segments; *N. andersoni* 10 segments.

The diagnosis of the larval stages is given under the diagnosis of *N. horni.*

ECOLOGY: Larvae of this species have been found in a number of different situations, suggesting that it is a general scavenger on dried protein materials, like most other members of the tribe. It was taken at Maricopa, Arizona, in a *Sceliphron* mud dauber nest and at Gillespie Dam, Arizona, in a swallow nest. At Roll, Arizona, a specimen was found on a dead mouse. A specimen deposited at the United States National Museum reportedly came from a Tempe, Arizona, flour mill. The writer has reason to believe that the specimen did not come from the mill itself but from a neighboring warehouse filled with grain sacks heavily infested with *Ephestia* and other insects, where it was likely feeding on their dead remains.

Adults have been swept from mesquite (*Prosopis juliflora*), creosotebush [*Larrea tridentata* (DC.) Coville], and willow.

Novelsis timia Beal

Novelsis timia Beal, 1954, pp. 82, 88.

ADULT FEMALES: Described by Beal (1945). Males were unknown at the time of the description of the species. The following is a description of a male from Highway 74 above Palm Desert, Riverside County, California.

ADULT MALES: Integument of head dark brown; integument of pronotum light brown with lateral carina and narrow posterior border dark brown; elytra light brown; ventral surfaces brown with abdomen dark brown; legs and antenna yellowish tan. Pubescence of head and dorsum subrecumbent, piceous and golden-white; pubescence of ventral surfaces recumbent, white. Eye emarginate over base of antenna. Antenna 11-segmented, in repose extending behind anterior margin of metasternal episternum; flagellar shaft (segments 3–8) little shorter than first segment of club (segment 9); ratios of lengths of first, second, and third segments of club 11:13:21; ratio of length of terminal segment to length of pronotum and elytra combined 1:7.3. Channel below eye for reception of flagellar shaft of antenna shallowly concave; anterior margin of channel forming low carina not visibly projecting from side of head when seen from front (similar to Fig. 2); carina not curved behind base of maxilla but projecting diagonally behind base of maxilla parallel to margin of eye (relation of carina to gular suture not apparent since suture not distinct). Pattern of pubescence of pronotum and elytra as described for female. Pronotum with lateral

carina continued thread-like around anterolateral angle; basal lobe feebly rounding or truncate and not produced abruptly posteriad; disc with intermingled craterform punctures about diameter of facet of eye and simple punctures about half diameter of facet of eye; punctures separated by less than half diameter of larger punctures; punctures toward side becoming slightly larger but not quite contiguous; setae on basal lobe and lateroposterior angles about twice length of setae of disc. Elytron with hairs of disc about one and one-half times as long as third segment of antenna. Hypomeron slightly inflated. Posternum with posterior margin of lateral lobe scarcely reflected against procoxa; prosternal process slightly expanded at apex, not extending posteriad as far as apex of procoxa in repose; disc of prosternum without longitudinal carina, without distinct lateral carina before anterior margin, and without median anterior denticle. Epipleuron terminating gradually behind first abdominal sternum. Ventral plate of hind coxa not forming tooth lateral to insertion of trochanter; plate extending behind metepisternum but not quite attaining metepimeron. Protibia not carinate on dorsal margin. Mesofemur with crural cavity in nearly horizontal plane; anteroventral carina extending from apex to about basal third; posteroventral carina indistinct. Metatibia with stout spines and setae along shaft not longer than apical spines. Length (of pronotum and elytra combined): 2.5 mm.

RECORDED DISTRIBUTION: The species has been known only from its type locality, Potholes, Imperial County, California, and one other locality, Palm Springs, California.

NEW RECORDS: *Arizona*: Junction of the North and South Forks of the Santa Maria River, Yavapai County, as larva November 20, 1956 (R. S. Beal). *California*: Highway 74, 3,000 ft. elev., above Palm Desert, Riverside County, June 21, 1961 (G. H. Nelson); Painted Canyon (near Indio), April 18, 1926 (Low); Palm Springs, May 20, 1916 (H. C. Fall Collection).

DIAGNOSIS: The three transverse bands of light pubescence on the elytra distinguish this from most of the other species considered here. *N. perplexus, N. varicolor,* and *N. aequalis* also have three or more bands of light colored pubescence on the elytra, but in these species the pubescence is long, giving the specimens a shaggy appearance, and the pubescence is tricolorous. In *N. timia* the dorsal hairs are quite short and are bicolorous. *N. picta* might be confused with *N. timia*; the two species mutually resemble each other more than they do any other species. However, *N. picta* has a 10-

segmented antenna, *N. timia* an 11-segmented antenna. *N. picta* also has a number of long hairs on the hind tibia that are two or three times as long as the apical spines of the tibia. The tibial hairs of *N. timia* are at most no more than subequal to the tibial spines.

ECOLOGY: Almost nothing is known of the ecology of the species. Adults have been taken on catclaw (*Acacia greggii*). One larva was found in a sheltered bird's nest in a recess in a cliff on the Santa Maria River in central-western Arizona. The nest was not positively identified, but possibly was a phoebe nest.

UNNAMED FORMS NEAR *N. timia*: Three Arizona specimens that may represent a geographic variant of *N. timia* or possibly a new species near *N. timia* have been collected by the author. They closely resemble specimens of *N. timia* except that the integument is darker brown and the antennae of two of the specimens are 10-segmented. Data for the specimens are as follows: McDowell Mountains, Maricopa County, May 6, 1962, on flowers of *Acacia* (11-segmented antenna; female); same locality, May 19, 1961, at light (10-segmented antenna; male); Komatke, Maricopa County, August 25, 1966, at light (10-segmented antenna; male).

Novelsis picta Casey

Novelsis picta Casey, 1900, p. 184.—Beal, 1954, pp. 81–82, 89.

ADULT MALES: Redescribed by Beal (1954).

ADULT FEMALES: Previously undescribed; differing from males in the following observed characteristics: Antenna in repose extending to middle of lateral margin of pronotum; ratio of length of first, second, and terminal segments of club 11:10:20. Length of pronotum and elytra combined): 3.6 mm. to 3.8 mm.

RECORDED DISTRIBUTION: The type locality is given as Riverside, Arizona. The locality was later named Kelvin (Barnes, 1960) and is located in Pinal County seven miles northwest of Kearny. In addition the species has been recorded from the following Arizona localities: west of Tucson, San Luis (Yuma County), and Hot Springs (Castle Hot Springs, Maricopa County?). It has also been recorded from four miles east of Yermo, San Bernardino County, California.

NEW RECORDS: *Arizona*: Globe (D. K. Duncan); Sabino Canyon, Santa Catalina Mountains, July 12, 1935 (E. D. Ball); same locality, June 29, 1955 (G. D. Butler and F. W. Werner); Santa Rita Range Reserve, Pima County, May 23, 1957 (G. D. Butler and F. W. Werner); Tucson, June 25, 1937 (O. Bryant).

California: Cathedral City, Riverside County, June 20, 29, August 24, 28, 1950 (L. W. Isaak); 15 miles east of Calexico, Imperial County, June 5, 1961 (G. H. Nelson and H. F. Howden); Trona, San Bernardino County, June 13, 1961 (G. H. Nelson).

DIAGNOSIS: Adults of the species are easily distinguished from most other Nearctic Attagenini by the three bands of light pubescence on the elytron. There is a broad subbasal band, a narrow submedian band, and a narrow subapical band. Sometimes the subbasal band occupies the entire basal area of the elytron except for a patch of darker pubescence that forms a subbasal "eye." The subapical band may or may not extend to the elytral apex or there may be a separate apical patch of light pubescence. *N. aequalis, N. varicolor,* and *N. perplexus* also have three or more bands of light-colored pubescence on the elytra. However, in these species the darker colored hairs of the elytra are blackish rather than a golden-brown, as they are in *N. picta.* Only *N. timia* is likely to be confused with *N. picta*, but *N. timia* has an 11-segmented rather than 10-segmented antenna. *N. picta* is unique among Nearctic Attagenini in having long, erect or suberect setae along the posterior face of the shaft of each tibia in addition to the usual appressed hairs and short, stout, erect, spine-like setae. On the hind tibia these hairs are up to a fourth longer than the longest apical spines of the tibia. The species is also remarkable for the length of the segments of the antennal club of the male. The antenna in repose may extend beyond the hind margin of the metepimeron.

ECOLOGY: No information on the species is available other than that adults have been swept from mesquite (*Prosopis juliflora*) and *Condalia* sp. (Rhamnaceae). They have also been taken at light. The larval stages remain unknown.

SPECIES DESCRIBED BUT UNRECOGNIZED

There is no way of knowing the identity of the following species, since the types have been lost and the original descriptions are not definitive:

Attagenus cylindricornis Say, 1825, p. 185.
Attagenus cylindricollis Melsheimer, 1853, p. 48.

ACKNOWLEDGMENTS

This paper could not have been completed without the kind help of a great many workers who either donated specimens for study or loaned specimens under their care. Among them should

be mentioned the following: W. F. Barr of the University of Idaho; L. J. Bayer of the University of Wisconsin; W. E. Burkholder, Market Quality Research Division, Agricultural Research Service, Madison, Wisconsin; J. F. Gates Clarke of the Department of Entomology of the United States National Museum; J. B. Dimond and E. A. Osgood, Jr., of the University of Maine; the late S. A. Graham of the University of Michigan; M. H. Hatch of the University of Washington; C. L. Hogue of the Los Angeles County Museum; P. D. Hurd of the California Insect Survey of the University of California; M. T. James of Washington State University; V. Kalík of Pardubice, Czechoslovakia; V. M. Kirk of the Entomology and Crops Research Division of the Agricultural Research Service, Brookings, South Dakota; G. F. Knowlton of Utah State University; H. B. Leech of the California Academy of Sciences; Arnold Mallis of the Gulf Research Development Company; T. E. Moore of the Museum of Zoology of the University of Michigan; W. L. Nutting of the University of Arizona; J. A. Payne of the Market Quality Research Division, Agricultural Research Service, Tifton, Georgia; L. L. Pechuman of Cornell University; Jerome G. Rozen, Jr., of the Department of Entomology, American Museum of Natural History; M. W. Sanderson of the Illinois Natural History Survey; W. B. Showers, Jr., of the Plant Pest Control Division of the Agricultural Research Service, Phoenix, Arizona; the late G. J. Spencer of the University of British Columbia; C. A. Triplehorn of Ohio State University; H. V. Weems, Jr., of the Florida State Plant Board; F. G. Werner of the University of Arizona; and R. D. Zhantiev of Lomonosov University, Moscow. I also wish to thank V. D. Roth of the Southwestern Research Station of the American Museum of Natural History for determination of some spider hosts as well as for contributing specimens collected in spider nests. I am grateful to Maciej Mroczkowski of the Institute of Zoology of the Polish Academy of Science for the privilege of examining the manuscript of his catalogue of the Dermestidae of the world in advance of its publication. J. M. Kingsolver of the Insect Identification and Parasite Introduction Branch of the Entomology Research Division deserves particular thanks for many helpful comments and suggestions during the course of my study, for checking many bibliographic references inaccessible to me, and for a critical reading of the manuscript.

The study was funded in part by Grant No. G13280 and Grant No. GU 691 from the National Science Foundation.

LITERATURE CITED

(All references have been verified from the original by the author or by Dr. J. M. Kingsolver except those followed by an asterisk.)

ARMSTRONG, J. W. T.

1945. On Australian Dermestidae. Part IV. *Proc. Linnean Soc. N.S.W.*, **70:** 47–52.

ARROW, G. J.

1915. Notes on the Coleopterous family Dermestidae, and descriptions of some new forms in the British Museum. *Ann. and Mag. Natur. Hist. London* [8] **15:** 425–451.

BARNES, W. C.

1960. Arizona place names (ed. rev. by Byrd H. Granger). Tucson, University of Arizona Press, xxi + 519 pp.

BEAL, R. S., JR.

1951. Habitats of species of *Novelsis* (Coleoptera: Dermestidae). *Pan-Pac. Entomol.*, **27:** 57.

1954. A revision of the species included in the genus *Novelsis* (Coleoptera: Dermestidae). *Trans. Amer. Entomol. Soc.*, **80:** 73–90.

BOUSH, G. M., F. V. DUNKEL, AND W. BURKHOLDER

1968. Progeny suppression of *Attagenus megatoma* and *Trogoderma parabile* by dietary factors. *J. Econ. Entomol.*, **61:** 644–646.

BRAHM, N. J.

1791. Insektenkalender für Sammler und Oekonomen. Handbuch der ökonomischen Insektengeschichte in Form eines Kalenders bearbeitet. Mainz. Erster Theil, part II, pp. 129–248.

BRULLÉ, A.

1832. Expédition scientifique de Morée. Section des sciences physiques. Tome III. lre Partie. Zoologie. Deuxième Section— Des animaux articulés. Paris, 395 pp., 22 pl.

CASEY, T. L.

1900. Review of the American Corylophidae, Cryptophagidae, Tritomidae, and Dermestidae, with other studies. *J. N. Y. Entomol. Soc.*, **8:** 51–172.

1916. Some random studies among the Clavicornia. *Mem. Coleoptera,* **7:** 35–292.

CHAO, YUNG-CHANG

1954. Insects in grain elevators at Pullman and Albion, Washington. *Pan-Pac. Entomol.*, **30:** 260–262.

CHARLES, V. K.

1941. A preliminary check-list of entomogenous fungi of North America. *U. S. Dep. Agr. Insect Pest Survey Bull.*, **21:** 770–785.*

CHEVROLAT, A.
1863. Coléoptères de l'ile de Cuba. *Ann. Soc. Entomol., Fr.,* [4] **3:** 489–620.

CROTCH, G. R.
1873. Check list of the Coleoptera of America, North of Mexico. Salem, Mass., 136 pp.

DAHL, G.
1823. Coleoptera und Lepidoptera. Wien, 105 pp.

VON DALLA TORRE, K. W.
1911. Nosodendridae, Byrrhidae, Dermestidae. *In* Junk, Coleopterorum Catalogus, pars 33, pp. 1–96.

DEGEER, C.
1774. Charactères des genres des insectes. Mémoires pour servir à l'histoire des insectes, Stockholm, vol. 4, pp. 1–456, 19 pl.

DEJEAN, P. F.
1837. Catalogue des Coléoptères de la collection de M. le Comte Dejean. Troisième édition, revue, corrigée et augmentée. Paris, viii + 503 pp.

DUNKEL, F. V., AND G. M. BOUSH
1968a. Studies on the internal anatomy of the black carpet beetle, *Attagenus megatoma. Ann. Entomol. Soc. Amer.,* **61:** 755–765.
1968b. Biology of the gregarine *Pyxinia frenzeli* in the black carpet beetle, *Attagenus megatoma. J. Invertbr. Pathol.,* **11:** 281–288.

EICHLER, W.
1939. Gregarinen als Feinde von Vorratsschädlingen. *Mitt. Ges. Vorratsschutz,* **15:** 48–50.

ERICHSON, W. F.
1846. Naturgeschichte der Insekten Deutschlands. Erste Abtheilung. Coleoptera, vol. 3, pp. 321–480.

FABRICIUS, J. C.
1798. Supplementum entomologiae systematicae. Hafniae, ii + 572 pp.
1801. Systema eleutheratorum secundum ordines, genera, species; adjectis synonymis, locis, observationibus, descriptionibus. Kiliae, vol. 1, pp. xxiv + 1–506.

FALDERMANN, F.
1835. Additamenta entomologica ad faunam Rossicam in itineribus Jussu Imperatoris Augustissimi annis 1827–1831 a Cl. Ménétriés et Szovitz susceptis collecta, in lucem edita. Coleoptera Persico-Armeniaca. *Nouv. Mém. Soc. Imp. Nat. Moscou,* **4:** 1–310.*

FAUVEL, A.
1903. Faune analytique des coléoptères de la Nouvelle-Caledonie. *Rev. d'Entomol.,* **22:** 203–378.

FOERSTER, H.
1938. Beobachtungen uber das Auftreten von Gregarinen in Insekten. *Z. Parasitenk.*, **10:** 157–209.
GANGLBAUER, L.
1904. Die Käfer von Mitteleuropa, Wien, vol. 4, pp. 1–286.
GRISWOLD, G. H., AND M. GREENWALD
1941. Studies on the biology of four common carpet beetles. Part I. The black carpet beetle (*Attagenus piceus* Oliv.), the varied carpet beetle (*Anthrenus verbasci* L.), and the furniture carpet beetle (*Anthrenus vorax* Waterh.). *Mem. Cornell Agr. Exp. Sta.*, **240:** 3–57, 70–75.
VON HAROLD, F. E.
1868. Berichtigungen und Zusätze zum Catalogus Coleopterorum synonymicus et systematicus. *Coleopterologische Hefte*, **4:** 104.
HATCH, M. H.
1962. The beetles of the Pacific Northwest. Part III: Pselaphidae and Diversicornia I. *Univ. Wash. Publ. Biol.*, **16:** 1–503.
HERBST, J. F. W.
1792. Natursystem aller bekannten in- und ausländischen Insekten als eine Fortsetzung der von Büffonschen Naturgeschichte. *In* Jablonsky, Der Käfer, vol .4, pp. 1–197, 8 pl.
HICKS, E. A.
1959. Check-list and bibliography on the occurrence of insects in birds' nests. Ames, Iowa State College Press, 681 pp.
HINTON, H. E.
1943. Notes on two species of *Attagenus* (Col., Dermestidae) recently introduced into Britain. *Entomol. Mon. Mag.*, **79:** 224–227.
1945. A monograph of the beetles associated with stored products. London, British Museum, vol. 1, pp. 1–443.
1946. The "gin-traps" of some beetle pupae; a protective device which appears to be unknown. *Trans. Roy. Entomol. Soc. London*, **97:** 473–496.
HOPE, F. W.
1840. Coleopterists' manual, London, vol. 3, pp. 1–191, pl. I–III.
HOWE, R. W.
1952. A note on the egg output of *Attagenus megatoma* (F.) (= *piceus* (Ol.)) (Col., Dermestidae). *Entomol. Mon. Mag.*, **88:** 40–41.
1962. The influence of diapause on the status as pests of insects found in houses and warehouses. *Ann. Appl. Biol.*, **50:** 611–614.
ILLIGER, J. K. W.
1798. *In* Kugelann, Verzeichniss der Käfer Preussens. Halle, xlii + 510 pp.

JACQUELIN DU VAL, C.
1858. Manuel entomologique. Genera des coléoptères d'Europe, vol. 2, pp. 1–285; Catalogue, pp. 1–124, 67 pl.

JAYNE, H. F.
1882. Revision of the Dermestidae of the United States. *Proc. Amer. Phil. Soc.*, **20:** 343–377, pl. 1–4.

JOHANSEN, C., AND J. EVES
1966. Parasites and nest destroyers of the alfalfa leafcutting bee. *Wash. State Univ. Agr. Exp. Sta.*, cir. 469, pp. 1–12.

KALÍK, V.
1948. Contribution to knowledge of Czechoslovak Dermestidae. *Sborník Přírodovědeckého klubu* v *Pardubicích*, pp. 1–13, pl. 1–3.
1955. Dermestidae der aethiopischen Region aus den Sammlungen des Königl. Museums von Belgisch Kongo in Tervuren (mit Bemerkungen über verwandte Arten). *Rev. Zool. Bot. Afr.*, **52:** 294–322.

KEMPERS, K. J. W. B.
1923. Abbildungen von Flügelgeäder der Coleopteren. *Entomol. Mitt.*, **12:** 71–115.

KIRBY, W.
1837. The Insects. *In* Richardson, Fauna Boreali-Americana. London, vol. 4, pp. 1–325, 8 pl.

KORSCHEFSKY, R.
1944. Bestimmungstabelle der bekanntesten deutschen Dermestidenlarven (Coleoptera). *Arb. Physiol. Angew. Entomol. Berlin-Dahlem*, **11:** 140–152.

KUGELANN, J. G.
1792. Verzeichniss der in einigen gegenden Preussens bis jetzt entdeckten Käfer-Arten, nebst kurzen Nachrichten von denselben. Fortsetzung. *Neu. Mag. Entomol.*, **1:** 477–512.*

LACORDAIRE, J. T.
1854 (1855). Paussides-Heterocerides. Histoire naturelle des insectes. Genera des Coléoptères, ou exposé méthodique et critique de tous les genres proposés jusqu'ici dans cet ordre d'insectes. Paris, vol. 2, pp. 1–548.

DE LAPORTE, F. L.
1840. Histoire naturelle des insectes Coléoptères. Histoire naturelle des animaux articulés. Paris, vol. 2, pp. 1–563.

LATREILLE, P. A.
1802. Histoire naturelle, générale et particulière des crustacés et des insectes. Paris, vol. 3, pp. i–xii + 13–468.
1807. Genera Crustaceorum et Insectorum secundum ordinem naturalem in familias disposita, iconibus exemplisque plurimis explicata. Paris, vol. 2, pp. 1–280.

LECONTE, J. L.
1854. Synopsis of the Dermestidae of the United States. *Proc. Acad. Natur. Sci. Philadelphia,* **7:** 106–113.
1859. Catalogue of the Coleoptera of Fort Tejon, California. *Proc. Acad. Natur. Sci. Philadelphia,* **11:** 69–90, 281–292.

LEPESME, P., AND R. PAULIAN
1939. Etude biologique et morphologique d'*Entomotrogus megatomoides* Rtt. (Col. Dermestidae). *Bull. Soc. Zool. Fr.,* **64:** 159–168.

LINNAEUS, C.
1758. Systema Naturae per regna tria naturae secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Edito decima, Reformata. Stockholm: vol. 1, pp. 1–823.

LINSLEY, E. G.
1944. Natural sources, habitats, and reservoirs of insects associated with stored food products. *Hilgardia,* **16:** 187–224.
1946. Some ecological factors influencing the control of carpet beetles and clothes moths. *Pests and Their Control,* July.

LUTZ, K. G.
1911. Die Käfer des Deutschen Reiches. *In* Reitter, Fauna Germanica, vol. 3, pp. 1–436, pl. 81–128.

MALLIS, A., B. T. BURTON, AND A. C. MILLER
1962. The attraction of salts and other nutrients to the larvae of fabric insects. *J. Econ. Entomol.,* **55:** 351–355.

MALLIS, A., A. C. MILLER, AND R. C. HILL
1958. Feeding of four species of fabric pests on natural and synthetic textiles. *J. Econ. Entomol.,* **51:** 248–249.
1959. The attraction of stains to three species of fabric pests. *J. Econ. Entomol.,* **52:** 382–384.

MELSHEIMER, F. E.
1853. Catalogue of the described Coleoptera of the United States. Smithson. Misc. Collect. Washington, D.C., xvi + 174 pp.

MOORE, W., AND M. B. MOORE
1942. Two species of black carpet beetle. *J. Econ. Entomol.,* **35:** 288.

VON MOTSCHULSKY, T. V.
1858. Sur les collections Coléoptèrologiques de Linné et de Fabricius. *Études Entomol.,* Part. **7:** pp. 123–152.

MROCZKOWSKI, M.
1954. Skórniki-Dermestidae. Klucze do oznaczania owadów Polski *Polski Zwiazek Entomol.,* [2] **19:** 1–47.
1958. Dermestidae (Coleoptera) collected in Bulgaria by members of the staff of the Zoological Institute of the Polish Academy of Sciences in the years 1950 and 1956. *Fragmenta Faunistica* (Warszawa) **8:** 2–9.

1962. *Anthrenus minutus* Er. and faunistic notes on other Sardinian Dermestidae (Coleoptera). *Studi Sassarensi,* Sassari, [3] **9:** 544–549.

1964. Systematic and synonymic notes upon certain species of Dermestidae (Coleoptera). *Ann. Zool.*, **22:** 179–187.

1965. Ergebnisse der Albanien-Expedition 1961 des Deutschen Entomologischen Institutes. 36 Beitrag. Coleoptera: Dermestidae. *Beitr. Entomol.,* **15:** 665–671.

1968. Distribution of the Dermestidae (Coleoptera) of the world with a catalogue of all known species. *Ann. Zool.*, **26:** 15–191.

MUTCHLER, A. J., AND H. B. WEISS

1927. The dermestid beetles of New Jersey including the carpet beetles and those which feed on animal products. *N. J. Dep. Agr.,* cir. 108, pp. 1–31.

MULSANT, E., AND C. REY

1867 (1868). Tribu des Scuticolles. *Ann. Soc. Linnean. Lyon,* N.S., **15:** 1–188, pl. 1–3.

OLIVIER, A. G.

1790. Entomologie, ou histoire naturelle des insectes, avec leurs caractères génériques et spécifiques, leur description, leur synonymie et leur figure enluminée. Paris, Coléoptères, vol. 2, No. 9. Dermeste. 16 pp.

PANZER, G. W. F.

1795. Entomologia Germanica exhibens Insecta per Germaniam indigena secundum Classes, Ordines, Genera, species, adjectis synonymis, locis, observationibus. I. Eleutherata cum tab. aeneis. 36 + 372 pp., + 12 pl.*

PIC, M.

1910. Descriptions ou diagnoses et notes diverses. Suite. *Échange,* **26:** 17–19.

REDTENBACHER, L.

1843. Bemerkungen über die in Syrien von Theodor Kotschy gesammelten Käfer [and] Coleopterorum Syriae genera et species novae. *In* Russegger, J., Reisen in Europa, Asien und Afrika. Erster Band. Reise in Griechenland, Unteregypten, im nördlichen Syrien und Südöstlichen Kleinasien, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder, unternommen in dem Jahre 1836. Zweiter Theil. Stuttgart, pp. 973–990.*

REES, B. E.

1943. Classification of the Dermestidae (larder, hide, and carpet beetles) based on larval characters, with a key to the North American genera. *U. S. Dep. Agr. Misc. Publ.* no. 511. 18 pp.

REITTER, E.
1880 (1881). Die aussereuropäischen Dermestiden meiner Sammlung. Mit 70 Diagnosen neuer Arten. *Verh. Naturf. Ver. Brünn,* **19:** 27–60.
1887. Bestimmungs-Tabellen der europäischen Coleopteren, III, enthaltend die Familien Scaphidiidae, Lathridiidae und Dermestidae. Zweite vermehrte und verbesserte Auflage. Mödling, 75 pp.
1889. Insecta, a Cl. G. N. Potanin in China et in Mongolia novissime lecta. VIII. Clavicornia. Hydrophilidae. Bruchidae. *Horae Soc. Entomol. Rossicae.,* **23:** 555–559.

ROSENHAUER, W. G.
1856. Die Thiere Andalusiens nach dem Resultate eine Reise zusammengestellt, nebst den Beschreibungen von 249 neuen oder bis jetzt noch unbeschreibungen Gattungen und Arten. Erlangen, viii + 429 pp., 3 plates.*

ROTH, J. R.
1851. Diagnosen neuer Coleoptera aus Abyssinien. *Arch. Naturges.,* **17:** 115–113.*

SAY, T.
1825. Descriptions of new species of coleopterous insects inhabiting the United States. *J. Acad. Natur. Sci. Philadelphia,* **5:** 160–204.

SCHÖNHERR, C. J.
1808. Synonymia Insectorum, oder: Versuch einer synonymie aller bisher bekannten Insecten, nach Fabricii Systema Eleutheratorium &c. geordnet, mit Berichtigungen und Anmerkungen, wie auch Beschreibungen neuer Arten und illuminirten Kupfern. Erste Band. Eleutherata oder Käfer. Zweiter Theil. Spercheus—Cryptocephalus. Stockholm, ix + 423 pp., 4 pl.

SHARP, D.
1885. On some new species and genera of Coleoptera, Fam. Dermestidae. *Sci. Trans. Roy. Dublin Soc.,* N.S., **3:** 147–150.

SOLODOVNIKOVA, O.
1938. [Biology of the Dermestidae *Attagenus byturoides* Solo. and *Trogoderma versicolor* Creutz. and control of them.] *Acta Univ. Asiae med.,* (8 zool.), fasc. 41, 20 pp. Abstract (1941) in *Rev. Appl. Entomol.,* **29:** 453–454.

SOLSKY, S. M.
1876. A second tetrad of beetles (Coleoptera) [in Russian], *in* A. P. Fedchenko, Expedition to Turkestan [in Russian]. *Izv. Imp. Obshch. Lyub. Estest. Antrop. Entogr., Imp. Mosk. Univ.* **21**(1): 223–398.

SPENCER, G. J.
1947 (1948). Notes on some Dermestidae of British Columbia (Coleoptera). *Proc. Entomol. Soc. Brit. Columbia,* **44:** 6–9.

STEPHENS, J. F.
1830. Dermestidae. Illustrations of British entomology; Mandibulata. London, vol. 3, pp. 118–128.
THUNBERG, C. P.
1795. Dissertatio entomologica, sistens insecta suecica. Part 9. Upsaliae, pp. 105–113.*
TRIPLEHORN, C. A.
1965. Insects found in Ohio grain elevators and feed mills. *J. Econ. Entomol.*, **58:** 578–579.
WOLLASTON, T. V.
1864. Catalogue of the coleopterous insects of the Canaries in the Collection of the British Museum. London, Trustees of the British Museum, xiii + 648 pp.
WOODROFFE, G. E.
1953. An ecological study of the insects and mites in the nests of certain birds in Britain. *Bull. Entomol. Res.*, **44:** 739–772, pl. xiv–xvi.
WRADATSCH, G.
1914. Die Kaferausbeute von 1913 und die angewendete Fangtechnik. *Entomol. Blätt.*, **10:** 150–154.
ZHANTIEV, R. D.
1963a. New species of dermestids belonging to the genus *Attagenus* Latr. (Coleoptera, Dermestidae) from Central Asia [in Russian]. *Zool. Zh.*, **42:** 454–457.
1963b. Dermestid beetles of the genus *Attagenus* Latr. (Coleoptera, Dermestidae) from the U.S.S.R. [in Russian]. *Entomol. Obozrenie* (Rev. d'Entom. de l'URSS), **42:** 415–424.
ZINKERNAGEL, R.
1952. Remarks on *Attagenus* species. *Trans. Ninth Int. Congr. Entomol.*, No. 1, pp. 844–848.
ZINKERNAGEL, R., AND E. MÜLLER
1952. Kreuzungsversuche mit *Attagenus piceus* Oliv. (Dermestidae). *Verh. Schweiz Naturf. Ges.*, **132:** 156.

ENTOMOLOGICA AMERICANA

A REVISION OF THE GENUS LOXANDRUS LECONTE (COLEOPTERA: CARABIDAE) IN NORTH AMERICA

ROBERT T. ALLEN

PUBLISHED BY THE
NEW YORK ENTOMOLOGICAL SOCIETY
INCORPORATING THE BROOKLYN ENTOMOLOGICAL SOCIETY

Vol. 46, No. 1 August 1, 1972

The New York Entomological Society (incorporating the Brooklyn Entomological Society) publishes two journals: *Entomologica Americana* (irregularly, according to the availability of acceptable papers) and the *Journal of the New York Entomological Society* (quarterly). Monographs and longer papers (minimum length approximately 70 manuscript pages) are published in *Entomologica Americana.* Shorter papers may be submitted to the *Journal.* Manuscripts should be sent to the Editor, *Entomologica Americana*, Department of Entomology, The American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024.

Entomologica Americana was first published by the Brooklyn Entomological Society in April, 1885. Publication was suspended after six volumes, resumed in 1926, again suspended in 1964 with Volume 44, and resumed in 1969 with Volume 45. The subscription rate to *Entomologica Americana* is $9.00 per volume. Correspondence regarding subscriptions and other non-editorial matters should be addressed to Publication Business Manager, New York Entomological Society, Department of Entomology, The American Museum of Natural History.

Mailed August 1, 1972

Entomologica Americana is published for the Society by Allen Press, Inc., 1041 New Hampshire, Lawrence, Kansas 66044.

Vol. 45, No. 3 was published on October 26, 1970.

Entomologica Americana
Vol. 46, 1972, pp. 1–184

A REVISION OF THE GENUS LOXANDRUS LECONTE (COLEOPTERA: CARABIDAE) IN NORTH AMERICA[1,2,3]

By
Robert T. Allen[4,5]

Table of Contents

---

[1] Modified from a thesis submitted to the Graduate School of the University of Illinois in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

[2] Partially supported by grants from the Bach Fund (National Academy of Sciences) and a Sigma Xi Grant-in-Aid.

[3] Published with the approval of the Director, Arkansas Agricultural Experiment Station.

[4] The study was begun while the author was employed by the Illinois State Natural History Survey and was completed as an Assistant Professor, Entomology Department, University of Arkansas.

[5] Author's address: Department of Entomology, University of Arkansas, Fayetteville, Arkansas 72701.

ABSTRACT: Fifty-two species in the genus *Loxandrus* are recognized as occurring in North America. Twenty-seven new species are described. A key to the species, descriptions, locality records, illustrations of pertinent anatomical parts and a discussion of the phylogenetic relationships and the zoogeography of the 52 species are presented. Nine additional species from Australia and three species from South America are treated in the phylogenetic and zoogeographic sections but not in the taxonomic section. Based on the information now available it is postulated that the genus may have arisen in Middle or South America and then dispersed to North America, Australia and New Guinea.

INTRODUCTION

The genus *Loxandrus*, a taxon of the order Coleoptera, family Carabidae, has historically been considered as having its closest affinities with other genera comprising the tribe Pterostichini. Ball (1962), in the most recent comprehensive study of the North American beetle family Carabidae, placed the tribe Pterostichini in the subfamily Carabinae and in division B, the Caribida. Other workers (Darlington, 1962; Blackburn, 1890, 1892, 1907; Sloane, 1898, 1903; Straneo, 1949, 1951, 1953; Tschitscherine, 1898, 1900, 1901; Moore, 1965) who studied the species of *Loxandrus* occurring in South America, Australia and New Guinea also considered the genus to belong in the tribe Pterostichini. I concur with Ball's hierarchical arrangement and placement of *Loxandrus*.

The need for a generic revision of the genus *Loxandrus* was pointed out by Ball (1962). The complexity of the evolution and phylogenetic relationships in the tribe Pterostichini and its genera was discussed by Darlington (1962), Moore (1965) and Ball (1966). The lack of information in these two areas prompted my original investigation of *Loxandrus*. The following paper is a presentation of findings, thus far, concerning the taxonomy and phylogenetic relationships among species of the genus *Loxandrus*.

LeConte's original description characterized the genus *Loxandrus* as follows:

Antennae slender, base not carinate; palpi cylindrical, slender, ultimate article not short, mentum dentate, ligula flat, apex truncate; labrum not emarginate; mandibles short; elytra with one dorsal puncture; scutellar stria not impressed; tarsi slender; outside of posterior tarsi sulcate, anterior tarsal segments one to three dilated, inside prolonged, outside oblique.

All the characters mentioned in the original description are valid and are used in present day taxonomic works to characterize *Loxandrus*. In addition to those characters mentioned by LeConte an additional character is necessary to distinguish the genus *Loxandrus* from the genus *Oxycrepis* Reiche. Members of the genus *Oxycrepis* have the sides of the pronotum strongly constricted towards the base. This constriction is not evident in any species of *Loxandrus*. The genus *Loxandrus*, as it is interpreted in this paper, cannot be set apart on any one single character but can be defined by utilizing the combination of characters recorded by LeConte plus the additional character of the base of the pronotum not being constricted.

HISTORICAL SUMMARY

LeConte (1852), in his synoptic work on *Pterostichus* Bonelli and allied genera, "synthesized" and described *Loxandrus*. He included in *Loxandrus* three new species and eight species previously described by himself and other authors in other genera. The eight previously named species were described by LeConte (1848), Say (1823), Dejean (1828), and Chaudoir (1843) and were assigned to one of the following genera: *Argutor* Stephens, *Feronia* Latrielle, *Megalostylus* Chaudoir or *Pogonus* Nichol. Since 1852 several workers published on new species of *Loxandrus* from North America. Motschulsky (1865) described a new species from Mississippi and one listed from North America. Chaudoir (1868) described three new species, one each from Texas, Louisiana and South Carolina. LeConte (1878) also described three new species from Florida. Blatchley (1918) described two new species from Florida. Casey (1918) revised the genus *Loxandrus* but did not include all the species that had been described from North America. He also described nineteen new species at that time as well as two additional new species in 1924. Since 1924, only one worker, Wright (1939), has described a new species of *Loxandrus* from the United States and the group as a whole has not been treated since Casey's work in 1918. Darlington (1938) recorded *L. infimus* Bates, previously known only from Mexico and Central America, from Brownsville, Texas.

Darlington (1934, 1935) treated the genus as it occurrs in the West Indies. He described two new species, one from Cuba and one from Haiti and recorded the occurrence of several other previously-described species but did not provide a key to these forms.

Bates (1871, 1881, 1891) described five species occurring in the Mexico-Central America area. He did not give a key to the species and only listed the general location from which the type material came.

Lindroth (1966) recorded two species from Southern Ontario, Canada. A key was presented and a type locality for a third species not occurring in Canada, *L. erraticus* (Dejean), was designated.

BIOLOGY AND DISTRIBUTION

Very little is known concerning the biology of *Loxandrus* species. Adults are found near water, under stones and logs along stream banks, and on flood plain areas. They can be obtained by treading vegetation in swamps and along stream banks. Some species have also been collected at black light traps. Life history studies have not been made for any of the species and no larval forms have been associated with the genus. Species of the genus occur as far north as Southern Canada in the Eastern United States and west to Illinois, Missouri, Arkansas and South-western Texas. They are also found in Mexico, Central America, the Antilles, Australia and in New Guinea. One species has been recorded from Celebes.

METHODS AND MATERIALS

The material for this study consisted of over 3,000 borrowed specimens of *Loxandrus* representing 61 species. Several hundred specimens belonging to related groups were also examined. These consisted of 58 species representing 29 genera and subgenera in three tribes belonging to the family Carabidae. These related species, genera, subgenera and tribes were studied in order to establish the ancestral and derived states of characters in the genus *Loxandrus*. These specimens were preserved on insect pins or points. The external morphology and genitalia of all these species were examined. The external anatomical parts are illustrated in Figure 1A, B.

The genitalia of the males of all species, when available, were examined. The genitalia of the females were also examined but few stable taxonomic characters were found.

The following method was used to remove the genitalia and prepare them for study. Specimens were placed in household ammonia for about 20 minutes. They were then removed and placed in boiling water for 2–3 minutes. As each specimen was removed from the boiling water, it was placed on a paper towel, which absorbed the excess water, and then dissected under a stereo-microscope. Using a pair of small scissors, an incision was made on the dorsal surface of the abdomen from the midpoint of the apex along the lateral margin for a short distance. The genitalia were removed by reaching under the "flap" with a pair of forceps and removing them. Internal membranes and muscles still attached to the genitalia were cut with the scissors.

The basal ring of the males was left in the abdomen and not removed. The genitalia were then placed in individual small tubes containing 10–20 percent potassium hydroxide in a water bath and heated to just below boiling for 10–15 minutes. The genitalia were removed and placed under the microscope in 70 percent alcohol and agitated to force the potassium hydroxide and dissolved tissues from the median lobe of the males and from around the coxites of the females. The female genitalia were then placed in glycerine.

After being subjected to hot potassium hydroxide, the walls of the median lobe of the aedeagus become somewhat transparent, and the scale groups on the internal sac were visible. In most instances, it was desirable to evert the sac to gain a better idea of the arrangement of the scale groups. This was accomplished by either of two methods. The first method employed the use of a minute insect pin that had been bent to form a hook at its tip. The base of the pin was inserted in a match stem that served as a handle. The hooked pin was inserted into the apex of the median lobe and the internal sac gradually pulled out. The second method, the one used most often by this writer, utilized a hypodermic syringe, a small hypodermic needle and 70 percent alcohol. The syringe was filled with 70 percent alcohol and the needle tip was placed in or against the basal foramen of the median lobe. The median lobe was held firmly but not tightly between a pair of forceps. The alcohol was injected into the basal foramen and the pressure thus created forced the internal sac out. Using this technique, the internal sac of about 98 percent of all specimens examined were everted. After washing in alcohol, whether the internal sacs were everted or not, the genitalia were placed in glycerine for 30 minutes before transferring them to genitalia vials containing glycerine. The vials were then placed on the insect pins under the specimens.

MEASUREMENTS. Measurements were made of the length and width of the head, thorax, and elytra. Abbreviations used for the measurements are as follows: TL—total length; WE—width across eyes, outside margins; WP—width of pronotum at widest point; WW—width across elytra at widest point. The total length was derived by combining the lengths of the head, thorax, and abdomen which were measured individually as follows: head—from the anterior margin of the clypeus along the midline to an imaginary line connecting the posterior margins of the compound eyes; thorax—from the anterior to the posterior margin along the midline; elytra—from the apex of the scutellum to the apex of the right elytron along the midline. All measurements are in millimeters.

ABBREVIATIONS.

An asterisk (*) has been used in the locality sections of the descriptions to note localities that could not be located and mapped.

Museums and Private Collectors

AM — American Museum of Natural History, New York
BM — British Museum (Natural History), London
CAS — California Academy of Sciences, San Francisco
CINM — Cincinnati Museum of Natural History, Cincinnati
CNC — Canadian National Collection, Ottawa
CNHM — Chicago Natural History Museum, Chicago
CU — Cornell University, Ithaca
FSPB — Florida State Collection of Arthropods, Gainesville
GB — George Ball Collection, Edmonton
GN — Gerald Noonan Collection, Washington, D. C.
INHS — Illinois Natural History Survey, Urbana
MCZ — Museum of Comparative Zoology, Cambridge
MNHP — Museum of Natural History, Paris
MSU — Michigan State University, East Lansing
NCSC — North Carolina State University, Raleigh
OSU — Ohio State University, Columbus
PSU — Pennsylvania State University, University Park
PU — Purdue University, Lafayette
RTB — Ross T. Bell Collection, Burlington
TAM — Texas A & M University, College Station
TLE — Terry L. Erwin Collection, Cambridge
UA — University of Arkansas, Fayetteville
UK — University of Kansas, Lawrence
UM — University of Michigan, Ann Arbor
UMIN — University of Minnesota, St. Paul
UMO — University of Missouri, Columbia
USNM — United States National Museum, Washington

Anatomical Regions

AN — Antenna
AS — Ambulatory setae
ATS — Anterior sulcus
BI — Basal impression
C — Clypeus
CE — Compound eye
CX — Coxae
F — Femur
FR — Frons
G — Gula
GE — Gena
H — Humerus
I1–I9 — Intervals
IS — Internal sac
LM — Lobes of mentum
LP — Labial palpi
LPA — Left paramere
MC — Mesocoxae
FS — Frontal sulci
ML — Median lobe
MN — Mentum
MS — Mesosternum
MT — Metasternum
MTM — Metepimeron

MTP — Metepisternum
MXP — Maxillary palpi
PA — Posterior angle
PC — Procoxae
PE — Epipleura of pronotum
PM — Proepimeron
PP — Proepisternum
PR — Intercoxal process
MES — Mesepimeron
PS — Prosternum
RPA — Right paramere
S — Sclerite
SA — Scale area
SC — Scutellum
SG — Scale group
SR — Sclerotized ring
STI — Sternites of abdomen
T — Tibia
TC — Tarsal claw
TO — Tooth of mentum
TR — Trochanter
TS — Tarsal segments

TYPES

Besides trying to follow the Rules of Zoological Nomenclature, two additional objectives influenced my work with types. First, in most instances species of *Loxandrus* cannot be accurately identified unless the internal sac of the male aedeagus is examined. Thus most species that are based on female types cannot be, at this time, adequately diagnosed. Secondly, I do not wish to multiply the number of names available for *Loxandrus* if it can be avoided. Therefore in this paper species are utilized that are based on female types but have a male that was in the original type material. I have tried to determine from the original description and from any other sources (mainly personal communication with other specialists) precisely what material was in the original series.

The types of three species, *Loxandrus parvulus* Chaudoir, *L. inquietus* Casey, and *L. duryi* Wright, could not be located. However, a male paratype of *L. duryi* was studied and this species is considered in more detail below. The types of the two species described by Motschulsky, *L. commutables* and *L. iris*, were not available for study. The types of the latter two species are presumably in the Moscow Museum in Moscow, USSR.

The following tables contain information accumulated concerning *Loxandrus* types for North America.

TABLE I.

Species in the genus *Loxandrus* based on male types or with a male in the original material. Type localities given in text.

L. agilis	Dejean	1828:244	♂ (MNHP)
L. brevicollis	LeConte	1848:338	♀ 3 specimens in the series; the third specimen in the series is a ♂ (MCZ)

TABLE I (*Continued*)

L. brunneus	Blatchley	1918:417	♂ (PU)
L. calathinus	LeConte	1878:376	♀ Type no. 5693, one additional specimen in the series, a ♂ (MCZ)
L. celeris	Dejean	1828:246	♂ (MNHP)
L. cervicalis	Casey	1918:391	♂ (USNM)
L. cincinnatiensis	Casey	1924:80	♂ (USNM)
L. crenatus	LeConte	1852:252	♂ (MCZ)
L. crenulatus	Chaudoir	1868:343	♂ (MNHP)
L. cubanus	Tschitscherine	1903:60	♂ (MNHP)
L. duryi	Wright	1939:257	♂ (Unlocated)
		paratype	♂ (CINM)
L. erraticus	Dejean	1828:24	♂ (MNHP)
L. flavilimbus	Blatchley	1918:418	♂ (PU)
L. floridanus	LeConte	1878:376	♀ 7 specimens in the series, second specimen is a ♂, two additional ♂♂ in the series, all the same species (MCZ)
L. infimus	Bates	1882:87	♂ *lectotype* here designated (BM)
L. laticollis	Chaudoir	1868:342	♂ (MNHP)
L. lucens	Chaudoir	1868:342	♂ (MNHP)
L. lucidulus	Dejean	1831:239	♂ (MNHP)
L. mandibularis	Casey	1918:382	♂ (USNM)
L. micans	Chaudoir	1868:342	♂ (MNHP)
L. minor	Chaudoir	1843:766	♂ (MNHP)
L. mutans	Darlington	1935:180	♂ Type No. 22022 (MCZ)
L. nitidulus	LeConte	1848:239	♀ 4 specimens in the series, the second specimen is a ♂ (MCZ)
L. nocticolor	Darlington	1934:91	♂ (MCZ)
L. parallelus	Casey	1918:396	♂ (USNM)
L. rapidus	Chaudoir	1868:344	♂ (MNHP)
L. rectangulus	LeConte	1878:377	♂ (MCZ)
L. rectus	Say	1825:58	♂ neotype designated by Lindroth & Freytag (1969) (MCZ)
L. reflexus	LeConte	1878:376	♀ Type No. 5692, three additional specimens in the series, second specimen is a ♂ (MCZ)
L. saphyrinus	Chaudoir	1843:766	♂ (MNHP)
L. scitus	Casey	1918:388	♂ (USNM)
L. sculptilis	Bates	1884:(278)	♂ *lectotype* here designated (BM)
L. taeniatus	LeConte	1852:(252)	♂ (MCZ)
L. tetrastigma	Bates	1882:87	♂ (MNHP)
L. unistigma	Bates	1882:87	♂ *lectotype* here designated (BM)
L. velocipes	Casey	1918:390	♂ (USNM)
L. velox	Dejean	1828:245	♂ (MNHP)

TABLE II.

Species in the genus *Loxandrus* based on female types without a male in the original material. Type localities given.

L. accelerans	Casey	1918:386	♀ Type No. 47338 Texas, Galveston. (USNM)
L. breviusculus	Casey	1924:80	♀ Type No. 47350 Florida, Dunedin. (USNM)
L. collucens	Casey	1918:382	♀ Type No. 47336 Texas, Houston (USNM)
L. comptus	Casey	1918:387	♀ Type No. 47349 Florida, Dunedin (USNM)
L. contumax	Casey	1918:388	♀ Type No. 47352 Florida, Indian River (USNM)
L. cursitans	Casey	1918:387	♀ Type No. 47348 Florida, Dunedin (USNM)
L. concinnus	Casey	1918:341	♀ Type No. 47353 Florida, Dunedin (USNM)
L. fulgens	Casey	1918:388	♀ Type No. 47344 Mississippi, Vicksburg (USNM)
L. lateralis	Casey	1918:381	♀ Type No. 47347 Florida, Sarasota (USNM)
L. limatus	Casey	1918:382	♀ Type No. 47335 District of Columbia. (USNM)
L. ludovicianus	Casey	1918:383	♀ Type No. 47337 Louisiana, Cane River. (USNM)
L. mondus	Casey	1918:385	♀ Type No. 47341 Florida, LaBelle. (USNM)
L. parvicollis	Casey	1918:389	♀ Type No. 47343 Texas, Galveston. (USNM)
L. piceolus	Chaudoir	1868:343	♀ A single specimen from Texas, C. Pilate (Coll.?). (MNHP)
L. piciventris	LeConte	1848:237	♀ Type No. 5698 Georgia (MCZ)
L. proximus	Chaudoir	1868:344	♀ Chaudoir states in the original description that he was studying a ♂. The specimen I found in the MNHP was a ♀. The genitalia had been destroyed or lost. The Chaudoir determination label gives Texas as the locality. This locality agrees with the original description.
L. pusillus	LeConte	1852:252	♀ Type No. 5699 Georgia. (MCZ)
L. rubricatus	Bates	1891:250	♀ (BM)
L. suturalis	Casey	1918:384	♀ Type No. 47339 Florida, Dunedin (USNM)
L. vulneratus	Casey	1918:390	♀ Type No. 47354 Indiana. (USNM)

TABLE III.

Species in the genus *Loxandrus* for which a type could not be located or was unavailable for study.

L. blatchelyi	Csiki	1930	A name proposed for *L. brunneus* Blatchley now a synonym of *L. cervicalis* Casey
L. commutablis	Motschulsky	1865:243	
L. inquietus	Casey	1918:389	♀ Indiana.
L. iris	Motschulsky	1865:242	
L. parvulus	Chaudoir	1868:342	♀ Carolina

MORPHOLOGY

The general external morphological characters are illustrated in Figures 1 A, B. The characters used in this paper are familiar to most systematists. Thus, most of them are self-explanatory and only a few warrant discussion in this section.

In most species of *Loxandrus*, the lobes of the mentum are evidently longer than the mental tooth (Figs. 141, 142, 143). However,

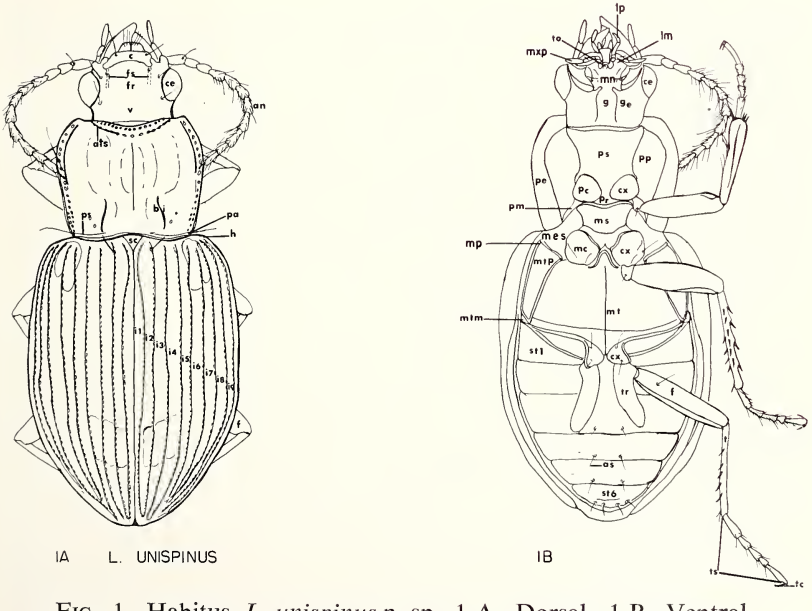


FIG. 1. Habitus, *L. unispinus* n. sp. 1 A. Dorsal. 1 B. Ventral.

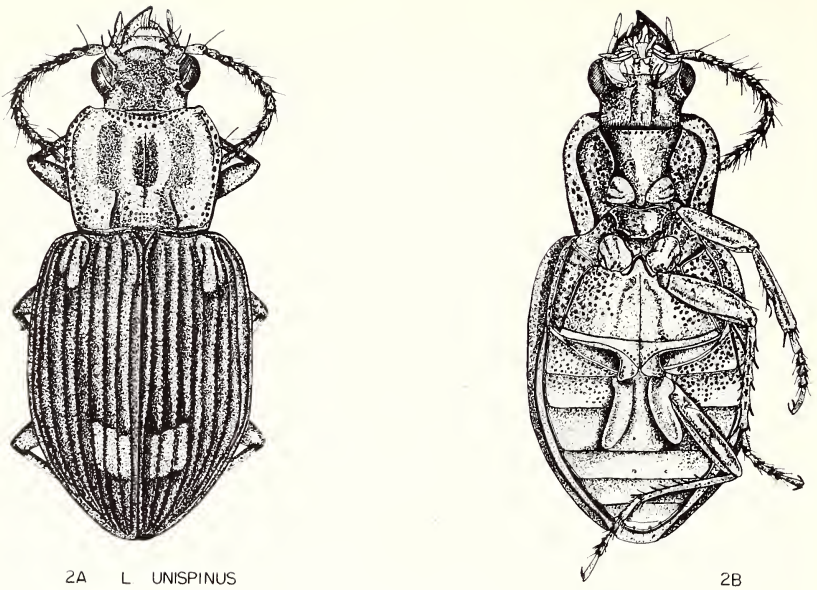


FIG. 2. Habitus, *L. unispinus* n. sp. 2 A. Dorsal. 2 B. Ventral.

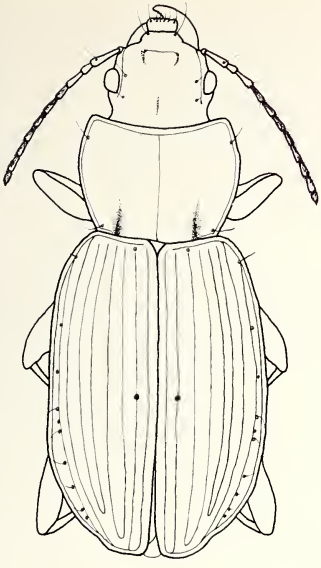
in a few species, the length of the tooth is equal to the length of the mental lobes (Figs. 138–140). This gives the mentum a more transverse appearance.

The external surface of all sclerites has a characteristic type of microsculpture, or the microsculpture is entirely absent. Two basic types of microsculpture with several intermediate types are present. The two basic types are referred to as isodiametric (Figs. 11 A, B; 16 A, B, C; 20 A, B, C) and transverse (Figs. 12, 15). The transverse type can be extremely stretched into fine parallel lines (Fig. 15) or only slightly stretched.

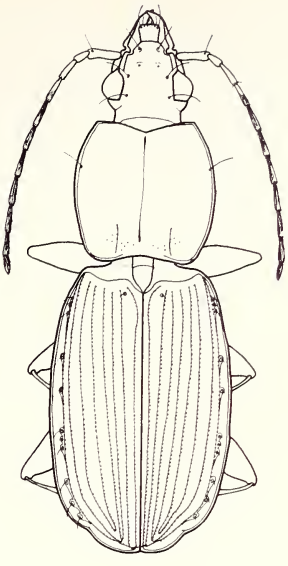
The shape of the pronotum is characteristic for many species groups as well as individual species. The lateral margins are either evenly rounded from the posterior to the anterior margins (Fig. 35 B) or slightly oblique (Fig. 47) or sinuate (Fig. 45) in the posterior ¼ to ⅓. Since these variations are sometimes difficult to convey in words, they have been illustrated (Figs. 25 to 70).

→

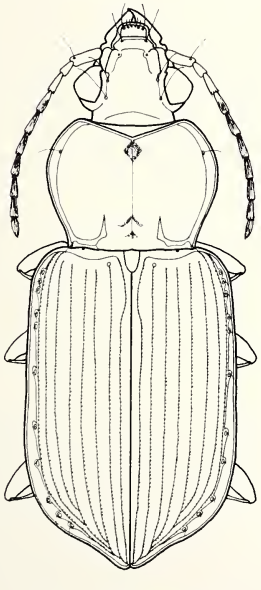
FIGS. 3–6. Habitus, dorsal. 3. *L. infimus* Bates. 4. *L. parallelus* Casey. 5. *L. remotus* n. sp. 6. *L. gibbus* n. sp.



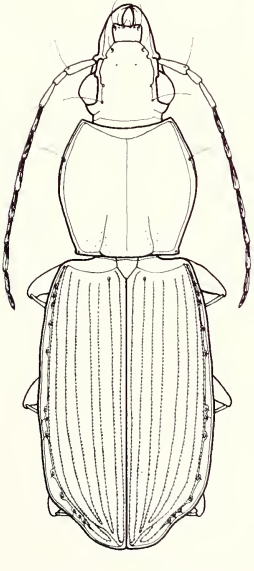
3 L. INFIMUS



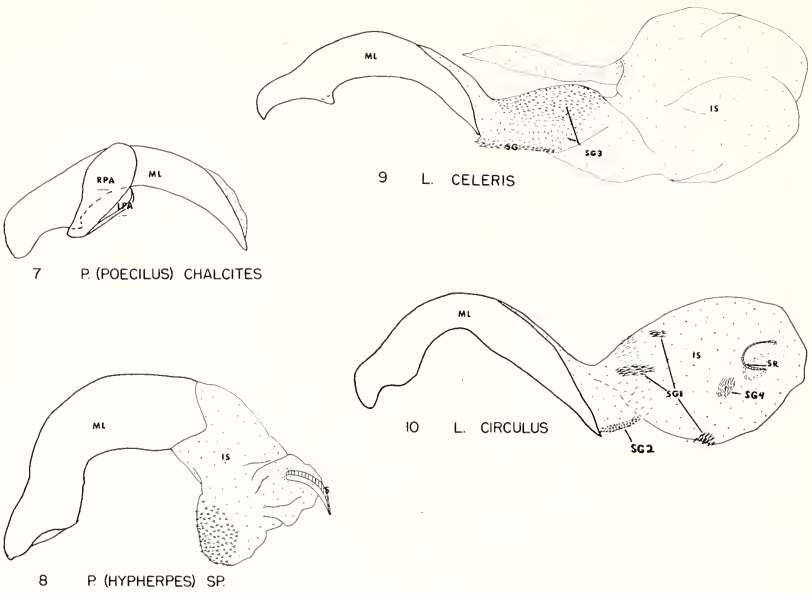
4 L. PARALLELUS



5 L. REMOTUS



6 L. GIBBUS



FIGS. 7–10. Male genitalia, left lateral aspect. 7. *Pterostichus* (*Poecilus*) *chalcites* Say. 8. *Pterostichus* (*Hypherpes*) sp. 9. *L. celeris* (Dej.). 10. *L. circulus* n. sp.

Characters associated with the genitalia, especially the males, are complex and difficult to describe. In many species of *Loxandrus*, only the males can be recognized, based on characters associated with the male genitalia. For these reasons, numerous illustrations of the male genitalia are provided.

The male genitalia of *Loxandrus* are composed of a median lobe with an internal sac and a pair of parameres at the base of the median lobe (Fig. 7). The internal sac can be everted as previously described. Associated with the genitalia is a sclerotized ring process: the modified 9th abdominal sternite which appears to possess no taxonomic or phylogenetic characters.

The scale groups on the internal sac are constant in position and characteristic for each species of *Loxandrus*. The number of scales in each group varies from specimen to specimen but the variation is not significant in species recognition. With the stereo-microscope, several different types of scales can be identified. The most common type is moderately long with a pointed apex (Fig. 10 SG1). The size range of this type of scale is variable (Fig. SG2). They are usually found in groups but occasionally a small group may be reduced to one scale

(Fig. 109 D). A second common scale type is a very small weakly-sclerotized scale with the apex usually rounded but sometimes minutely pointed (Fig. 9 SG3). These do not usually form well-defined groups. They are more common in the basal portion of the sac but are not uncommon over much of the surface of the sac. A third type of scale that is relatively rare is hair-like (Fig. 10 SG4). They are very slender and pointed and are usually found in small groups (Figs. 102 A; 103 B). In one species, *L. rectangulus* LeConte, they occur over much of the surface of the sac (Fig. 74 A, B). In *L. spinigrandis* (Fig. 83 A, B) large, strong spines are present on the internal sac. These different types and their significance have not been studied in detail. The function of the scales is also unknown. They may or may not be a part of a lock and key mechanism essential for fertilization of the female.

Sclerotized bars, plates or sclerites are found on the internal sac of only one species of *Loxandrus*, *L. dubius* Curt. Sclerites are common on the internal sacs of other Pterostichine species however (Fig. 8 S).

In many species of *Loxandrus* a sclerotized ring occurs on the internal sac towards the apex. In other species the ring is weakly sclerotized and in a third group it is totally absent. This may be the exit of the ejaculatory duct, the gonopore. In those species in which a well-developed ring is present the ejaculatory duct was traced to the opening. However, an opening was not found for the ejaculatory duct in those species without the ring. I have, therefore, referred to this only as a "sclerotized ring" in this paper.

THE GENUS *LOXANDRUS*

TYPE SPECIES & LOCALITY

Feronia recta Say 1823:58. "A ♂ with genitalia dissected from South Carolina, designated by R. T. Allen as neotype and the state as type area" (Lindroth & Freytag 1969).

DESCRIPTION. General characteristics that prevail among all species of *Loxandrus* found in North America.

Head. Labrum: Anterior margin straight or slightly concave, both conditions apparent among specimens of the same species; 6 setae along the anterior margin, decreasing in length inwardly; anterior lateral angles rounded; microsculpture usually distinct, isodiametric; color always of a lighter hue than rest of head. Clypeus: anterior lateral margins rounded; 1 seta each side, removed from the anterior and lateral margins (distance variable). Mentum: tooth always well developed, apex rounded or straight; a pair of setae at base of tooth.

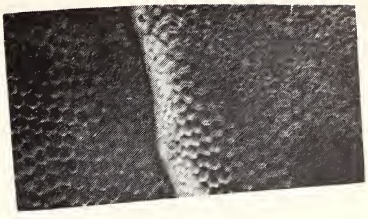
Submentum: a slightly elevated, well-rounded ridge; microsculpture elongate. Gular sutures: distinct; microsculpture elongate or absent. Postgenae: microsculpture elongate or absent. Eyes: large and distinct. Antennal segments: I, one dorsal seta near the apex, otherwise glabrous; II–III, a ring of setae at apex, otherwise glabrous; IV–XI, somewhat compressed laterally, pubescence covering each segment except a narrow, elongate area on each lateral surface. Mandibles: scrobes always distinct, without setae, microsculpture isodiametric. Anterior tentorial pits: distinct, located in the frontal sulci, approximate to the epistomal suture.

Thorax. Pronotum: 1 seta in or approximate to each hind angle; 1 seta along each lateral margin (position variable); anterior lateral angles rounded; lateral margin narrowly reflexed its entire length. Prosternum: intercoxal process not margined. Mesosternum: declivate medially; never punctate. Metasternum: area between mesocoxae margined; median sulcus reaching from posterior margin of metasternum to posterior margin of mesocoxae; lateral sulci elongate but never reaching lateral margins. Metepisternum: lateral margin always much longer than anterior margin. N. B. Microsculpture and punctation are variable on all ventral thoracic sclerites except where specifically noted above. *Legs.* Segment 5 of all tarsi usually with 2 ventral rows of very minute setae toward the apex; protarsal segments 1–3 of male obliquely dilated with 2 rows of large scales on the ventral surface. *Elytra.* 1 seta at base of stria 2; 1 seta on interval 3 approximate to stria 2 (longitudinal position variable); usually 15 setiferous punctures in stria 8 along the lateral margin; 2 setae near apex of stria 7; scutellar stria absent; lateral margin near apex usually with distinct internal plica (absent in some Central American species); lateral margin near apex distinctly sinuate. *Abdominal sternites.* Segments 3, 4 and 5 always with a pair of ambulatory setae; segment 2 with or without ambulatory setae; segment 6, males with 1 pair of setae along apical margin, females with 2 pair of setae along apical margin. *Aedeagus.* Median lobe: usually an elongate tube (modified in 4 species). Parameres: left paramere short, conchoid shaped; right paramere slightly longer than left. Internal sac: everts apically; surface covered with scales which may or may not form distinct groups; a sclerotized ring near the apex may or may not be present.

→

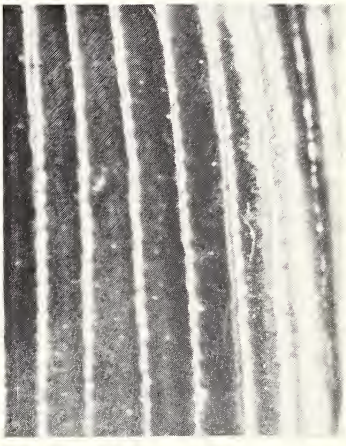
FIGS. 11–15. Elytra, dorsal aspect. 11 A. *L. yeariani* n. sp. 11 B. Same, close-up. 12. *L. nitidulus* (LeC.). 13. *L. agilis* (Dej.). 14. *L. brevicollis* (LeC.). 15. *L. discolor* n. sp.

11A L. YEARIANI

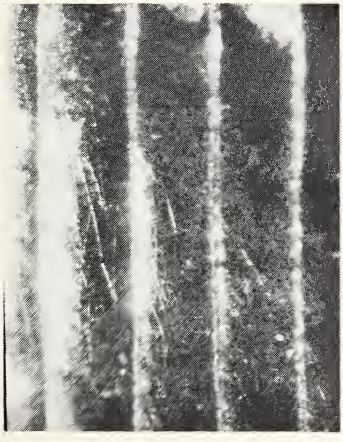


11B

12 L. NITIDULUS



13 L. AGILIS



14 L. BREVICOLLIS

15 L. DISCOLOR

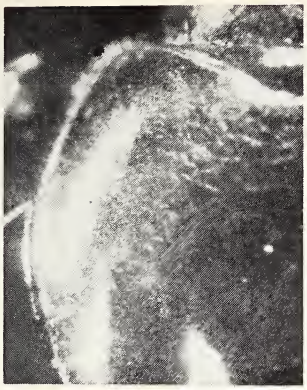
KEY TO THE SPECIES OF *LOXANDRUS* FOUND IN NORTH AMERICA

1. Microstructure on elytra distinct, isodiametric (Figs. 11 A, B) ... 2
   Microsculpture on elytra present or absent; if present, composed of fine elongate, parallel lines (Figs. 12; 13; 14; 15) ... 4
2. (1). Mentum with distinct fovae (Fig. 139) ... 3
   Mentum without fovae (Fig. 143) ... 1. *L. infimus* Bates
3. (2). Large specimens, total length 7.8–8.6 ... 2. *L. pactinullus* New Species
   Smaller specimens, total length 5.8–7.3 mm. ... 3. *L. sculptilis* Bates
4. (1). Microsculpture on head and pronotum distinct, mostly isodiametric (Figs. 16 A, B, C); microsculpture on elytra distinct or not; if so, composed of elongate stretched lines on the intervals; hind angles of pronotum acute (Figs. 31, 32); lateral areas of pronotum explinate ... 5
   Microsculpture on head present or absent; microsculpture on pronotum present or absent, if present never as distinct as on head (Figs. 18 A, B); microsculpture on elytra, if present, obscure and elongate; if hind angles of pronotum acute, then lateral areas not explinate ... 7
5. (4). Males ... 6
   Females keyed to this couplet belong to one of the following species ... *L. rectangulus* & *L. elongatus*
6. (5). Mid portion of IS* covered with elongate, slender, hair-like scales (Figs. 74 A, B) ... 4. *L. rectangulus* New Species
   IS without elongate, slender, hair-like scales (Fig. 72) ... 5. *L. elongatus* New Species
7. (4). Metepisternum punctate (Fig. 19 A) ... 53
   Metepisternum impunctate (Fig. 20 A) ... 8
8. (7). Elytra bicolored (at least one central, pale-colored spot near the apex of the elytra, or two spots basally and two spots apically on the elytra) ... 9
   Elytra unicolorous ... 22
9. (8). Only one centrally located pale area towards the apex of the elytra ... 10
   Pale areas on each elytron located at the humeri and toward the apex; area may be oval or elongate ... 14
10. (9). Males ... 11
    Females ... 12

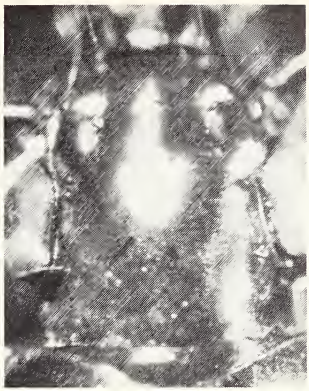
* IS = Internal sac of male aedeagus.

→

FIGS. 16–18. 16. Microsculpture distinct, isodiametric, *L. rectangulus* LeC. 16 A. Prothorax, dorsal aspect. 16 B. Head, dorsal aspect. 16 C. Head and prothorax, dorsal aspect. 17. Microsculpture slightly stretched, weakly present, *L. floridanus* LeC. 18. Microsculpture absent, *L. brevicollis* (LeC.). 18 A. Head, dorsal aspect. 18 B. Prothorax, dorsal aspect.



16A L. RECTANGULUS



16B

16C

17 L. FLORIDANUS

18A L. BREVICOLLIS

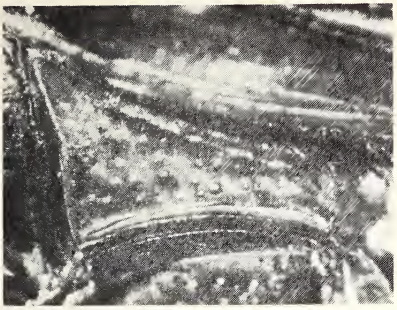
18B

11. (10). Internal sac of the aedeagus with an elongate group of scales on the ventral surface at the base of the sac (Figs. 9; 75); usually larger in size, total length 6.1–7.2 mm. (in part) ..... 6. *L. celeris* (Dejean)
Internal sac without any distinct scale groups (Fig. 76); usually smaller in size, total length 5.8–6.4 mm. (in part) ..... 7. *L. cubanus* Tschitscherine
12. (10). Females from the United States (in part) ..... *L. celeris* (Dejean)
Females from Mexico, Central America or the West Indies 13
13. (12). Females from Costa Rica, or Mexican states of Jalisco, Oaxaca, Nayarit, Sinaloa (in part) ..... *L. cubanus* Tschitscherine
Females from Cuba or Mexican states of Campeche, Chiapas, Colima, Veracruz, San Luis Potosi (in part) ... *L. celeris* (Dejean)
14. (9). Males 15
Females 21
15. (14). IS without a secondary sac 16
IS with a secondary sac on the dorsal surface in the basal portion (Figs. 90 A, B) ..... 9. *L. elnae* New Species
16. (15). IS with scales but without a distinct scale group 17
IS with at least one distinct scale group 19
17. (16). IS very elongate, almost cylindrical 18
IS shorter, sac-like, not cylindrical in shape (Fig. 85) ..... 12. *L. lepidus* New Species
18. (17). IS with a small bulbous projection at the base on the right dorso-lateral surface (Figs. 86 A, B); smaller (in part) ..... 10. *L. whiteheadi* New Species
IS without a bulbous projection at the base on the right dorso-lateral surface (Fig. 84); larger ..... 11. *L. tropicus* New Species
19. (16). IS with only 1 distinct scale group 20
IS with 2 distinct scale groups (Fig. 89) ..... 13. *L. fraus* New Species
20. (19). Scale group on the right lateral side of the sac, elongate, length ½ or more than ½ the entire length of the sac (Fig. 88) ..... 8. *L. balli* New Species
Scale group on the right lateral side of the sac, short, oblong, length ¼ or less than ¼ the entire length of the sac (Figs. 87 A, B, C) ..... 14. *L. unispinus* New Species
21. (14). Area between basal fovae of pronotum and midline usually impunctate or with only 1 puncture on each side, rarely with 2–3 punctures ..... *L. balli* New Species

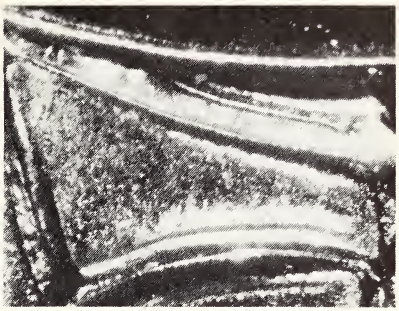
---

→

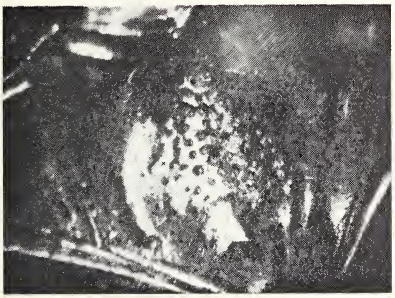
FIGS. 19–20. 19. Thorax, ventral aspect, *L. saphyrinus* (Chaud.). 19 A. Metepisternum, microsculpture absent, punctate. 19 B. Mesepisternum, microsculpture absent, punctate. 19 C. Metasternum, microsculpture absent, punctate laterally. 20. Thorax, ventral aspect, *L. agilis* (Dej.). 20 A. Metepisternum, microsculpture isodiametric, impunctate. 20 B. Mesepisternum, microsculpture isodiametric, impunctate. 20 C. Metepisternum, microsculpture isodiametric, impunctate.



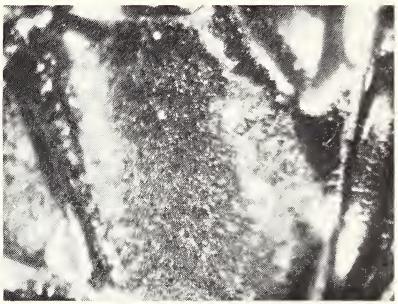
19A L. SAPHYRINUS



20A L. AGILIS

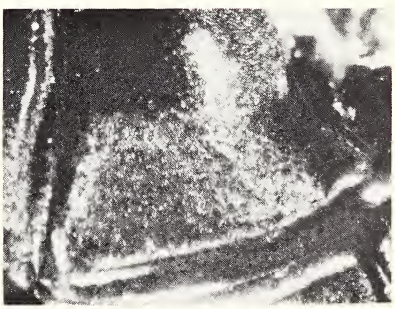


19B



20B

19C



20C

Area between basal fovae of pronotum and midline usually with at least 4 punctures ..... Females keyed to this couplet belong to one of the following species: *L. unispinus*, *L. elnae*, *L. fraus*, *L. lepidus*, *L. tropicus*, *L. whiteheadi* (in part).

22. (8). Mesepisternum punctured anteriorly (Fig. 19 B); abdominal segment 2 without ambulatory setae; posterior angles of pronotum broadly rounded and distinctly explinate (Figs. 43 A, B; 44 A, B); large species 23

Mesepisternum not punctured anteriorly (Fig. 20 B); abdominal segment 2 with or without ambulatory setae, posterior angles or pronotum broadly rounded or not, not distinctly explinate; usually smaller species 25

23. (22). Specimens from United States 24

Specimens from Mexico (in part) ..... 15. *L. yeariani* New Species

24. (23). Larger, total length not less than 10.2 mm.; ♂ & ♀ genitalia characteristic (in part) ..... 16. *L. rectus* (Say)

Smaller, total length not greater than 9.3 mm.; ♂ & ♀ genitalia characteristic (in part) ..... 17. *L. pravitubus* New Species

25. (22). Metasternum punctured toward lateral margin (Fig. 19 C) 26

Metasternum not punctured toward lateral margin (Fig. 20 C) 30

26. (25). Males 27

Females keyed to this couplet belong to one of the following species: *L. unilobus*, *L. saccisecundaris*, *L. taeniatus*, *L. extendus*.

27. (26). 1 or 2 scale groups present on the left lateral surface at the base of the IS approximate to the median lobe (Figs. 121 A; 131 B); IS without a small secondary sac near the apex on the right lateral surface 28

Scale groups absent on the left lateral surface at the base of the IS (Fig. 123 A); a small secondary sac near the apex on the right lateral surface (Fig. 123 B) ..... 18. *L. unilobus* New Species

28. (27). No secondary sacs protruding from the main IS on the left lateral surface 29

A distinct secondary sac protruding from the left side of the main IS (Fig. 121 A) ..... 19. *L. saccisecundarius* New Species

29. (28). Apex of IS elongate and not or only sparsely covered with weak small scales (Figs. 131 A, B) ..... 20. *L. extendus* New Species

Apex of IS truncate, rounded, almost entirely covered with small weakly sclerotized scales (Figs. 127 A, B) ..... 21. *L. taeniatus* LeConte

30. (25). Pronotum with hind angles obtusely pointed, not rounded and usually weakly turned to the outside (Figs. 30 A, B; 68 A, B) 31

→

FIGS. 21–24. Hind coxae, inner surface. 21. *L. agilis* (Dej.), microsculpture isodiametric. 22. *L. saphyrinus* (Chaud.), microsculpture absent. Figs. 23–34. Prothorax, dorsal aspect. 23 A. *L. fraus* n. sp. 23 B. Same, close-up of hind angle. 24 A. *L. unispinus* n. sp. 24 B. Same, close-up of hind angle.

21 L. AGILIS

22 L. SAPHYRINUS

23A L. FRAUS

23B

24A L. UNISPINUS

24B

Pronotum with hind angles rounded or if obtusely pointed then never turned to the outside 35

31. (30). Males 32
Females 33

32. (31). IS of the aedeagus with an elongate group of scales on the ventral surface at the base of the sac (Figs. 9; 75); usually larger in size, total length 6.1–7.2 mm. (in part) ..... *L. celeris* Dejean
IS of the aedeagus without any distinct scale groups (Fig. 76) usually smaller in size, total length 5.8–6.4 mm. (in part) ..... *L. cubanus* Tschitcherine

33. (31). Females from the United States (in part) ..... *L. celeris* Dejean
Females from Mexico, Central America or the West Indies 34

34. (33). Females from Costa Rica or Mexican States of Jalisco, Oaxaca, Nayarit, Sinaloa (in part) ..... *L. cubanus* Tschitscherine
Females from Cuba or Mexican states of Campeche, Chiapas, Colima, Veracruz, San Luis Potosi (in part) ..... *L. celeris* Dejean

35. (30). Pronotum with distinct microsculpture on the dorsal discal area 36
Pronotum with the microsculpture on the dorsal discal areas very fine and obscure or absent 43

36. (35). Striae narrow, microsculpture in trough usually only 1 (sometimes 2) isodiametric units wide (Fig. 13) 37
Striae wide, microsculpture in trough at least 2 and usually 3–4 isodiametric units wide (Figs. 12; 14; 15) ..... 22. *L. floridanus* LeConte

37. (36). Inner surface of hind coxae with microsculpture usually weak very fine elongate parallel lines (Fig. 22); pronotum never explinate 38
Inner surface of hind coxae with distinct isodiametric microsculpture (Fig. 21); basal and lateral margin of pronotum explinate (in part) ..... 23. *L. agilis* (Dejean)

38. (37). Males 39
Females keyed to this couplet belong to one of the following species: *L. aduncus*, *L. parallelus*, *L. cervicalis*, *L. taeniatus*, *L. spinilunatus*.

39. (38). Apex of median lobe not turned apically 40
Apex of median lobe turned apically (Fig. 124 A) ..... 24. *L. aduncus* New Species

40. (39). IS without a secondary sac protruding from the left lateral side 41
IS with a secondary sac protruding from the left lateral side (Fig. 120 A) (in part) ..... 25. *L. parallelus* New Species

41. (40). IS with one or two distinct scale groups on the ventral surface 42
IS without distinct scale groups on the ventral surface, although some groups may partially touch the ventral surface (Figs. 127 A, B) ..... *L. taeniatus* LeConte

42. (41). IS with two distinct scale groups on ventral surface basal group oriented obliquely, apical group oriented transversely (Figs. 130 A, B, C) ..... 26. *L. cerivicalis* Casey
IS with one distinct scale group on ventral surface (Figs. 132 A, B) ..... 27. *L. spinilunatus* New Species

43. (35). Specimens from Mexico or West Indies 44
Specimens from U. S. 45
44. (43.) Specimens from Mexico ..... 15. *L. yeariani* New Species
Specimens from Cuba ..... 28. *L. nocticolor* Darlington
45. (43). Striae narrow, microsculpture in trough usually 1 (sometimes 2) isodiametric units wide (Fig. 13) 46
Striae wider, microsculpture in trough at least 2 and usually 3–4 or more isodiametric units wide (Figs. 12; 14; 15) (in part) ..... *L. rectus* (Say)
46. (45). Microsculpture on inner surface of hind coxae if present, fine elongate parallel lines (Fig. 22); median lobe not compressed dorso-ventrally 47
Microsculpture on inner surface of hind coxae isodiametric; (Fig. 21); median lobe compressed dorso-ventrally, sinuate on the right lateral margin near the apex (Fig. 125) ..... 23. *L. agilis* (Dejean)
47. (46). Males 48
Females keyed to this couplet belong to one of the following species: *L. rossi, L. algidus, L. parallelus, L. unilobus, L. taeniatus, L. velox.*
48. (47). Gonopore opening on the left lateral surface of the IS 49
Gonopore opening on the right lateral surface of the IS at or near the apex (Figs. 126 A, B) ..... 29. *L. rossi* New Species
49. (48). Apex of median lobe not modified 50
Apex of median lobe indented (Figs. 134 A, B) ..... 52. *L. velox* (Dejean)
50. (49). IS with a secondary sac everting on the left lateral surface (Figs. 120 A; 133 A) 51
IS without a secondary sac everting on the left lateral surface (Figs. 123 A; 127 B) 52
51. (50). 5 distinct scale groups present on the IS (Figs. 133 A, B, C) ..... 30. *L. algidus* New Species
7 distinct scale groups present on the IS (Figs. 120 A, B) (in part) ..... *L. parallelus* New Species
52. (50). IS with a rather large distinct scale group covering most of the apex (Figs. 127 A, B) (in part) ..... *L. taeniatus* LeConte
IS without a distinct scale group at the apex although very small, weakly sclerotized scales may cover the sac's surface (Figs. 123 A, B) (in part) ..... *L. unilobus* New Species
53. (7). Mentum transverse and with deep, distinct fovae (Fig. 138) 54
Mentum not transverse, with or without fovae; if fovae are present, small and shallow (Fig. 141) 58
54. (53). Dorsal color black (sometimes with a small pale area towards the apex of the elytra); posterior angles of pronotum narrowly rounded, never turned to the outside 55
Dorsal color brown; posterior angles obtusely pointed, usually turned to the outside (Fig. 40) ..... 31. *L. crenatus* LeConte
55. (54). Males 56
Females keyed to this couplet belong to one of the following species: *L. micans, L. vitiosus, L. duryi.*

56. (55). IS with a group of scales on the ventral surface in the basal ½ on the midline, more or less lying between two lateral groups of scales (Figs. 109 E; 110 C) 57
IS without a distinct scale group on the ventral surface (Figs. 108 A, B, C) ..... 32. *L. micans* Chaudoir
57. (56). IS with a secondary sac everting near the apex on the left lateral surface, the apex of which is covered with a distinct scale group (Figs. 110 A, B, C) ..... 33. *L. vitiosus* New Species
IS without a secondary sac, although a small lobe may appear to be present: if so, the apex of the lobe is never covered with a distinct scale group (Figs. 109 A, B, C, D, E, F) ..... 34. *L. duryi* Wright
58. (53). Elytra bicolored (discolored areas on the humeri and sometimes near the apex) 59
Elytra unicolorous 61
59. (58). Lateral margins of pronotum broadly explinate posteriorly, posterior angles narrowly rounded but not acute (Fig. 26); IS with 2 parallel rows of very large spines extending the entire length of the sac (Figs. 83 A, B) ..... 35. *L. spinigrandis* New Species
Lateral margin of pronotum not explinate posteriorly, posterior angles acute; IS with or without distinct scale groups but never with spines 60
60. (59). Lateral and basal margins of pronotum coarsely and profusely punctate (Figs. 29 A, B); IS of males elongate, more or less an evenly rounded tube, entirely covered with small scales (Fig. 82 A) ..... 36. *L. discolor* New Species
Lateral and basal margins of pronotum punctate but not as coarse or as numerous as in *L. discolor* (Figs. 27 A, B); IS an elongate tube convoluted towards the apex and with a small bulbous projection on the right side at the midpoint, some surface areas lacking scales (Figs. 86 A, B) (in part) ..... *L. whiteheadi* New Species
61. (58). Pronotum with the hind angles broadly rounded (Figs. 36 A, B; 37 A, B; 38 A, B; 43 A, B; 44 A, B) 62
Pronotum with the hind angles rounded or not but not broadly rounded 66
62. (61). Metasternum coarsely and distinctly punctate over a large area toward the lateral margin 63
Metasternum punctate or not, if so then only a few shallow punctures, never coarse punctures (in part) ..... *L. pravitubus* New Species
63. (62). Lateral margins of pronotum near basal angles distinctly explinate ..... 37. *L. saphyrinus* (Chaudoir)
Lateral margins of pronotum near basal angles not explinate 64
64. (63). Smaller, total length not greater than 10.0 mm. 65
Larger, total length not less than 10.2 mm. (in part) ..... *L. rectus* (Say)

→

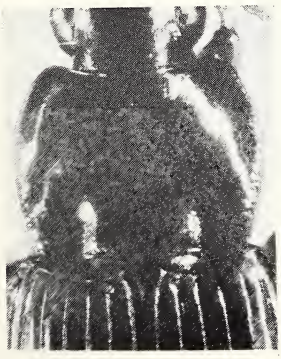
FIGS. 25–28. Prothorax, dorsal aspect. 25. *L. balli* n. sp. 26. *L. spinigrandis* n. sp. 27 A. *L. whiteheadi* n. sp. 27 B. Same, close-up of hind angle. 28 A. *L. elnae* n. sp. 28 B. Same, close-up of hind angle.

25 L. BALLI

26 L. SPINIGRANDIS

27A L. WHITEHEADI

27B



28A L. ELNAE

28B

65. (64). Lateral margins of pronotum evenly rounded giving the pronotum a more rotund appearance; basal angles broadly rounded (Figs. 37 A, B); IS distinctly turned to the left side, without scale groups on the ventro-lateral margins at the base of the sac (Fig. 105) ..... *L. lucens* (Chaudoir)

Lateral margins of pronotum less rounded basally, pronotum less rotund, posterior angles more distinct than in *L. lucens* (Figs. 38 A, B); IS elongate, not turned to the left side with 1 elongate scale group on the ventro-lateral margin on each side at the base of the sac (Fig. 107) ..... 39. *L. uniformis* New Species

66. (61). Pronotum with hind angles more or less acute; species with a total length not less than 8 mm. 67

Pronotum with hind angles rounded (Figs. 65 A, B); species with a total length not greater than 7 mm. .. 40. *L. minutus* New Species

67. (66). Pronotum with distinct microsculpture AND/OR the IS with a large distinct secondary sac everting on the right lateral surface near the apex, sclerotized ring on the secondary sac (Figs. 99 A, B) 68

Pronotum without distinct microsculpture (sometimes vaguely present); IS without a large secondary sac on the right lateral surface near the apex 70

68. (67). Males 69

Females keyed to this couplet belong to one of the following species: *L. velocipes*, *L. inferus*.

69. (68). Five distinct scale groups on the IS (Figs. 99 A, B) ..... 41. *L. velocipes* Casey

Four distinct scale groups on the IS ..... 42. *L. inferus* New Species

70. (67). Lateral margin of pronotum sinuate posteriorly (Figs. 45; 46; 48; 70 A, B); IS without parallel scale groups at the base on the dorsal or ventral surface or if with parallel scale groups then an elongate secondary sac everting on the left lateral surface (Fig. 101 A) 71

Lateral margin of pronotum not at all sinuate posteriorly, evenly rounded; IS with parallel scale groups at the base on the dorsal or ventral surface without an elongate secondary sac (Fig. 102 D) 74

71. (70). Basal impressions of pronotum continuous with a secondary posterior marginal sulcus (Figs. 5; 70 A, B); specimens from Central America ..... 43. *L. remotus* New Species

Basal impressions of pronotum not continuous with a secondary posterior marginal sulcus; specimens from the Continental United States 72

72. (71). IS with an elongate secondary sac everting on the left lateral surface (Fig. 101 A); width of pronotum 3.4 mm. or more ..... 44. *L. brevicollis* (LeConte)

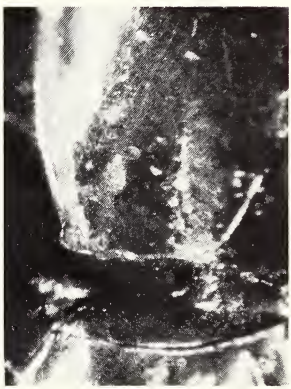
→

FIGS. 29–32. Prothorax, dorsal aspect. 29 A. *L. discolor* n. sp. 29 B. Same, close-up of hind angle. 30 A. *L. celeris* (Dej.). 30 B. Same, close-up of hind angle. 31. *L. rectangulus* LeC. 32. *L. elongatus* n. sp.

29A L. DISCOLOR

29B

30A L. CELERIS



30B

31 L. RECTANGULUS

32 L. ELONGATUS

IS without an elongate secondary sac everting on the left lateral surface; width of pronotum 3.3 mm. or less 73

73. (72). Specimen usually larger; TL—9.6, WH—1.9, WP—3.0, WW—3.9; IS elongate without a secondary sac (Figs. 95 A, B) ..... 45. *L. erraticus* (Dejean)

Specimens usually smaller, TL—8.6, WH—1.5, WP—2.6, WW—3.0; IS not elongate, with a bulbous secondary sac everting on the left lateral surface (Figs. 96 A, B; 97) .. 46. *L. gibbus* New Species

74. (70). Males 75

Females keyed to this couplet belong to one of the following species: *L. nitidulus, L. minor, L. cincinnatiensis, L. robustus, L. circulus.*

75. (74). IS with two elongate groups of scales lying parallel to one another on the dorsal surface in the basal ½ 76

IS without two parallel groups of scales on the dorsal surface in the basal ½ (one elongate group may be present on the left side but never a matching group on the right side) 78

76. (75). IS with 5 or 6 distinct scale groups 77

IS with 4 distinct scale groups (Figs. 118 A, B) ..... 48. *L. robustus* New Species

77. (76). IS with 5 distinct scale groups (Fig. 116) ..... 49. *L. cincinnatiensis* Casey

IS with 6 distinct scale groups (Fig. 117) .... 50. *L. minor* Chaudoir

78. (75). IS with 5 distinct scale groups excluding a group of very elongate, slender scales near the sclerotized ring .. 47. *L. nitidulus* LeConte

IS with 6 or 7 distinct scale groups excluding a group of very elongate scales near the sclerotized ring which may or may not be present ..... 51. *L. circulus* New Species

1. **Loxandrus infimus** Bates
Figs. 3; 33; 71 A, B; 144

Loxandrus infimus Bates 1881:87. *Lectotype* (here selected). ♂. The data label lists the specimen from Cubilguitz, Vera Paz. Collected by Champion. One additional specimen is in the syntypic series (BM). This does not agree with Bates' description in which he stated there was a male and a female.

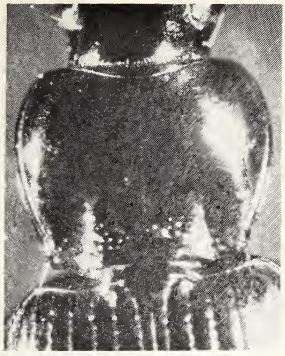
L. mutans Darlington 1935:180. *Holotype.* ♂. Type No. 22022. Haiti, Etang Lachau.

DESCRIPTION: *Color.* Dorsal: black, dull, not shining, apex of elytra in some specimens orange or light brown. Ventral: black to

---

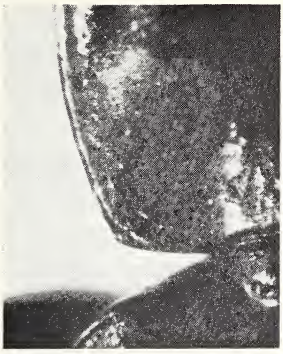
→

FIGS. 33–36. Prothorax, dorsal aspect. 33. *L. infimus* Bates. 34. *L. sculptilis* Bates. 35 A. *L. pactinullus* n. sp., close-up of hind angle. 35 B. Same. 36 A. *L. saphyrinus* (Chaud.), close-up of hind angle. 36 B. Same.



33 L. INFIMUS

34 L. SCULPTILIS



35A L. PACTINULLUS

35B

36A L. SAPHYRINUS

36B

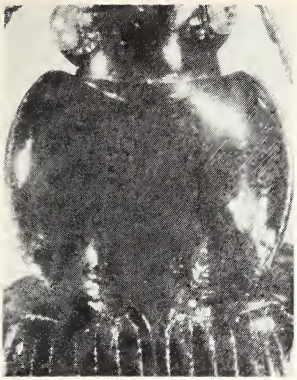
dark brown; last abdominal segment sometimes light brown. Appendages: dark to light brown, occasionally black. *Head.* Clypeus: anterior margin straight. Epistomal suture: distinct, complete. Subgenal suture: obscure or absent. Frontal sulci: obscure or absent. Microsculpture: clypeus, frons and vertex absent. Mentum: apex of lobes rounded; tooth distinct, slightly shorter than lobes; furrows shallow; fovae absent; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture elongate on disk, isodiametric along the lateral margins and posteriorly; lateral margins sinuate posteriorly; posterior angles subacute; anterior marginal sulcus complete; posterior marginal sulcus incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions short, broad, punctate, area between basal impressions punctate; area between basal impressions and lateral margins sparsely punctate posteriorly. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: microsculpture elongate medially, isodiametric laterally; impunctate. Proepisternum and Proepimeron: microsculpture isodiametric; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: Microsculpture isodiametric; anterior quarter punctate. Metasternum: microsculpture elongate medially, isodiametric laterally; impunctate. Metepisternum and Metepimeron: microsculpture isodiametric; impunctate. *Legs.* Hind coxae: microsculpture on inner surface isodiametric. Tarsal segments: 1–3 of middle and hind tarsi grooved dorsolaterally. *Elytra.* Microsculpture on intervals distinct, isodiametric; all striae distinct, punctate, trough 1–2 isodiametric units wide; internal plica well developed, weakly developed, or absent; humeri rounded; microsculpture of epipleura isodiametric. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally, impunctate; segments 1–5 rugose laterally. *Aedeagus.* Median lobe: apical half to quarter enlarged. Internal sac: everts medially; a scale group developed at apex of sac; most of the remainder of surface covered with small scales; sclerites absent; sclerotized ring absent. *Measurements.* (18 specimens). TL—7.4 (6.3–8.0); WH—1.5 (1.3–1.7); WP—2.2 (1.8–2.3); WW—2.9 (2.4–3.3).

DISTRIBUTION. Central and South America.

LOCALITIES. MEXICO. Colima: 16.5 mi. E. Colima, Rte. 110, 1900 ft. (GB); Colima, Rte. 110, 1500 ft. (GB); 8 mi. S. W. Colima (GB). Guerrero: 30.8 mi. N. Zumgango del Rio, Rte. 95, 1900 ft. (GB). Michoacan:

→

FIGS. 37–40. Prothorax, dorsal aspect. 37 A. *L. lucens* Chaud. 37 B. Same, close-up of hind angle. 38 A. *L. uniformis* n. sp. 38 B. Same, close-up of hind angle. 39. *L. micans* Chaud. 40. *L. crenatus* LeC.

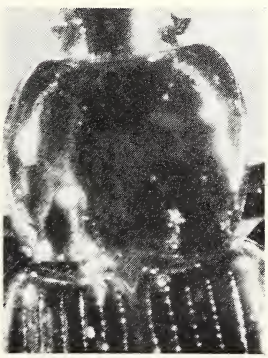


37A L. LUCENS

37B

38A L. UNIFORMIS

38B



39 L. MICANS

40 L. CRENATUS

15 mi. W. La Piedad (GB). Morelos: Tejalpa (GB). Quintana Roo: 15.3 mi. W. Chetumal, 100 ft. (GB). Sinaloa: Mazatlan (GB). Sonora: El Oasis, Rte. 15 (GB). Tabasco: San Juan Bautista (BM). Tamaulipas: 73.1 mi. N. Manuel, 200 ft. (GB). UNITED STATES. Texas. Cameron; Brownsville (Darlington, 1935). WEST INDIES. Haiti. Etang Lachaux; swamps north of Dessalines; Damien (near Port-au-Prince) (MCZ). *Cubilguitz, Vera Paz (BM).

COMMENTS. This species resembles *L. sculptilis* and *L. perplexus* in external appearance. It can readily be separated from them by the absence of fovae on the mentum, by the sinuate lateral margins of the pronotum, and by the more acute posterior angles of the pronotum. I have seen one specimen of this species from Brazil. Two specimens I examined were collected in New Orleans, Louisiana (USNM) but were intercepted on banana debris from Mexico. Darlington (1938) recorded this species from Brownsville, Texas. Darlington (1935) described *L. mutans*, a synonym of *L. infimus*, from Haiti. There were 19 paratypes in the material he studied from three different localities. He states that "My specimens were taken under trash and in loose soil a little above water level beside standing water." The remainder of the specimens I have examined were collected in Mexico. Csiki's Catalogue also records this species from Guatemala. Collecting data shows that the species has been collected in the months of April, June, July, August, September, October, and November. It has occoccasionally been taken at lights.

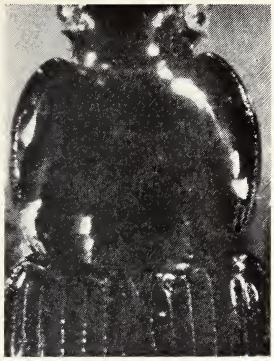
2. **Loxandrus pactinullus** New Species
Figs. 35 A, B; 93 A, B, C; 154

HOLOTYPE. ♂. MEXICO. Michoacan: 8.1 mi. E. Villamar, Rte. 15, 5500 ft., July 31, 1966. George E. Ball and D. R. Whitehead, Collectors (MCZ). Paratypes. 12♂♂ 8 ♀♀ (GB); 1 ♀ 1♂ (UA); 1 ♂ (BM).

DESCRIPTION. *Color.* Dorsal: black to dark brown. Ventral: dark to light brown. Appendages: usually light brown, sometimes dark. *Head.* Clypeus: anterior margin straight. Epistomal suture: distinct, complete. Subgenal suture: present or absent. Frontal sulci: obscure or absent. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, as long as lobes; furrows present, shallow; fovae deep; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture elongate

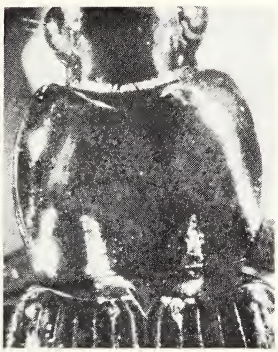
→

FIGS. 41–44. Prothorax, dorsal aspect. 41. *L. vitiosus* n. sp. 42. *L. duryi* Wright. 43 A. *L. rectus* (Say). 43 B. Same, close-up of hind angle. 44 A. *L. pravitubus* n. sp. 44 B. Same, close-up of hind angle.

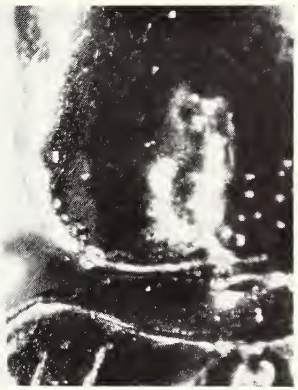


41 L. VITIOSUS

42 L. DURYI



43A L. RECTUS



43B

44A L. PRAVITUBUS

44B

on the disk, isodiametric along the lateral margins and posteriorly; lateral margins punctate, not sinuate posteriorly; posterior angles weakly pointed; anterior marginal sulcus complete; posterior marginal sulcus present, never complete; median sulcus may or may not reach the anterior and/or posterior sulci; basal impressions shallow, short, punctate; area between basal impressions punctate (more so than in *L. sculptilis* Bates); area between basal impressions and lateral margins punctate. Scutellum: apex narrowly rounded; microsculpture distinct, isodiametric. Prosternum: microsculpture elongate medially, isodiametric laterally; impunctate. Proepisternum and Proepimeron: microsculpture isodiametric; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture isodiametric; impunctate. Metasternum: microsculpture elongate medially, isodiametric laterally; impunctate. Metepisternum: microsculpture isodiametric; impunctate. Metepimeron: microsculpture elongate; impunctate. *Legs.* Hind coxae: microsculpture on inner surface isodiametric. Tarsal segments: 1–3, sometimes 4, of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals distinct, isodiametric; all striae distinct, trough 1–2 isodiametric units wide; internal plica weakly developed or absent; humeri rounded; microsculpture of epipleura isodiametric. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–4 rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially; scales present but no distinct scale groups; sclerites absent; the ring is a very elastic process but not sclerotized. *Measurements.* (19 specimens). TL—8.0 (7.8–8.6); WH—1.7 (1.6–1.9); WP—2.7 (2.6–2.9); WW—3.3 (2.9–3.5).

DISTRIBUTION. Mexico.

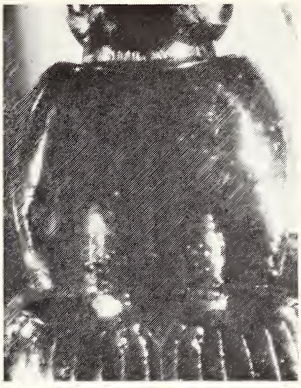
LOCALITIES. MEXICO. Colima: 16.5 mi. E. Colima, Rte. 110, 1900 ft. (GB). Michoacan: 8.1 mi. E. Villamar, Rte. 15, 5500 ft. (GB). Morelos: Cuatla (GB); Cuernavaca (GB); Tejalpa (GB). Sonora: El Oasis, Rte. 15 (GB).

DISCUSSION. This species is similar to *L. infimus* but can be readily separated from that species by the absence of fovae on the mentum. *L. pactinullus* agrees in most external characters with *L. sculptilis* but the latter species is considerably smaller. Bates confused this species with *L. sculptilis* and it is probably misidentified in most collections.

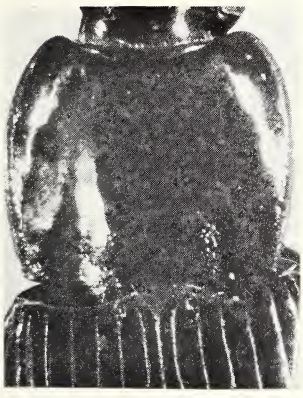
→

FIGS. 45–50. Prothorax, dorsal aspect. 45. *L. erraticus* (Dej.). 46. *L. gibbus* n. sp. 47. *L. velocipes* Casey. 48. *L. brevicollis* (LeC.). 49. *L. nitidulus* (LeC.). 50. *L. circulus* n. sp.

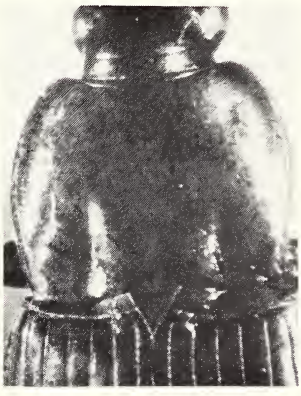
45 L. ERRATICUS



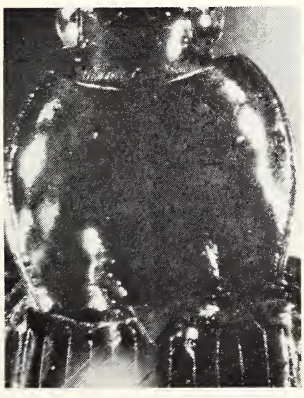
46 L. GIBBUS



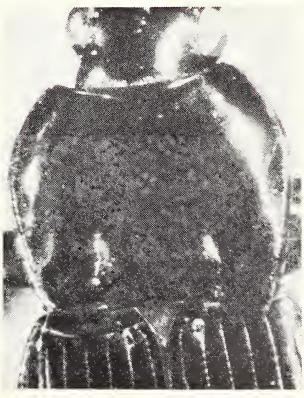
47 L. VELOCIPES



48 L. BREVICOLLIS



49 L. NITIDULUS



50 L. CIRCULUS

It also resembles some Agonini due to the absence on the elytra of the internal plica in some specimens. For further comments see the description of *L. sculptilis* and *L. pactinullus*. It is known only from Mexico where it has been collected during the months of June, July, and August.

3. **Loxandrus sculptilis** Bates
Figs. 34; 91 A, B; 153

Loxandrus sculptilis Bates, 1881:278. *Lectotype* (here designated). ♂. The data label gives the following information: Tole, Panama, Champion (Collector) (BM). Four additional specimens are marked as syntypes in the BM collection. This does not agree with Bates' description which listed only a male and female.

DESCRIPTION. This species resembles *L. pactinullus* in all characters except the following: (1) furrows on the mentum are absent; (2) the posterior areas of the pronotum are not as densely punctate; (3) the posterior marginal sulcus of the pronotum is sometimes complete; (4) the species is smaller in almost all respects. A comparison of size ranges follows:

	TL	WH	WP	WW
L. sculptilis	5.8–7.3	1.3–1.5	1.9–2.2	2.5–2.9
L. pactinullus	7.8–8.6	1.6–1.9	2.6–2.9	2.9–3.5

The aedeagus is also smaller in *L. sculptilis*.

DISTRIBUTION. Central America.

LOCALITIES. MEXICO. Morelos: Santa Rosa, 3.2 mi. N. Zacatepec, 3100 ft. (GB). Sinaloa: Presidio River vs. Union Sin (USNM). Tamaulipas: 27.5 mi. W. Soto la Marina, 1600 ft. (GB); *1.4 mi. SE. Chamal, 500 ft. (GB); 73.1 mi. N. Manuel, 200 ft. (GB). Chiapas: 7.7 mi. N. Frontera Comalpa, 2600 ft. (GB). Jalisco: 23.2 mi. S. Autlan, 800 ft., Rte. 80 (GB). Colima: Colima, 1500 ft., Rte. 110, at light (GB). Oaxaca: Tehuantepec (RTB). PANAMA. Riqui: Tolé (BM).

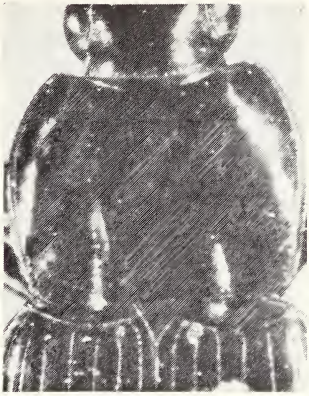
DISCUSSION. This is one of several species of *Loxandrus* that closely resemble some species in the tribe Agonini. The presence of the internal plica is variable and the presence of distinct isodiametric microsculpture on the elytra is unlike most species of *Loxandrus*. It

---

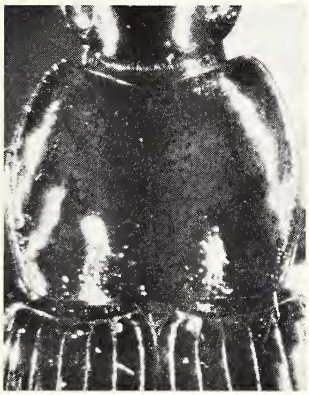
→

FIGS. 51–56. Prothorax, dorsal aspect. 51. *L. minor* (Chaud.). 52. *L. cincinnatiensis* Casey. 53. *L. robustus* n. sp. 54. *L. saccisecundaris* n. sp. 55. *L. parallelus* Casey. 56. *L. agilis* (Dej.).

51 L. MINOR



52 L. CINCINNATIENSIS



53 L. ROBUSTUS

54 L. SACCISECUNDARIS

55 L. PARALLELUS

56 L. AGILIS

shares most characters in common with *L. pactinullus* but can be distinguished from this species by its smaller size. This species has been collected in March, April, June, July, August, September, and October.

4. **Loxandrus rectangulus** LeConte
Figs. 31; 74 A, B; 146

Loxandrus rectangulus LeConte 1878:377. Holotype. ♂. Enterprise, Florida, May 19 (MCZ). One additional specimen in the series, a female. This agrees with LeConte's original description.

DESCRIPTION. *Color.* Dorsal and ventral: usually black, sometimes dark brown,, shining but not iridescent. Appendages: dark to light brown. *Head.* Clypeus: anterior margin straight. Epistomal and subgenal sutures distinct, complete. Frontal sulci: moderately impressed; short, broad. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, almost as long as lobes; furrows and fovae absent; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture distinct, isodiametric anteriorly, sometimes slightly elongate posteriorly and laterally; lateral margins punctate in the posterior half to quarter, sinuate posteriorly; posterior angles acute; anterior marginal sulcus deep, complete; posterior marginal sulcus reaching past the basal fovae but incomplete; median sulcus distinct, reaching anterior sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions punctate; area between impressions and lateral margins sparsely punctate or not. Scutellum: apex narrowly rounded; microsculpture isodiametric. Ventral surface entirely impunctate, microsculpture elongate, more or less present on all ventral sclerites. *Legs.* Hind coxae: Microsculpture on inner surface elongate. Tarsi: segments 1–4 of hind tarsi, 1–3 and sometimes 4 of middle tarsi grooved dorso-laterally. *Elytra.* Microsculpture present or absent, if present composed of very elongate parallel lines; all striae distinct, punctate, trough 2–4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura isodiametric along the margin, very elongate or absent elsewhere. *Abdominal sternites.* Microsculpture isodiametric laterally, slightly elongate medially; segment 1 sometimes punctate at the base, laterally, other segments impunctate; segments 1–4 sometimes weakly rugose laterally.

→

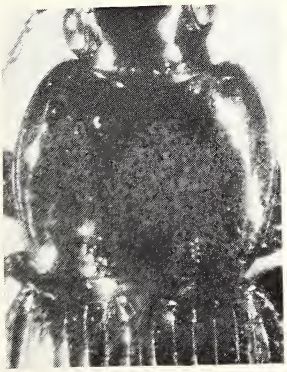
FIGS. 57–62. Prothorax, dorsal aspect. 57. *L. aduncus* n. sp. 58. *L. floridanus* LeC. 59. *L. unilobus* n. sp. 60. *L. taeniatus* LeC. 61. *L. rossi* n. sp. 62. *L. extendus* n. sp.

57 L. ADUNCUS

58 L. FLORIDANUS

59 L. UNILOBUS

60 L. TAENIATUS



61 L. ROSSI

62 L. EXTENDUS

Aedeagus. Median lobe: not modified. Internal sac: everts in a median position, very elongate; one distinct scale group present; much of the mid-portion covered by very elongate scales; other areas covered with small, weakly sclerotized scales. Sclerotized ring absent. *Measurements.* (9 ♂ specimens). TL—7.3 (6.7–7.6); WH—1.5 (1.3–1.5); WP—2.1 (1.9–2.2); WW—3.1 (2.8–3.4).

DISTRIBUTION. United States (Southern Florida) and Southern Mexico.

LOCALITIES. MEXICO. Campeche: 14.9 mi. S. Champoton, Rte. 180, 20 ft. (GB). Chiapas: San Quintin, 91°20′–16°24′, 700 ft. (GB). Veracruz: .8 mi. W. Sontecomapan, sea level (GB). UNITED STATES. Florida. Highlands Co.: Archbold Bio. Sta., Lake Placid (CU). Manatee Co.: Oneco (GB). Volusia Co.: Enterprise (MCZ). *Texas. An unrecorded locality (MCZ, LeConte Coll.). WEST INDIES. Grand Cayman Island. South Sound (MCZ).

DISCUSSION. This species and *L. elongatus* appear to be alike in all external characters. They can be separated only on characters associated with the male genitalia. *L. rectangulus* has been collected at two localities in Florida while *L. elongatus* is known only from Mexico. Collecting data indicate that *L. rectangulus* has been collected in swamp and marsh habitats. It has been found in February, April and September.

5. **Loxandrus elongatus** New Species

Figs. 32; 72; 145

HOLOTYPE. ♂. MEXICO. Veracruz: 3.6 mi. N. Catemaco, 1000 ft., June 5, 1966. George E. Ball and D. R. Whitehead, Collectors (MCZ). Paratypes. 12 ♂♂ (GB) 1 ♂ (UA).

DESCRIPTION. This species resembles *L. rectangulus* in most external characters. The only distinguishable external difference appears to be in the microsculpture on the intervals of the elytra. In this species the microsculpture is usually evident as fine elongate parallel lines whereas in *L. rectangulus* the microsculpture is always absent. Other distinguishing differences are found in the male genitalia. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position and is directed to the left side; a small bulbous secondary sac on the basal quarter of the main sac protruding from

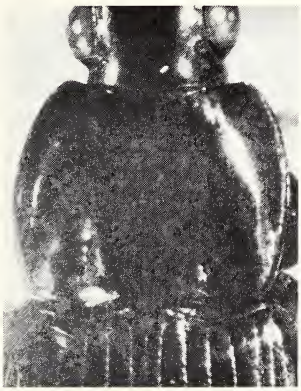
---

→

FIGS. 63–67. Prothorax, dorsal aspect. 63. *L. cervicalis* Casey. 64. *L. spinilunatus* n. sp. 65 A. *L. minutus* n. sp. 65 B. Same, close-up of hind angle. 66. *L. algidus* n. sp. 67. *L. lepidus* n. sp.

63 L. CERVICALIS

64 L. SPINILUNATUS



65A L. MINUTUS

65B

66 L. ALGIDUS

67 L. LEPIDUS

the right lateral surface, a small scale group at its apex; no distinct scale groups present on the main sac although the surface is covered with very small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (11 ♂ specimens). TL—7.6 (6.7–8.1); WH—1.5 (1.4–1.6); WP—2.1 (1.8–2.3); WW—3.3 (3.0–3.5).

DISTRIBUTION. Southern Mexico.

LOCALITIES. MEXICO. Chiapas: San Quintin, 91°20′–16°24′ (GB); 700 ft. Veracruz: 3.7 mi. N. Catemaco 1000 ft. (GB); 2.5 mi. W. Sontecomapan 100 ft. (GB); .8 mi. W. Sontecomapan (GB).

DISCUSSION. This species has been collected in February, June and September. It closely resembles *L. rectangulus* in external appearances. Females of the two species cannot be separated.

6. **Loxandrus celeris** (Dejean)

Figs. 9; 30 A, B; 75; 147

Feronia celeris Dejean 1828:246. *Lectotype* (here selected). ♂. The first specimen in a series of four specimens in the Paris Museum. The locality label lists it from Boreal America.

Loxandrus rapidus Chaudoir 1868:344. *Lectotype* (here selected). ♂. The first specimen in a series of three specimens in the Paris Museum. The specimen bears no data labels on the pin but the Chaudoir determination label lists it from Louisiana.

DESCRIPTION. This species is like *L. cubanus* Tschitscherine in all external characters except the following: (1) the microsculpture on the pronotum is not as distinct; (2) the microsculpture on the mesepisternum is isodiametric in the anterior half and elongate or absent in the posterior half. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially; slightly directed to the right side; one elongate, well developed scale group on the ventral surface at the base of the sac; remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (20 specimens). TL—6.8 (6.1–7.2); WH—1.4 (1.3–1.5); WP—2.1 (1.9–2.2); WW—2.8 (2.6–3.1).

DISTRIBUTION. Southern United States and Southern Mexico.

LOCALITIES. MEXICO. Campeche: 14.9 mi. W. Champaton, Rte. 180, 20 ft. (GB); 31.8 mi. E. Escarcega, 200 ft. (GB). Chiapas: 6 mi. W. Cintalapa, Rte. 190, 1950 ft. (GB); San Quintin, 90°20′–16°24′, 700 ft. (GB). Colima: 16.5 mi. E. Colima, Rte. 110, 1900 ft. (GB). San Luis Potosi: 1.8 mi. N. El Narajo, 1000 ft. (GB). Veracruz: E. Minatilan, Rte. 180, 60 ft. (GB); 2.5 mi. W. Sontecompan 100 ft. (GB). UNITED STATES. Alabama. Mobile Co.: Mobile (MCZ). Winston Co.: Winston Co. National Forest (CU). Florida. Alachua Co.: Gainesville (FSPB).

Dade Co.: Homestead (FSPB). Duval Co.: Jacksonville (CAS). Highlands Co.: Archbold Biological Station, Lake Placid (PSU, CU). Hillsborough Co.: Tampa (MSU). Jefferson Co.: Monticello (DW). Lucie Co.: Capron (Ft. Capron on an 1861 map) (USNM). Manatee Co.: Oneco (GB). Okeechobee Co.: Shore Lake Okeechobee, 6 mi. S. Okeechobee (GB, CU); Basinger (PU). Orange Co.: Titusville (CNC). Pinellas Co.: Clearwater (CMNH); Dunedin (CU, PU); Royal Palm Park (PU). Sarasota Co.: Myakka River State Park (TLE, GB). St. Johns Co.: St. Augustine (MCZ). Volusia Co.: Enterprise (USNM); New Smyrna (OSU). Unrecorded localities in Florida (OSU, USNM, CU). Georgia. Baker Co.: Emory Univ. Field St., Newton (CU?). Bibb Co.: Macon (TLE); Glynn Co.: St. Simons Island (USNM). Lee Co.: Smithville (CU). Louisiana. Calcasieu Co.: Sabine River Ferry Landing (CU, CAS). Franklin Co.: Chase (UA). Orleans Co.: New Orleans (MCZ, USNM, CAS). Plaquemines Co.: Myrtle Grove (INHS). St. Mary Co.: Franklin (DW). Vermilion Co.: Gueydan (USNM). Unrecorded localities in Louisiana (UM, CAS, AM, USNM). Mississippi. Jackson Co.: Horn Island (CU); Lucedale (CU). South Carolina. Beaufort Co.: no locality (CNC). Texas. Brazos Co.: College Station (TAM). Dallas Co.: Dallas (MCZ). Galveston Co.: Galveston (UK). WEST INDIES. Bahamas. Cat Island: Arthur's Town (MCZ). Grand Cayman: South Sound (MCZ). Inayua (Island?) (MCZ). CUBA. Soledad (MCZ).

DISCUSSION. *L. celeris* resembles *L. cubanus* in most external characters. Identification of females from outside the United States can be made only on the basis of their geographical distribution. Identification of females and males from the United States is based on the shape of the posterior angles of the pronotum and on the aedeagii of males. Specimens from the eastern part of the United States usually have a distinct orange spot near the apex of the elytra while those from farther west usually lack this spot. This species has been collected in all months of the year. It is commonly found in very moist areas and can be collected under leaf debris and by treading. It has also been collected at lights.

7. **Loxandrus cubanus** Tschitscherine
Figs. 68 A, B; 76; 148

Loxandrus cubanus Tschitscherine 1903:60. *Holotype*. ♂. Brussels Museum of Natural History. *Paratypes*. 1 ♀. Brussels Museum of Natural History.

DESCRIPTION. *Color*. Dorsal: black or dark brown; shining; elytra iridescent; distal area of elytra sometimes with a centrally located orange spot. Ventral: black or dark brown; apex of last abdominal segment usually light brown. Appendages: dark to light brown or straw yellow. *Head*. Clypeus: anterior margin straight or very

slightly concave. Epistomal suture: distinct, complete. Subgenal suture: present or absent. Frontal sulci: obscure, broad, shallow. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, almost as long as lobes (mentum more or less transverse); furrows shallow; fovae, if present, small, shallow; microsculpture isodiametric or slightly elongate. *Thorax.* Pronotum: microsculpture elongate on the disk, isodiametric along the lateral and basal margins and in the basal impressions; lateral margins rounded in the anterior half, more or less tapering in the posterior half, not sinuate, impunctate, posterior angles acute; anterior marginal sulcus present or absent, not complete if present; posterior marginal sulcus reaching well past the basal impressions but incomplete; median sulcus usually not reaching the anterior marginal sulcus, never reaching the posterior margin; basal impressions elongate, moderately deep, sparsely punctate; area between the basal impressions punctate; area between the basal impressions and the lateral margins, if punctate, with only 1 or 2 punctures. Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture elongate medially, isodiametric laterally. Proepisternum and proepimeron: microsculpture slightly to very elongate. Mesosternum: microsculpture elongate. Mesepisternum: microsculpture isodiametric in anterior three quarters, elongate in posterior quarter. Metasternum: microsculpture elongate medially, isodiametric laterally. Metepisternum: microsculpture isodiametric. Metepimeron: microsculpture, if present, very elongate. *Legs.* Hind coxae: microsculpture on inner surface absent or very elongate. Tarsi: segments 1–3 of middle and hind tarsi and sometimes 4 of hind tarsi grooved dorsolaterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 1–3 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture distinct, isodiametric laterally, elongate medially; impunctate; segments 1–5 sparsely rugate laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, strongly turned to the right side; district scale groups absent; small, weakly sclerotized scales covering most of the sac's surface; sclerotized ring absent. *Measurements.* (16 specimens). TL—6.0 (5.8–6.4); WH—1.3 (1.2–1.4); WP—1.8 (1.7–2.0); WW—2.5 (2.3–3.1).

→

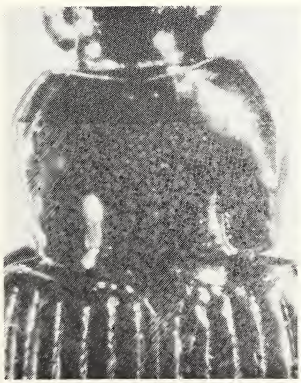
FIGS. 68–70. Prothorax, dorsal aspect. 68. A. *L. cubanus* Tschit. 68 B. same, close-up of hind angle. 69 A. *L. tropicus* n. sp. 69 B. Same, close-up of hind angle. 70 A. *L. remotus* n. sp. 70 B. Same, close-up of hind angle.

68A L. CUBANUS

68B

69A L. TROPICUS

69B



70A L. REMOTUS

70B

DISTRIBUTION. Mexico, Central America and West Indies.

LOCALITIES. COSTA RICA. Guanacaste: 5 km. N. Canas (GN). MEXICO. Jalisco: 10.2 mi. NE. La Huerta, Rte. 80, 1200 ft. (GB). Sinaloa: Los Machis (GB). Nayarit: 5.7 mi. E. San Blas, Rte. 46, 140 ft. (GB). Oaxaca: 13.8 mi. W. Zanatepec, Rte. 190, 475 ft. (GB); 1.7 mi. W. Zanatepec, Rte. 190, 300 ft. (GB). WEST INDIES. Bahamas. Arthur's Town (Cat I.) (MCZ); Inagua (MCZ). Cuba. Soledad (Cienfuegos) (MCZ). Oriente: *Aguadores (MCZ). Dominican Republic. Puerto Plata (MCZ), *Sanchez (MCZ). Haiti. Swamps N. of Dessalines (MCZ). Puerto Rico. Guanica Lagoon (MCZ).

DISCUSSION. This species closely resembles *L. celeris*. Females of these two species can only be identified by using geographical data. Specimens from Oaxaca have an orange colored spot near the apex of the elytra. Specimens from other areas in Mexico and Central America lack this spot. Darlington (1934) synonymized this species with *L. celeris*. As I have stated, the external characters of the two species are very similar. The genitalia of the males, however, are distinct. *L. cubanus* has been found in marsh habitats. It has been collected in July and August.

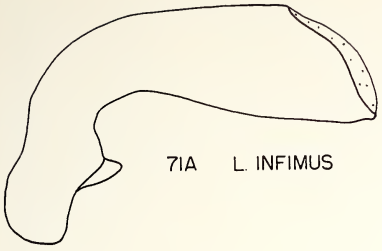
8. **Loxandrus balli** New Species
Figs. 25; 88; 151

HOLOTYPE. ♂. MEXICO. Veracruz: 2.5 mi. W. Sontecomapan, 100 ft., September 20–26, 1965. George E. Ball and D. R. Whitehead, Collectors (MCZ). Paratypes: 65 ♂♂ 66 ♀♀ (GB); 1 ♂ 1 ♀ (GN); 1 ♂ 2 ♀♀ (UA); 1 ♀ (BM).

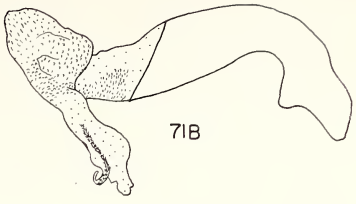
DESCRIPTION. *Color*. Dorsal: black to dark brown, shining; elytron with 1 yellow or orange spot near the humeri and 1 near the apex. Ventral: black to dark brown, apex of last abdominal segment yellow. Appendages: usually pale yellow, sometimes brown or orange. *Head*. Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: obscure, ill defined. Frontal sulci: obscure; shallow, broad, short. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct,

→

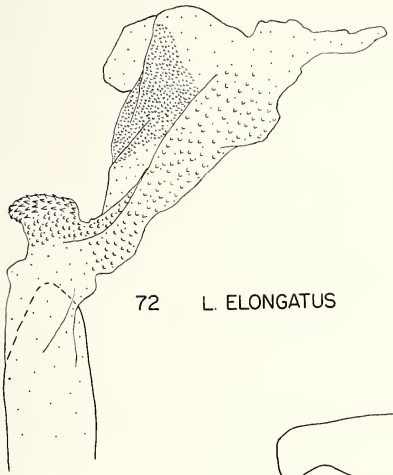
FIGS. 71–74. Male genitalia. 71 A. *L. infimus* Bates, left lateral aspect. 71 B. Same, right lateral aspect, IS everted. 72. *L. elongatus* n. sp., dorsal aspect, IS everted. 73 A. *L. dubius* (Curtis), left lateral aspect. 73 B. Same, left lateral aspect, IS everted. 74 A. *L. rectangulus* LeC., left lateral aspect, IS everted. 74 B. Same, dorsal aspect, IS everted.



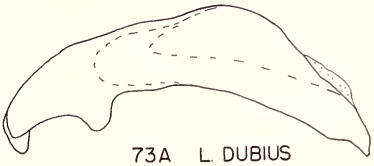
71A L. INFIMUS



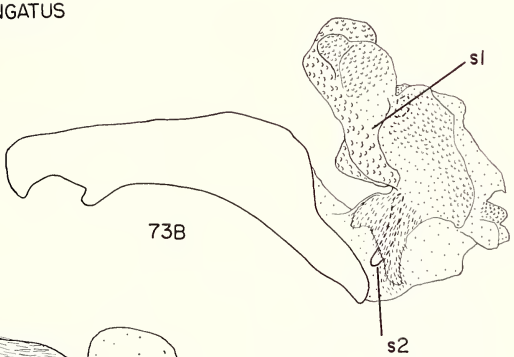
71B



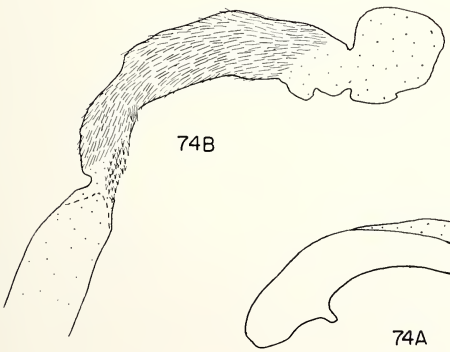
72 L. ELONGATUS



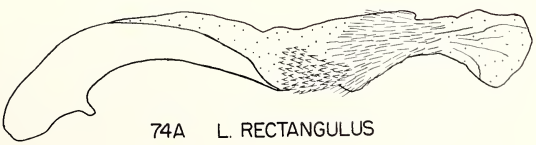
73A L. DUBIUS



73B



74B



74A L. RECTANGULUS

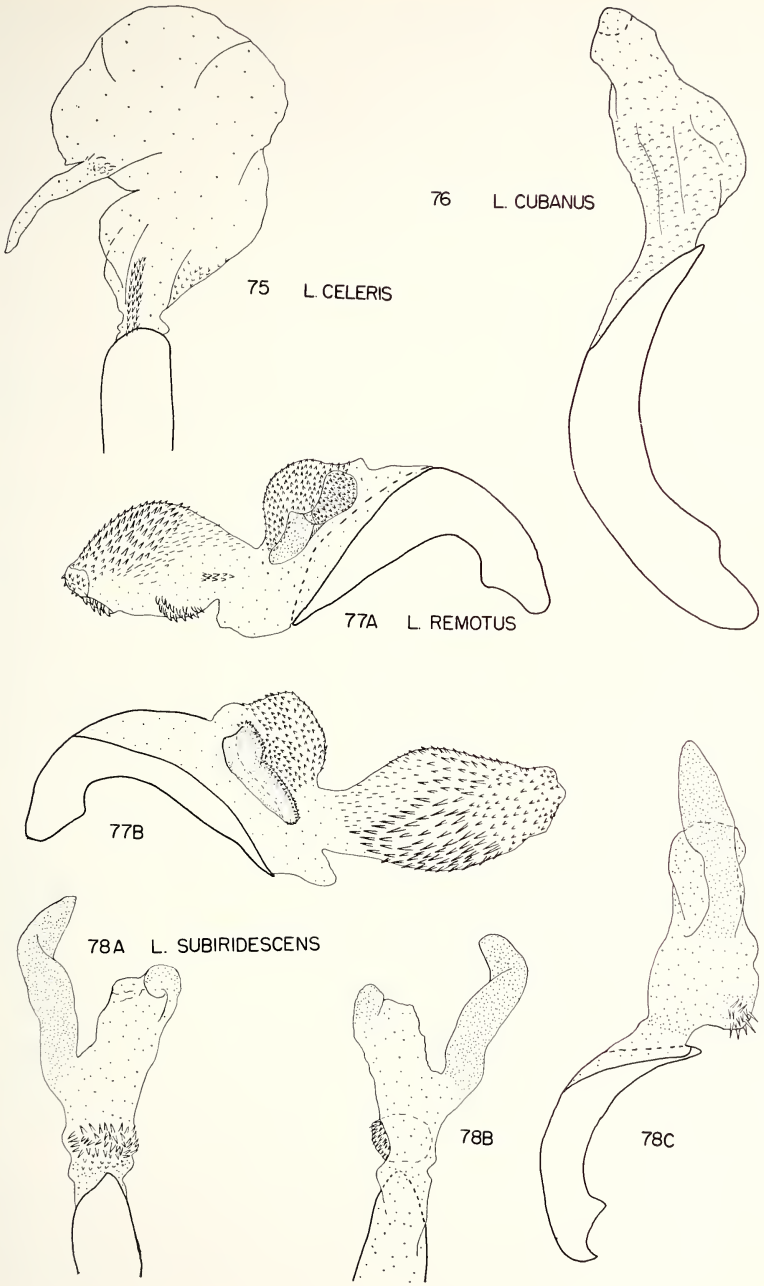
not as long as lobes; furrows shallow; fovae small; microsculpture elongate. *Thorax.* Pronotum: microsculpture absent; lateral margins very slightly sinuate posteriorly, punctate in posterior quarter to half; posterior angles acute; anterior marginal sulcus complete or not; posterior marginal sulcus reaching past the basal impressions but incomplete; median sulcus not reaching anterior marginal sulcus or posterior margin; basal impressions elongate, moderately deep, usually impunctate; area between basal impressions with only 1–2 punctures if punctate; area between basal impressions and lateral margins usually impunctate. Scutellum: microsculpture isodiametric and elongate; apex pointed. N. B. Microsculpture on ventral surface absent except around hind coxae. Prosternum, proepisternum, proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: weakly punctate in anterior quarter. Metasternum: punctate toward the lateral margin. Metepisternum, metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture on epiplura absent. *Abdominal sternites.* Microsculpture vaguely present around metacoxae; segment 1 punctate laterally at the base; segments 1–3 rugate laterally at the base. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and directed dorsally; 1 elongate scale group on the right lateral surface; most of the sac's surface covered with small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (20 specimens). TL—5.3 (5.1–5.3); WH—1.1 (1.0–1.2); WP—1.6 (1.5–1.7); WW—2.4 (2.5–2.2).

DISTRIBUTION. Mexico and Central America.

LOCALITIES. COSTA RICA. Cartago: Turrialba, IICA Experiment Station (UA). Guanacaste: 5 Km. N. Canas (GN). MEXICO. Chiapas: 11.6 mi. N. Ocozocuautla, 3200 ft. (GB); San Quintin, 90°20′–16°24′, 700 ft. (GB); San Quintin, Sierra de la Colmena ca. 300–700 ft. (GB); Palenque Ruins, 400 ft. (GB). Veracruz: 2.5 mi. W. Sontecomapan, 100 ft. (GB); 6.7 mi. NW. Sontecomapan, 200 ft. Coyame, Lake Catemaco (GB).

→

FIGS. 75–78. Male genitalia, IS everted. 75. *L. celeris* (Dej.), ventral aspect. 76. *L. cubanus* Tschit., left lateral aspect. 77 A. *L. remotus* n. sp., left lateral aspect. 77 B. Same, left lateral aspect. 78 A. *L. subiridescens* M'Leay, ventral aspect. 78 B. Same, dorsal aspect. 78 C. Same, left lateral aspect.


75 L. CELERIS
76 L. CUBANUS
77A L. REMOTUS
77B
78A L. SUBIRIDESCENS
78B
78C

DISCUSSION. More specimens of this species were collected by Ball and company in Mexico than any other *Loxandrus*. It is a rather small species. The males can be readily identified utilizing the characters associated with the genitalia. The females can usually be identified on the basis of external characters set forth in the key. It has been collected in the months of Februrary, June, July and September in leaf litter and at black lights. It is named in honor of my friend and colleague Dr. George E. Ball whose contributions to the study of Carabidae are without equal.

9. **Loxandrus elnae** New Species
Figs. 28 A, B; 90 A, B; 152

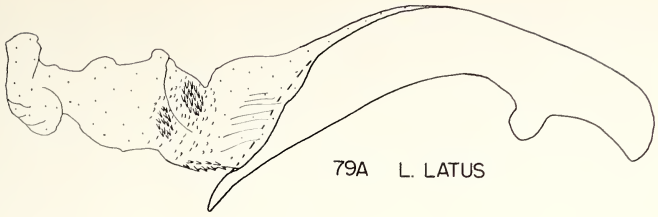
HOLOTYPE. ♂. MEXICO. Chiapas: 32.5 mi. E. Comitan, Rte. 190, 2200 ft., September 3, 1965. George E. Ball and D. R. Whitehead, Collectors (MCZ). Paratypes. 19 ♂♂ (GB); 1 ♂ (UA); 1 ♂ (GN).

DESCRIPTION. *Color*. Dorsal: head and pronotum and background of elytra black to dark brown; elytra various, usually with at least two orange to yellow spots at the humeri and two apically, sometimes the humeral spots greatly elongate reaching or almost reaching the apical spots; labrum and apex of clypeus usually orange or yellow. Ventral: black to dark brown, apex of last abdominal segment usually light yellow. Appendages: brown, apex yellow or light yellow. *Head*. Clypeus: anterior margin straight or slightly concave. Epistomal suture: distinct, complete. Subgenal suture: obscure if present. Frontal sulci: obscure, broad, short, shallow. Microsculpture: clypeus isodiametric. Mentum: apex of lobes acute; tooth distinct, not as long as lobes; furrows shallow; fovae distinct, small; microsculpture elongate. *Thorax*. Pronotum: microsculpture entirely absent; lateral margins punctate in the posterior half, evenly rounded their entire length; posterior angles narrowly rounded: anterior marginal sulcus complete; posterior marginal sulcus complete or not; median sulcus not reaching anterior or posterior marginal sulci; basal impressions elongate, moderately deep, punctate; area between basal impressions sparsely punctate; area between impressions and lateral margins with or without 1–2 punctures. Scutellum: microsculpture isodiametric; apex pointed. N. B. Microsculpture evident only near the pro- and

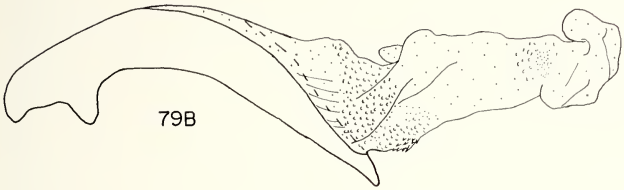
---

→

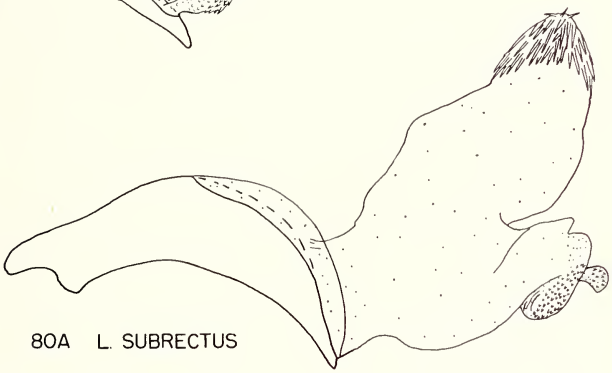
FIGS. 79–81. Male genitalia. 79 A. *L. latus* Darl., right lateral aspect, sac everted. 79 B. Same, left lateral aspect, sac everted. 80 A. *L. subrectus* Darl., left lateral aspect, sac everted. 80 B. Same, right lateral aspect, sac everted. 81. *L. discolor* n. sp., left lateral aspect.



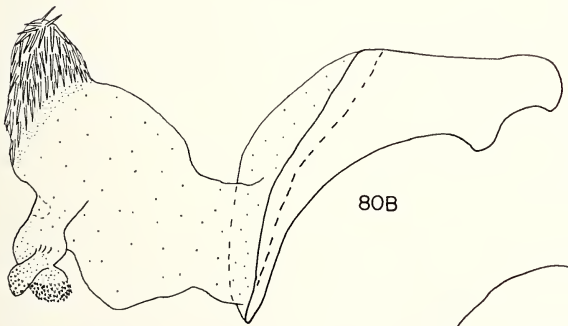
79A L. LATUS



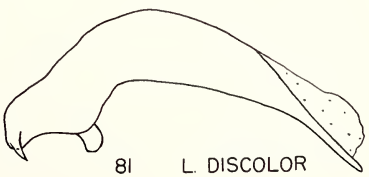
79B



80A L. SUBRECTUS



80B



81 L. DISCOLOR

metacoxae. Prosternum: impunctate. Proepisternum: sparsely punctate. Proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: punctate in anterior half to three quarters. Metasternum: punctate toward lateral margins. Metepisternum sparsely punctate or impunctate. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent on the intervals; all striae distinct, punctate, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 punctate laterally at the base; segments 1–5 rugate laterally. *Adeagus.* Median lobe: not modified. Internal sac: everts in a median position, distinctly turned dorsally; three distinct scale groups on the main sac; secondary sac everts on the dorsal membraneous portion of the median lobe, scale group at the apex; much of the remainder of sac's surface covered with small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (25 specimens). TL—6.8 (5.6–7.4); WH—1.3 (1.2–1.4); WP—2.1 (1.7–2.4); WW—3.0 (2.5–3.3).

DISTRIBUTION. Mexico and Central America.

LOCALITIES. COSTA RICA. Guanacaste: 5 Km. N. Canas (GN). MEXICO. Chiapas: 32.5 mi. E. Comitan, Rte. 190, 2200 ft. (GB); 37.7 mi. E. Comitan, Rte. 190, 2200 ft. (GB); 37.7 mi. E. Comitan, Rte. 190, Rio Chiapa, 2200 ft. (GB). Morelos: Santa Rosa, 3.2 mi. N. Zacatepec, 3100 ft. (GB). Oaxaca: 5 mi. E. Tapanatepec, Rte. 190, 800 ft. (GB).

DISCUSSION. This species closely resembles several other *Loxandrus* species from Mexico and Central America. It can be separated from them only by utilizing characters associated with the aedeagii of the males. It has been collected in the months of April, June, July and September. This species is named in honor of my wife Mrs. Elna Allen.

10. **Loxandrus whiteheadi** New Species

Figs. 27 A, B; 86 A, B; 150

HOLOTYPE. ♂. MEXICO. Chiapas: 32.5 mi. E. Comitan, Rte. 190, 2200 ft., September 4, 1965. G. E. Ball and D. R. Whitehead, Collectors (MCZ). Paratypes: 24 ♂♂ (GB); 2 ♂♂ (RTB); 1 ♂ (UA).

DESCRIPTION. *Color.* Dorsal: head, labrum and clypeus light brown to straw yellow, remainder of head usually black, sometimes dark brown; pronotum, dark to light brown, lateral areas usually lighter in color than disk; elytra, dark brown, an orange or yellow spot near the humerus and toward the apex. Ventral: dark brown, occa-

sionally black, apex of last abdominal segment sometimes yellow. Appendages: dark brown to straw yellow. *Head.* Clypeus: anterior margin slightly concave or straight. Epistomal and subgenal sutures: complete. Frontal sulci: broad, moderately impressed. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, broadly rounded at apex; furrows shallow or absent; fovae present or absent, if present small and puncture-like; microsculpture elongate. *Thorax.* Pronotum: microsculpture absent except along narrowly reflexed lateral margins; lateral margins weakly sinuate posteriorly, punctate in posterior half; posterior angles distinct, acute; anterior marginal sulcus complete; posterior marginal sulcus reaching only to basal impressions; median sulcus not reaching anterior marginal sulcus or posterior margin; basal impressions elongate, moderately deep, punctate; area between impressions and between impressions and lateral margins sparsely punctate. Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface without microsculpture. Prosternum: impunctate. Proepisternum: punctate. Proepimeron. impunctate. Mesosternum: impunctate. Mesepisternum: punctate in anterior quarter to half. Metasternum: punctate toward lateral margin. Metepisternum: punctate or not. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 2–3 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 punctate and rugose basally towards the lateral margin; segments 2 and 3 weakly rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position, directed dorsally; no distinct scale groups present; most of the sac's surface covered with small weakly sclerotized scales; a small bulbous projection on the right dorso-lateral margin of the sac; sclerotized ring absent. *Measurements.* (20 specimens). TL—6.5 (6.0–7.2); WH—1.4 (1.2–1.5); WP—2.0 (1.8–2.2); WW—2.9 (2.6–3.1).

DISTRIBUTION. Central America.

LOCALITIES. GUATEMALA. Escointla: Zapote. MEXICO. Chiapas: 8 mi. SE. Arriaga (RTB); 32.5 mi. E. Comitan, Rte. 190, 2200 ft. (GB); 0.9 mi. N. Frontera Comalapa, 2100 ft. (GB); 11.6 mi. N. Ocozocuautla, 3200 ft. (GB). Oaxaca: 5 mi. E. Tapanatepec, Rte. 190, 800 ft. (GB). Veracruz: 2.5 mi. W. Sontecomapan, 100 ft. (GB).

DISCUSSION. *L. whiteheadi* is named in honor of Mr. Don Whitehead. Specimens having a punctate metepisternum can readily be

distinguished on the basis of external characters. Those specimens in which the metepisternum is impunctate cannot be separated from *L. unispinus*, *L. elnae*, *L. fraus*, *L. lepidus*, or *L. tropicus* using external characters. For this reason females have been excluded from the paratype material. *L. whiteheadi* has been collected in the months of June, August, and September.

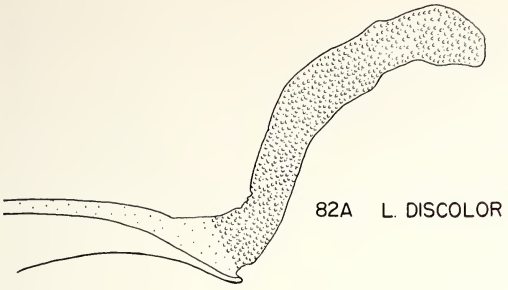
11. **Loxandrus tropicus** New Species
Figs. 69 A, B; 84; 149

HOLOTYPE. ♂. COSTA RICA. Cartago Province; Turrialba. July 11, 1965; R. J. Hampton, Collector (MCZ). Paratypes: 1 ♂ (GN); 1 ♂ (UA).

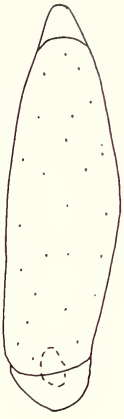
DESCRIPTION. *Color.* Dorsal surface: shining; head, disk of pronotum and elytra black to dark brown; elytra with two apical and two basal orange to yellow spots; pronotum with lateral areas light brown to straw yellow. Ventral surface: black to dark brown, abdominal segments tinged with yellow. Appendages: light brown to straw yellow. *Head.* Clypeus: anterior margin straight or slightly concave. Epistomal suture: distinct. Subgenal suture: distinct or absent. Frontal sulci: distinct, shallow, short. Microsculpture: clypeus, frons and vertex, distinct, isodiametric. Mentum: apex of lobes rounded; tooth distinct, not as long as lobes; furrows present; fovae present or absent; microsculpture elongate or absent. *Thorax.* Pronotum: microsculpture absent or very elongate, vaguely present only along the lateral margins in the anterior half; lateral margins coarsely punctate in the posterior half to three quarters, tapering evenly to the posterior angles, not sinuate posteriorly; posterior angles pointed; anterior marginal sulcus complete; posterior marginal sulcus complete or not; median sulcus distinct, reaching the anterior and posterior sulci or not; basal impressions distinct, elongate, punctate; basal quarter coarsely punctate. Scutellum: apex pointed; microsculpture distinct, isodiametric. N. B. Entire ventral surface without microsculpture. Prosternum; impunctate. Proepisternum: coarsely but sparsely punctate. Mesosternum: impunctate. Mesepisternum: coarsely punctate anteriorly. Metasternum: coarsely punctate laterally. Metepisternum: punctate or not. Metepimeron: impunctate.

→

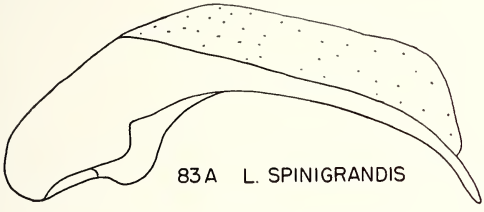
FIGS. 82–84. Male genitalia. 82 A. *L. discolor* n. sp., left lateral aspect, apex of median lobe with IS everted. 82 B. Same, dorsal aspect of median lobe. 83 A. *L. spinigrandis* n. sp., left lateral aspect. 83 B. Same, right lateral aspect, IS everted. 84. *L. tropicus* n. sp., left lateral aspect, IS everted.



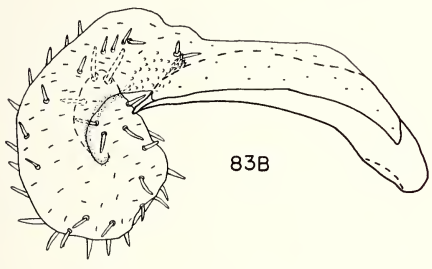
82A L. DISCOLOR



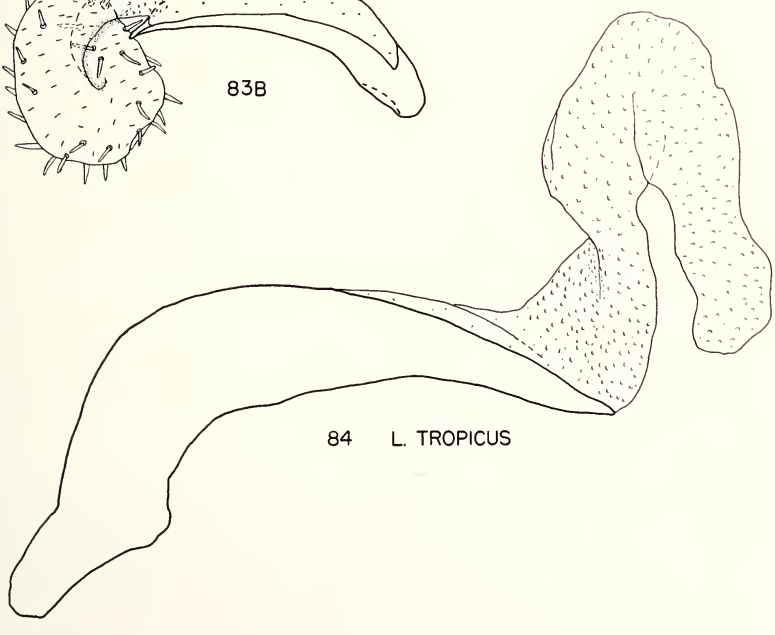
82B



83A L. SPINIGRANDIS



83B



84 L. TROPICUS

Legs. Hind coxae: microsculpture on inner surface absent; tarsal segments 1–4 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 2–3 isodiametric units wide; internal plica well-developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 coarsely punctate near the lateral anterior surface; segments 2 and 3 sometimes punctate in the central area; other segments impunctate. *Aedeagus.* Median lobe: apex not modified. Internal sac: everts medially but is turned dorsally and then ventrally and to the left side; no distinct scale groups; most of the surface of the sac is covered by small lightly sclerotized scales; sclerotized ring absent. *Measurements.* (2 ♂ specimens). TL—7.3 (7.1–7.6); WE —1.5 (1.4–1.5); WP—2.3 (None); WW—4.7 (4.6–4.8).

DISTRIBUTION. Central America.

LOCALITIES. COSTA RICA. Cartago: Turrialba (MCZ) (GN).

DISCUSSION. This species is known from Costa Rica. Two males and two females were collected by Mr. R. J. Hampton and donated to Mr. Gary Noonan. The specimens were probably collected on or near the IICA Experiment Station just outside of Turrialba. The external morphological characters are similar to the characters of the other species in this complex. The females can not be separated with any accuracy and are not marked as paratypes.

12. **Loxandrus lepidus** New Species

Figs. 67; 85; 149

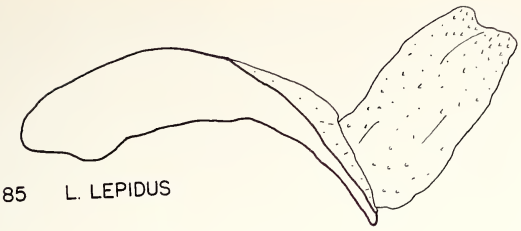
HOLOTYPE. ♂. MEXICO. Veracruz: Fortin de las Flores, June 26–30, 1963, leaf litter. D. R. Whitehead, Collector (MCZ).

DESCRIPTION. *Color.* Dorsal surface: shining, background color black, lateral areas of pronotum and lateral and apical areas of elytra brown; elytra with two apical and two basal orange to yellow spots. Ventral surface: shining, background color black, lateral and apical areas of segments 4 and 5 light brown. Appendages: brown to light brown. *Head.* Clypeus: anterior margin straight. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: distinct, broad,

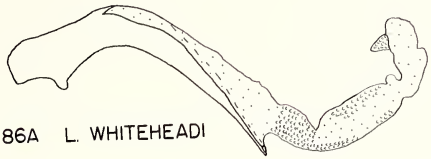
---

→

FIGS. 85–88. Male genitalia. 85. *L. lepidus* n. sp., left lateral aspect. IS everted. 86 A. *L. whiteheadi* n. sp., left lateral aspect, IS everted. 86 B. Same, dorsal aspect, apex of median lobe with IS everted. 87 A. *L. unispinus* n. sp., right lateral aspect, IS everted. 87 B. Same, left lateral aspect. 87 C. Same, dorsal aspect. 88. *L. balli* n. sp., left lateral aspect.

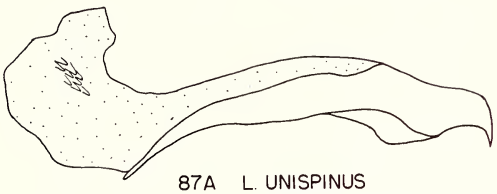


85 L. LEPIDUS

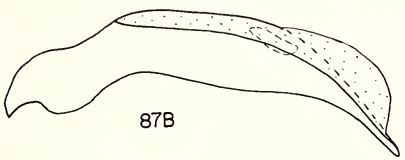


86A L. WHITEHEADI

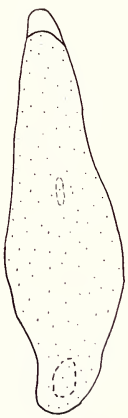
86B



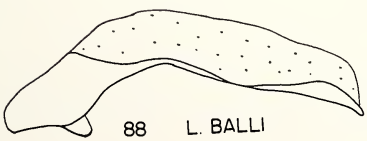
87A L. UNISPINUS



87B



87C



88 L. BALLI

shallow, short. Microsculpture: clypeus, frons and vertex, distinct, isodiametric. Mentum: apex of lobes rounded; tooth distinct, not as long as lobes; furrows present; fovae absent; microsculpture elongate. *Thorax.* Pronotum: microsculpture absent on most of the surface, present only along the reflexed lateral margins; lateral margins weakly punctate, slightly sinuate near the basal angle; posterior angles pointed; anterior marginal sulcus complete; posterior marginal sulcus incomplete; median sulcus present, not reaching anterior or posterior sulci; basal quarter sparsely punctate. Scutellum: apex pointed; microsculpture distinct, isodiametric. N. B. Entire ventral surface without microsculpture. Prosternum: impunctate. Proepisternum: weakly and sparsely punctate. Proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: punctate in the anterior half to three quarters. Metasternum: punctate toward lateral margin. Metepisternum and Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent; segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 coarsely punctate along the lateral basal margin; segment 2 sparsely punctate laterally; other segments impunctate. *Aedeagus.* Median lobe: apex not modified. Internal sac: everts medially, deflected dorsally. Internal sac: no distinct scale groups; small lightly sclerotized scales cover most of the surface of the sac, somewhat more dense towards apex and in the mid region of the right side; sclerotized ring absent. *Measurements.* (1 specimen). TL—7.3; WE—1.5; WP—2.1; WW—3.3.

DISTRIBUTION. Mexico.

LOCALITIES. MEXICO. Veracruz: Fortin de las Flores (MCZ).

DISCUSSION. This species is known from a single male specimen collected in leaf litter between June 26–30, 1963, by D. R. Whitehead. Its nearest relative appears to be *L. tropicus.* It differs from *L. tropicus* only in the shape of the internal sac of the aedeagus as characterized in the key.

13. **Loxandrus fraus** New Species

Figs. 23 A, B; 89; 152

HOLOTYPE. ♂. MEXICO. Morelos: Santa Rosa, 3.2 mi. N. Zacatepec, 3100 ft. elevation, March 31, 1966. McFadden, Whitehead, Collectors (MCZ). Paratypes: 44 ♂♂ (GB); 1 ♂ (UA).

DESCRIPTION. *Color.* Dorsal: shining, head and elytra black to dark brown, pronotum dark to light brown, elytra with two apical and

two basal orange to yellow spots, spots may sometimes be very elongate. Ventral: usually black to dark brown, sometimes light brown, abdominal segments sometimes tinged with yellow. Appendages: dark brown to straw yellow. *Head.* Clypeus: anterior margin straight or slightly concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: obscure, broad, shallow, short. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, not as long as lobes; furrows shallow, broad; fovae small but distinct; microsculpture absent or very elongate. *Thorax.* Pronotum: microsculpture absent even along the lateral margin and in the basal furrows; lateral margins evenly rounded their entire length, not sinuate, punctate in the posterior half to three quarters; posterior angles narrowly rounded; anterior marginal sulcus complete; posterior marginal sulcus complete or not; median sulcus reaching anterior marginal sulcus or not, never reaching posterior marginal sulcus; basal impressions elongate, moderately deep, punctate; area between basal impressions punctate; area between basal impressions and lateral margins sparsely punctate. Scutellum: microsculpture isodiametric and/or elongate; apex pointed. N. B. Entire ventral surface of the pronotum without microsculpture. Prosternum: impunctate. Proepisternum: sparsely and weakly punctate. Proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: anterior quarter to half punctate. Metasternum: punctate laterally. Metepisternum: usually impunctate, sometimes with 1–3 obscure punctures. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture absent except around hind coxae; segment 1 punctate laterally at the base, other segments impunctate; segments 1–5 sparsely rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and turned dorsally; two distinct scale groups on the right side; remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (25 specimens). TL—6.0 (5.6–6.5); WH—1.2 (1.1–1.3); WP—1.8 (1.7–2.0); WW—2.6 (2.5–2.8).

DISTRIBUTION. Mexico.

LOCALITIES. MEXICO. Chiapas: .9 mi. N. Frontera Comalapa, 2100 ft. (GB); 2.9 mi. N. Frontera Comalapa, 2200 ft. (GB); San Quintin, 700 ft., 91°21′–16°24′ (GB). Morelos: Santa Rosa, 3.2 mi. N. Zacatepec, 3100 ft. (GB). Nayarit: 5.7 mi. E. San Blas, Rte. 46, 140 ft. (GB); 13.8 mi.

E. San Blas, Rte. 46, 200 ft. (GB). Oaxaca: 5 mi. E. Tapanatepec, Rte. 190, 800 ft. (GB).

DISCUSSION. In external characters this species is most like *L. elnae*. It also resembles *L. tropicus*, *L. balli* and *L. unispinus* and cannot be separated from them using external characters. Determination of females has been based on geographical distribution. *L. fraus* has been collected in the months of February, March, April, June, July, and August.

14. **Loxandrus unispinus** New Species

Figs. 1 A, B; 2 A, B; 24 A, B; 87 A, B, C; 150

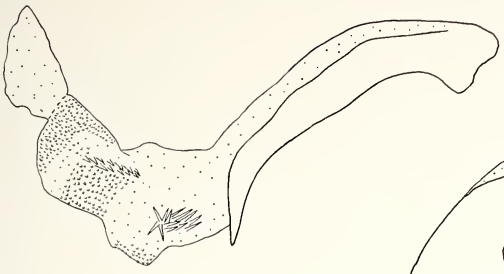
HOLOTYPE. ♂. CANAL ZONE. Barrro Colorado Island: April, 1941. James Zetek, Collector; No. 4781, Lot No. 41-8655 (USNM). Paratypes: 11 ♂♂ (USNM); 2 ♂♂ (UA).

DESCRIPTION. *Color.* Dorsal surface: shining, background color dark to light brown; head usually darker than other parts; disk of pronotum may or may not be darker than lateral areas; elytra with two apical and two basal orange to yellow spots; ventral surface: shining, background color dark to light brown, occasionally tinged with yellow; appendages generally light to dark brown, sometimes straw yellow. *Head.* Clypeus: anterior margin straight. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: distinct, broad, shallow, short. Microsculpture: clypeus, frons and vertex, distinct isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, not as long as lobes; furrows present; fovae present or absent; microsculpture absent or very elongate, vaguely present only along the lateral margin in the anterior fifth; lateral margins punctate, slightly sinuate posteriorly; posterior angles pointed; anterior marginal sulcus complete; posterior marginal sulcus complete or not; median sulcus present, reaching the anterior and posterior sulci or not; basal impressions distinct, elongate, sparsely punctate; basal quarter punctate. Scutellum: apex pointed; microsculpture distinct, isodiametric. N. B. Entire ventral surface without microsculpture. Prosternum: impunctate. Proepisternum: usually impunctate, sometimes with a few weak punctures. Proepimeron: impunctate. Mesosternum: impunctate. Mes-

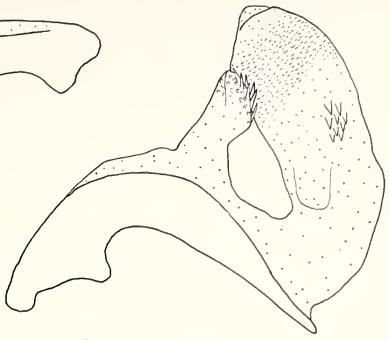
---

→

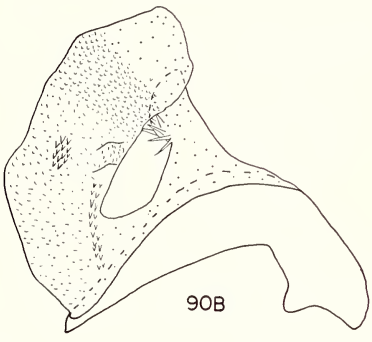
FIGS. 89–92. Male genitalia. 89. *L. fraus* n. sp., right lateral aspect, IS everted. 90 A. *L. elnae* n. sp., left lateral aspect, IS everted. 90 B. Same, right lateral aspect, IS everted. 91 A. *L. sculptilis* Bates, left lateral aspect. 91 B. Same, left lateral aspect, IS everted. 92. *L. negrei* Straneo, left lateral aspect, IS everted.



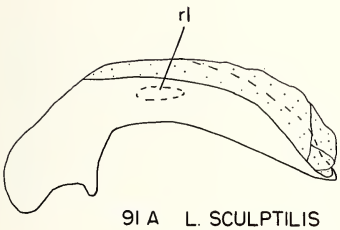
89 L. FRAUS



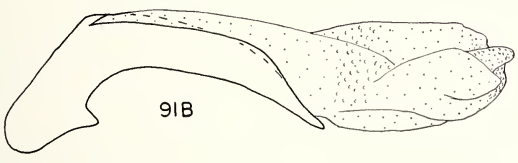
90A L. ELNAE



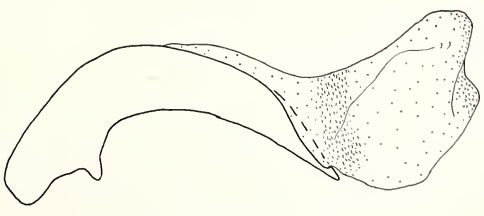
90B



91 A L. SCULPTILIS



91B



92 L. NEGREI

episternum: coarsely punctate anteriorly. Metasternum: coarsely punctate laterally. Metepisternum: usually impunctate, sometimes with a few weak punctures. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent; tarsal segments 1–3 and sometimes 4 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1 isodiametric unit wide; internal plica well-developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 coarsely punctate near the lateral anterior surface; other segments impunctate. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, deflected dorsally; one well-developed, distinct, small scale group on right side of sac near the midline: other small scales covering much of the sac's surface; sclerotized ring absent. *Measurements.* (14 specimens). TL—5.7 (5.0–6.1); WE—1.2 (1.1–1.2); WP—1.8 (1.6–1.9); WW—2.5 (2.2–2.8).

DISTRIBUTION. Southern Central America.

LOCALITIES. CANAL ZONE. Albrook Forest, Fort Clayton (UA); Barro Colorado Island (USNM); Corozal (USNM). PANAMA. Pearl Island, San Jose (USNM).

DISCUSSION. This species is presently known only from Panama where it has been collected at light traps in the months of April, May, June and July. The external characters of this species are very similar to those of *L. fraus*, *L. elnae*, *L. tropicus* and *L. lepidus.* No one external character sets it apart from these species though it is generally smaller than any of them. Determination of females has been made by associating them with males having the same collecting data.

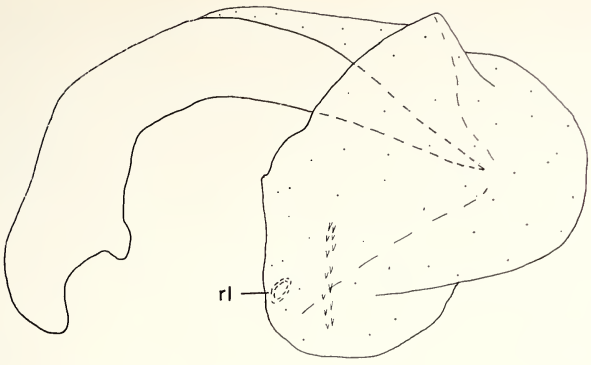
15. **Loxandrus yeariani** New Species
Figs. 119; 169

HOLOTYPE. ♂. MEXICO. Colima: 16.5 mi. E. Colima, 1900 ft., Rte. 110, August 2–3, 1966. G. E. Ball and D. R. Whitehead, Collectors (MCZ). Paratypes: 3 ♂♂ 4 ♀♀ (GB).

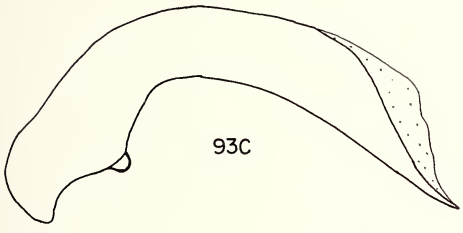
DESCRIPTION. *Color.* Dorsal and Ventral: black, shining. Appendages: usually black, sometimes tinged with brown. *Head.* Clypeus: anterior margin concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: obscure, shallow, broad, short.

→

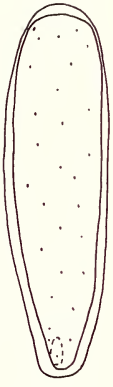
FIGS. 93–94. Male genitalia. 93 A. *L. pactinullus* n. sp., left lateral aspect, IS everted. 93 B. Same, dorsal aspect, 93 C. Same, left lateral aspect. 94 A. *L. tucumanus* (Dej.), right lateral aspect, IS everted. 94 B. Same, left lateral aspect.



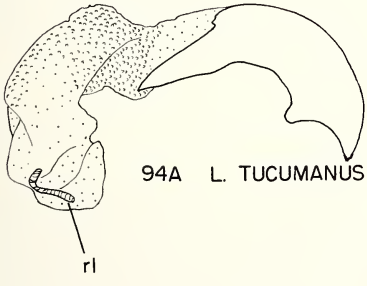
93A L. PACTINULLUS



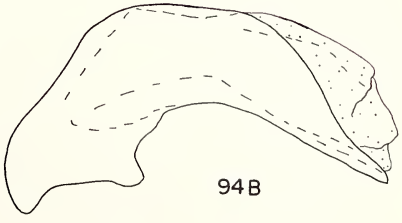
93C



93B



94A L. TUCUMANUS



94B

Microsculpture: clypeus, frons and vertex weak, isodiametric. Mentum: apex of lobes acute; tooth distinct, broadly rounded; furrows present; fovae present, small; microsculpture distinct, isodiametric. *Thorax.* Pronotum: microsculpture if present, elongate; lateral margins impunctate, broadly rounded; posterior angles absent; anterior marginal sulcus complete; posterior marginal sulcus incomplete; median sulcus barely reaching anterior marginal sulcus, not reaching posterior margin; basal impressions short, narrow, deep; area between impressions punctate; area between impressions and lateral margins sparsely punctate. Scutellum: microsculpture weak, isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture elongate medially, isodiametric laterally. Proepisternum: microsculpture where present, elongate. Proepimeron: microsculpture isodiametric. Mesosternum: microsculpture isodiametric. Mesepisternum: microsculpture isodiametric anteriorly, elongate posteriorly. Metasternum: microsculpture isodiametric laterally, absent medially. Metepisternum: microsculpture isodiametric. Metepimeron: microsculpture absent. *Legs.* Hind coxae: microsculpture on inner surface isodiametric. Tarsal segments: 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct; trough 3–4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture mostly isodiametric, obscure and elongate medially on segments 2 and 3; impunctate; segments 1 and 2 rugose along the base laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and is directed dorsally; 3 distinct scale groups present; 1 large group at the apex of each of 2 secondary sacs, 1 small group on the right lateral surface; most of the remainder of the sac's surface without small weakly sclerotized scales; sclerotized ring present. *Measurements.* (8 specimens). TL—10.5 (9.9–11.3); WH—2.2 (2.1–2.4); WP—3.3 (3.1–3.6); WW—4.1 (3.8–4.4).

DISTRIBUTION. Mexico.

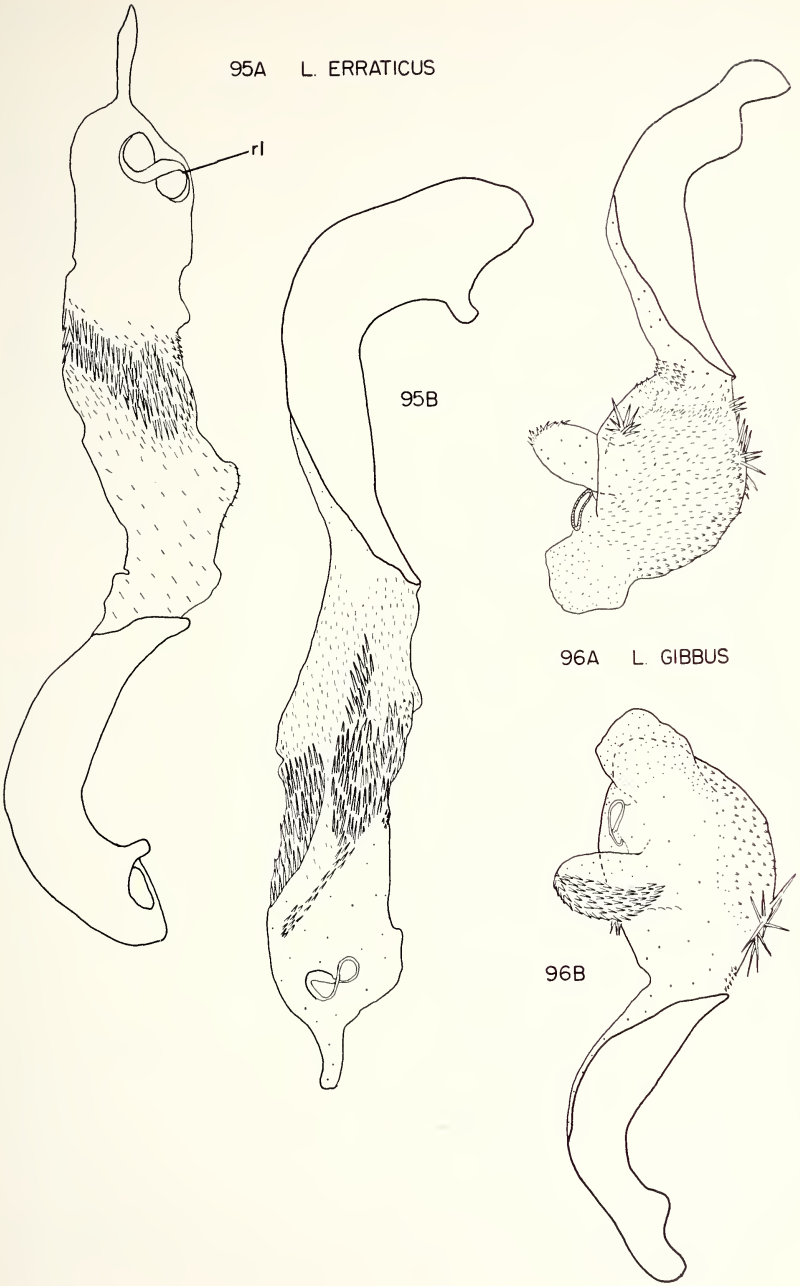
LOCALITIES. MEXICO. Colima: 16.5 mi. E. Colima, Rte. 110, 1900 ft. (MCZ, GB).

DISCUSSION. This is the largest species in the Mexican *Loxandrus* fauna. It is readily recognizable by the broadly rounded lateral margins of the pronotum resulting in the absence of distinct posterior angles. The aedeagus is also characteristic. It is known from only one

---

→

FIGS. 95–96. Male genitalia, IS everted. 95 A. *L. erraticus* (Dej.), left lateral aspect. 95 B. Same, right lateral aspect. 96 A. *L. gibbus* n. sp., right lateral aspect. 96 B. Same, left lateral aspect.


95A L. ERRATICUS
rl
95B
96A L. GIBBUS
96B

locality near Colima, Mexico, and has been collected only in August. It is named in honor of Dr. W. C. Yearian.

16. **Loxandrus rectus** (Say)
Figs. 43 A, B; 98 A, B, C; 157

Feronia recta Say 1823:58. *Neotype.* From Lindroth and Freitag (1969): "No type area given. The neotype agrees with Casey's description (1918, p. 381) and also, except it is larger, with the 7 ex. in coll. Lec. (MCZ). A ♂ with genitalia dissected, from South Carolina, designated by R. T. Allen as neotype and the state as type area."

Feronia lucidula Dejean, 1828:239. *Lectotype* (here selected). A male found mixed with *L. rectus* material but marked with the green Dejean determination label as *Lucidulus* from Boreal America (Paris Museum Nat. Hist.).

Megalostylus laticollis Chaudoir, 1843:96. *Lectotype* (here selected). A male and a female found mixed with *L. rectus* material belonging to the Chaudoir collection. The male bears a *Laticollis* Chaudoir determination label from Louisiana. The female bore no labels (Paris Museum Nat. Hist.).

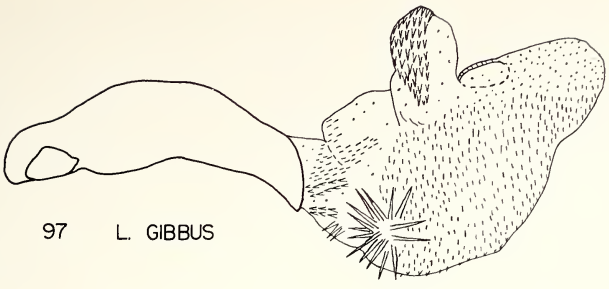
Loxandrus rectus sub. sp. *mandibularis* Casey, 1918:382. *Type.* Male from the District of Columbia. Type No. 47334 (USNM).

DESCRIPTION. *Color.* Body entirely black, iridescent; appendages, dark brown to black. *Head.* Clypeus: anterior margin slightly concave (distinctly notched in one specimen). Epistomal and subgenal sutures: distinct, complete. Frontal sulci: shallow, broad, obscure. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes pointed; tooth distinct, shorter than lobes, rounded at apex; furrows weak; fovae absent; microsculpture elongate lines if present. *Thorax.* Pronotum: microsculpture absent on the disk, isodiametric in the reflexed lateral margins, sulci, and basal furrows; lateral margins impunctate, evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus usually present and complete; posterior marginal sulcus incomplete; median sulcus present, reaching anterior marginal sulcus but not posterior margin; basal impressions distinct, elongate and broad, punctate; area between basal impressions sometimes

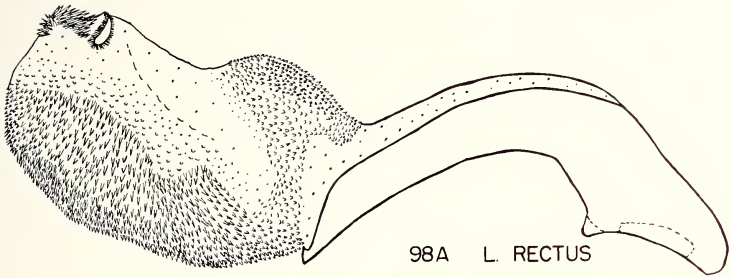
---

→

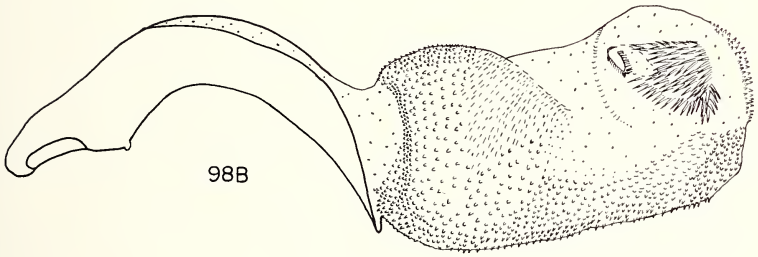
FIGS. 97–98. Male genitalia, IS everted. 97. *L. gibbus* n. sp., left ventrolateral aspect. 98 A. *L. rectus* (Say), right lateral aspect. 98 B. Same, left lateral aspect. 98 C. Same, dorsal aspect.



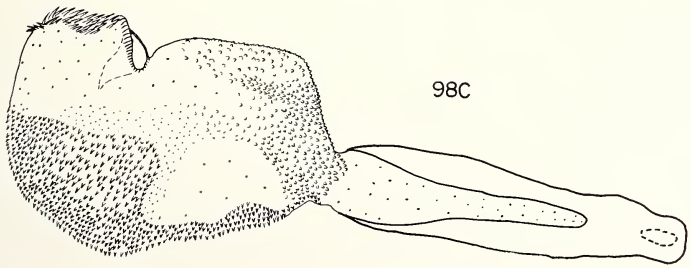
97 L. GIBBUS



98A L. RECTUS



98B

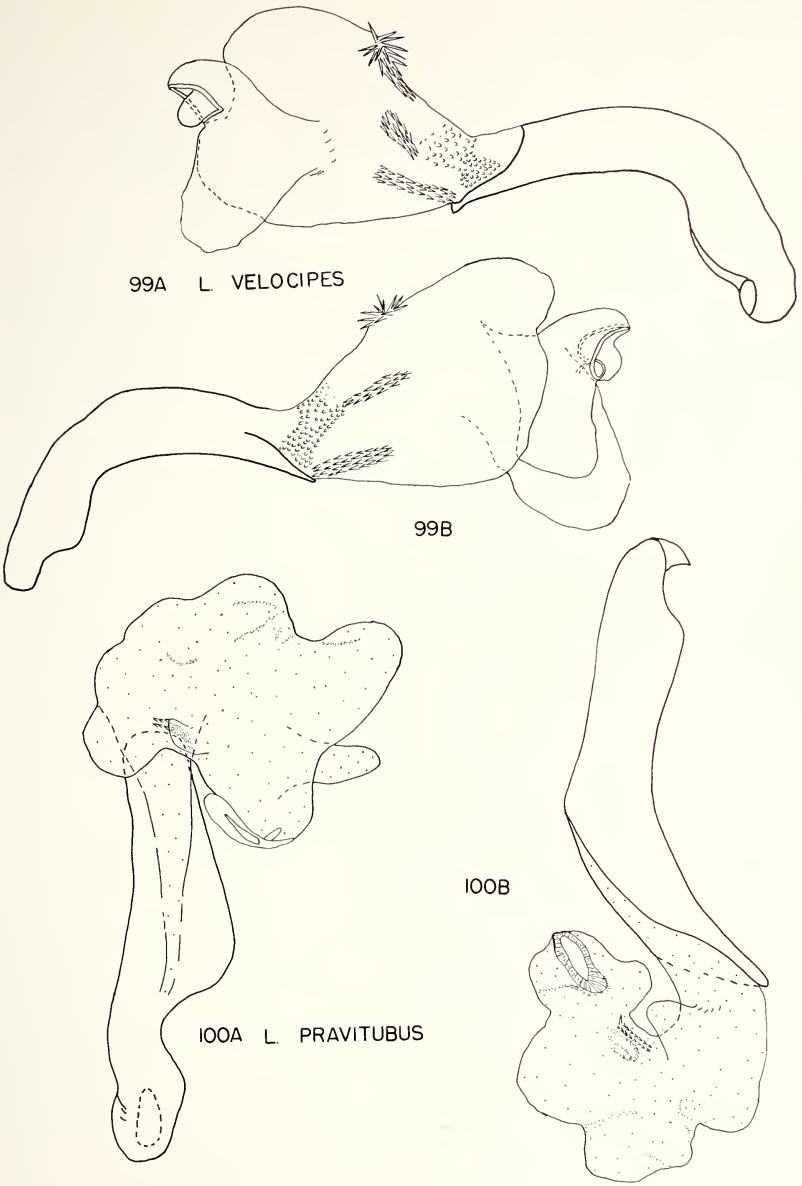


98C

sparsely punctate. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: impunctate; microsculpture absent medially, elongate towards lateral margin. Proepisternum: impunctate; microsculpture usually absent, if present, elongate. Proepimeron: impunctate; microsculpture elongate. Mesosternum: impunctate; microsculpture elongate. Mesepisternum: punctate anteriorly; microsculpture, if present, elongate. Metasternum: impunctate; microsculpture, if present, elongate. Metepisternum: impunctate; microsculpture, if present, elongate. Metepimeron: impunctate; microsculpture absent. *Legs.* Hind coxae: microsculpture on inner surface isodiametric; tarsal segments 1–4 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent except in striae, trough 3–4 isodiametric units wide; striae 7 not as distinct basally as 1–6; internal plica well-developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture isodiametric; segment 1 punctate along the basal margin; other segments impunctate. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, slightly turned dorsally; one large scale group covers much of the surface of the sac, the scales are distinct but vary in length and shape over the surface; a second distinct but smaller group of very elongate, slender scales is located apically near the sclerotized ring; sclerites not present; sclerotized ring present. *Measurements.* (20 specimens). TL—11.2 (10.2–11.8); WH—2.4 (2.1–2.5); WP—3.7 (3.2–4.0); WE—4.5 (4.1–4.9).

DISTRIBUTION. Southeastern United States north to Washington, D. C. and Illinois, and west to Arkansas and West Texas.

LOCALITIES. Alabama. Mobile Co.: Calvert (USNM, CAS); Mt. Vernon (OSU); Mobile (MCZ, TAM). Tuscaloosa Co.: Tuscaloosa (GB). Arkansas. Arkansas Co.: Bayou Meto, Hy. 11, East of Reydel (UA); Ashley Co.: Ouachita River, Hy. 84, 6 mi. W. Crossett (UA); Washington Co.: 5 mi. S. Fayetteville (INHS, MSU); White Co.: Cyprus Bayou, 10 mi. W. Beebe (UA). District of Columbia. Washington (USNM, UMIN, CU, MCZ, INHS, CNC, OSU). Florida. Marion Co. (AM). Illinois. Hardin Co.: Elizabethtown (INHS). Richland and Lawerence Co.'s: Wabash Valley (MCZ). Kentucky. Undetermined locality (CNHM). Louisiana. Calcasiew Co.: 8 mi. W. Vinton, Sabine River Relief (GB); Franklin Co.: Chase (UA); Madison Co.: Tallulah (MCZ); Orleans Co.: New Orleans (MCZ, GB, CAS, USNM, CU, KU); Ouachita Co.: Monroe (USNM). St. Martins Co. (UA); Union Co. (UA); Vernon Co.: Rosepine (UA). Undetermined localities in Louisiana (CAS, CU, INHS, MCZ, OSU, UM, UMIN, USNM). Maryland. Undetermined locality (UMIN). Mississippi. George Co.: Lucedale (CU); Green Co.: Leakville (CU); Harrison Co.: Gulfport (CU); Jackson Co.: Ocean Springs (CU). Missouri. St. Louis Co.: St. Charles



FIGS. 99–100. Male genitalia, IS everted. 99 A. *L. velocipes* Casey, right lateral aspect. 99 B. Same, left lateral aspect. 100 A. *L. pravitubus* n. sp., dorsal aspect. 100 B. Same, right lateral aspect.

(MCZ). North Carolina. Chowan Co.: Edenton (MCZ). South Carolina. Undetermined locality (MCZ). Tennessee. Lake Co.: Grays Ldg. (RTB); Shelby Co.: Memphis (USNM, CAS). Texas. Brazos Co.: College Station (TAM); Calhoun Co.: Alligator Head (USNM); Dallas Co.: Dallas (MCZ, USNM, MSU); Jackson Co.: Edna (USNM); Victoria Co.: Victoria (USNM). *Mitten (MCZ). Undetermined localities in Texas (MCZ, USNM). Virginia. Nelson Co.: Rosslyn (MCZ, USNM). Undetermined locality in Virginia (USNM).

DISCUSSION. This is one of the larger species of *Loxandrus* found in North America. The large size and broadly rounded and explinate posterior angles of the pronotum serve to distinguish this species and *L. pravitubus* from all other *Loxandrus* species. *L. rectus* can be distinguished from *L. pravitubus* by its larger size as well as the characteristic genitalia of both the males and females. It has been collected in all months of the year except September.

17. **Loxandrus pravitubus** New Species
Figs. 44 A, B; 100 A, B; 159

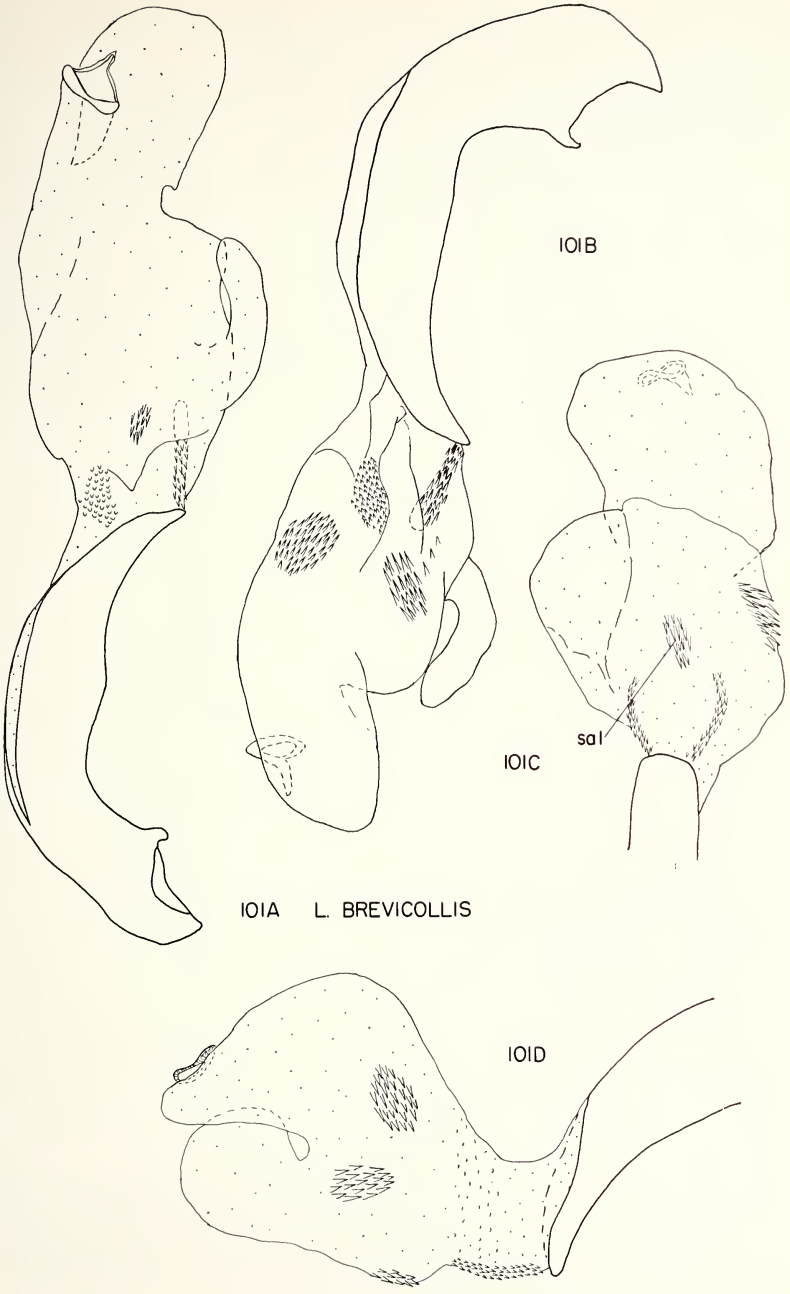
HOLOTYPE. ♂. U.S.A. Texas: Brownsville, June 11–16, 1933. Darlington, Collector. (MCZ). Paratypes. 17 ♂♂ 19 ♀♀ (MCZ); 13 ♂♂ 13♀♀ (USNM); 1 ♂ 4 ♀♀ (TAM); 1 ♂ (GB); 2 ♂♂ (OSU); 3 ♀♀ (CAS); 1 ♂ 1 ♀ (UA); 3 ♂♂ (CNC); 1 ♂ (CU).

DESCRIPTION. *Color.* Dorsal: black, iridescent. Ventral: usually black, some areas sometimes dark brown, iridescent. Appendages: dark to light brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: shallow, broad, obscure. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes pointed; tooth distinct, shorter than lobes, rounded at apex; furrows weak; fovae absent; microsculpture elongate lines if present. *Thorax.* Pronotum: microsculpture absent on the disk, isodiametric in the reflexed lateral margins, in the sulci and basal furrows; lateral margins impunctate, evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus usually present and complete; posterior marginal sulcus incomplete; median sulcus present, reaching anterior marginal sulcus but not posterior margin; basal impressions distinct, elongate and broad, punctate; area between basal impressions

---

→

FIG. 101. Male genitalia, IS everted. 101 A. *L. brevicollis* (LeC.), left lateral aspect. 101 B. Same, right lateral aspect. 101 C. Same, ventral aspect. 101 D. Same, apex of median lobe, left lateral aspect.


101B
sal
101C
101A L. BREVICOLLIS
101D

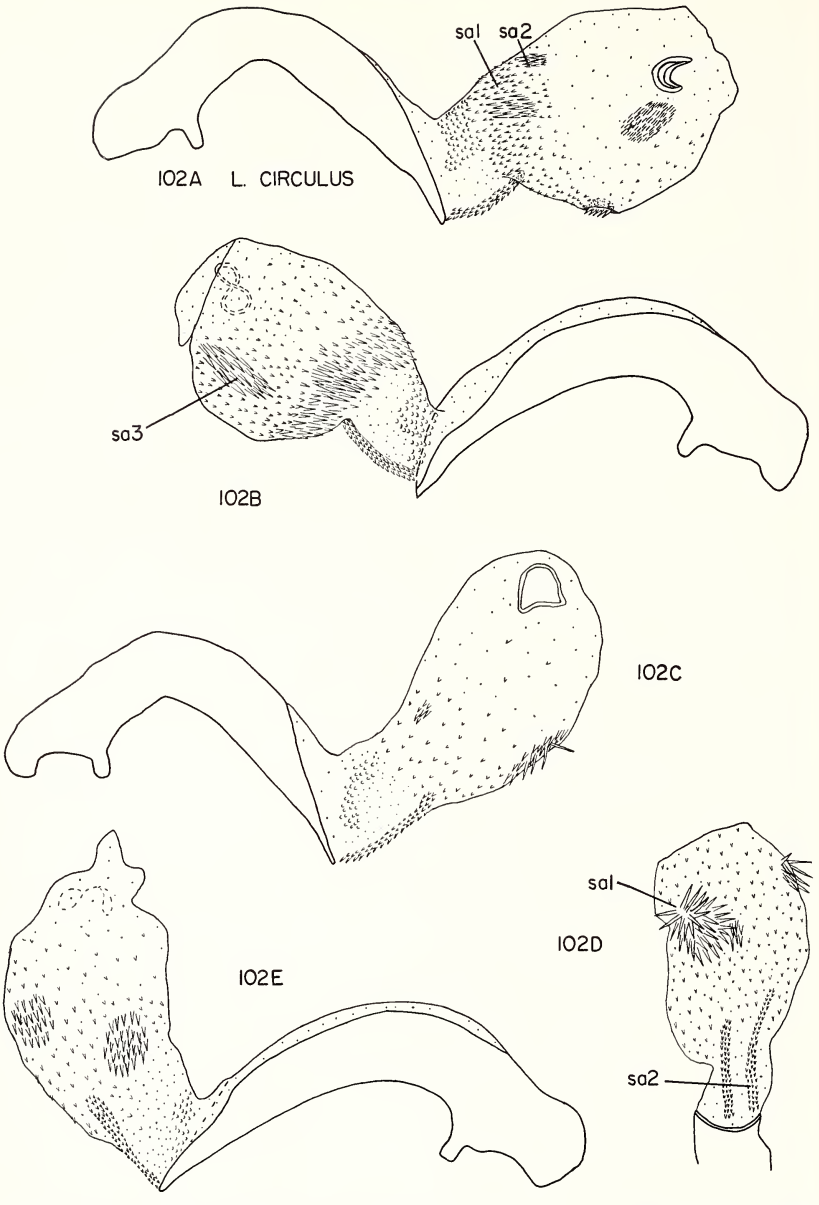


FIG. 102. Male genitalia, IS everted. 102 A. *L. circulus* n. sp., left lateral aspect. 102 B. Same, right lateral aspect. 102 C. Same, left lateral aspect. 102 D. Same, ventral aspect. 102 E. Same, right lateral aspect.

sometimes sparsely punctate. Scutellum: apex pointed; microsculpture variable, if present usually isodiametric or only slightly elongate. Prosternum: impunctate; microsculpture absent medially, elongate towards lateral margin. Proepisternum: sometimes weakly punctate; microsculpture distinctly elongate. Proepimeron: impunctate; microsculpture elongate. Mesosternum: impunctate; microsculpture elongate. Mesepisternum: punctate anteriorly (punctures usually more numerous than in *L. rectus* and covering more of the sclerite). Metasternum: weakly punctate towards lateral margins; microsculpture distinct laterally, elongate and isodiametric. Metepisternum: punctate, shallow but usually distinct; microsculpture distinct, elongate. Metepimeron: impunctate; microsculpture absent. *Legs.* Hind coxae: microsculpture on inner surface isodiametric; tarsal segments 1–4 of hind tarsi and 1–3 of middle tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent except in striae, trough 4–5 isodiametric units wide; striae 7 usually as distinct as 1–6; internal plica well-developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture isodiametric; segment 1 punctate along the basal margin; other segments impunctate. *Aedeagus.* Median lobe: modified, expanded and turned to the left side in the apical two thirds. Internal sac: everts medially and turns dorsally, several small bulbous projections on the sac; one distinct scale group present; the remainder of surface of the sac covered with very small, weakly sclerotized scales; sclerotized ring present. *Measurements.* (20 specimens). TL —9.3 (8.7–9.3); WH—1.9 (1.8–2.1); WP—3.0 (2.8–3.3); WW—3.7 (3.3–4.1).

DISTRIBUTION. Southeastern United States, west through South Texas to Mexican border.

LOCALITIES. Alabama. Mobile Co.: Calvert (USNM). Mobile (MCZ). Louisiana. Madison Co.: Tallulah (MCZ). North Carolina. Robeson Co.: Lumberton (USNM). Texas. Brazos Co.: College Station (TAM); Cameron Co.: Brownsville (CNC, MCZ, OSU, CAS, USNM); Colorado Co.: Columbus (USNM, MCZ, MSU); Coma Co.: New Brunfels (USNM, MCZ); Dallas Co.: Dallas (MSU, MCZ, USNM); Demmit Co.: Carrizo Springs (USNM); Galveston Co.: Dickinson (TAM); Gillespie Co.: (OSU); Harris Co.: Houston (CAS); Hildago Co.: Weslaco (TAM); Victoria Co.: Victoria (USNM, GB, UM). Wharton Co.: Wharton (CU). *Mitten (MCZ). Unrecorded localities in Texas (MCZ, USNM).

DISCUSSION. This species closely resembles *L. rectus* in most external characters but it is smaller. It has probably been confused with *L. rectus* in most collections. *L. pravitubus* can be distinguished from *L. rectus* by its smaller size and the differences in both the male and

female genitalia. It has been collected in April, May, June, July, October, and December.

THE *L. unilobus*, *L. saccisecundaris*, *L. extendus* AND *L. taeniatus* COMPLEX.

DISCUSSION. The four species in this complex cannot be distinguished from each other using external characters. Their determination depends on the examination of characters associated with the male genitalia. *L. saccisecundaris* is known from a single specimen collected from an undetermined locality in Georgia. *L. unilobus* has been collected at Carlisle, Arkansas, at Jacksonville, Florida, and at Lake Chicot State Park in Louisiana. It is also recorded from one or two undetermined localities in Texas. It was collected in June in Florida. *L. taeniatus* is known from eight localities. It has been collected in Alabama, Louisiana, Mississippi and South Carolina in the months of March, April, June and December. *L. extendus* has been collected from an undetermined locality in Arkansas and from two counties in Indiana. The Indiana specimens were collected in January and May.

18. **Loxandrus unilobus** New Species
Figs. 59; 123 A, B; 172

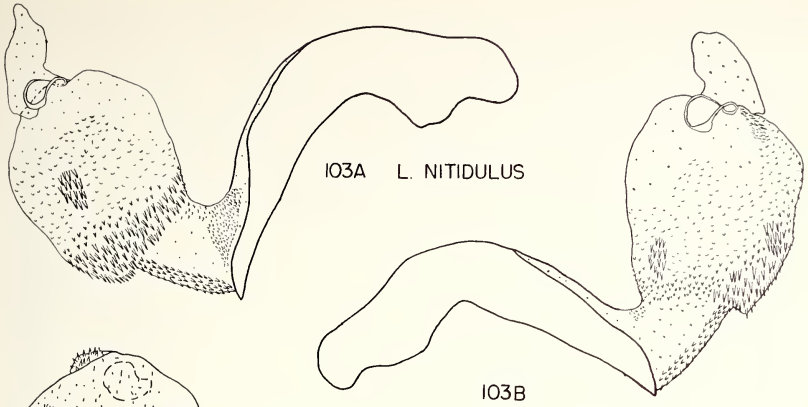
HOLOTYPE. ♂. Arkansas. Lonoke Co.: Carlisle (MCZ). Paraypes. 1 ♂ (MCZ); 2 ♂♂ (CU); 1 ♂ (CAS); 1 ♂ (UA); 1 ♂ (TLE).

DESCRIPTION. *Color.* Dorsal: black, shining. Ventral: black to dark brown. Appendages: black to dark brown except palpi which are reddish brown. *Head.* Clypeus: anterior margin straight or slightly concave. Epistomal and subgenal sutures: obscure, complete. Frontal sulci: obscure, shallow, broad. Microsculpture: absent on the anterior part of the clypeus; isodiametric on the frons and vertex. Mentum: apex of lobes narrowly rounded; tooth not as long as lobes; furrows shallow; fovae absent; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture on disk weak, elongate; lateral margins evenly rounded, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete or not; posterior marginal sulcus reaching past basal fovae but incomplete; median sulcus reaching anterior

---

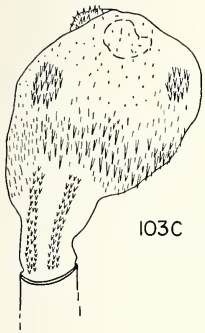
→

FIGS. 103–106. Male genitalia, IS everted. 103 A. *L. nitidulus* (LeC.), right lateral aspect. 103 B. Same, left lateral aspect. 103 C. Same, ventral aspect. 104. *L. crenatus* Chaud., dorsal aspect. 105. *L. lucens* Chaud., dorsal aspect. 106. *L. saphyrinus* (Chaud.), left lateral aspect.

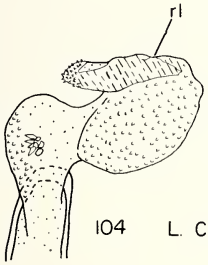


103A L. NITIDULUS

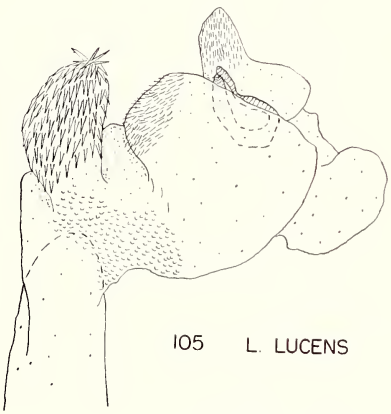
103B



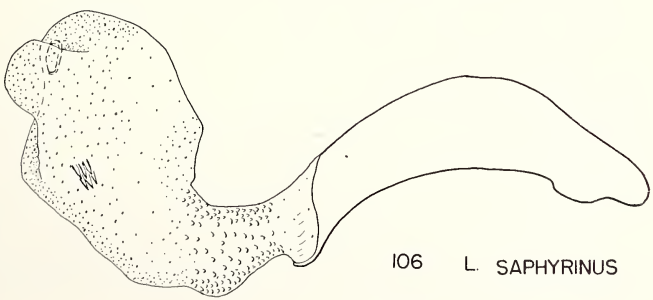
103C



104 L. CRENATUS



105 L. LUCENS



106 L. SAPHYRINUS

marginal sulcus or not, not reaching posterior margin; basal impressions elongate, moderately deep, punctate or not; area between impressions sparsely punctate or not; area between impressions and lateral margins if punctate only one or two punctures. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture elongate, distinct laterally, less so medially; impunctate. Proepisternum: microsculpture isodiametric; impunctate. Proepimeron: microsculpture isodiametric and elongate; impunctate. Mesosternum: microsculpture slightly elongate; impunctate. Mesepisternum: microsculpture isodiametric; impunctate but a few weak, small ridge-like structures anteriorly. Metasternum: microsculpture elongate, more distinct laterally; weakly punctate laterally in some specimens. Metepisternum: microsculpture isodiametric; weakly and sparsely punctate in some specimens. Metepimeron: microsculpture elongate; impunctate. *Legs.* Hind coxae: microsculpture on inner surface elongate. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent on intervals; all striae distinct, punctate, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–3 rugose laterally towards the base; ambulatory setae on segment 2. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position, slightly turned to the left side and directed dorsally; six distinct scale groups present; most of the remainder of the sac's surface coverd with small weakly sclerotized scales; sclerotized ring present, opening in the left side. *Measurements.* (4 specimens). TL—4.9 (5.5–6.4); WH—1.2 (1.1–1.2); WP—1.8 (1.7–1.9); WW—2.3 (2.2–2.5).

DISTRIBUTION. Central Southern United States.

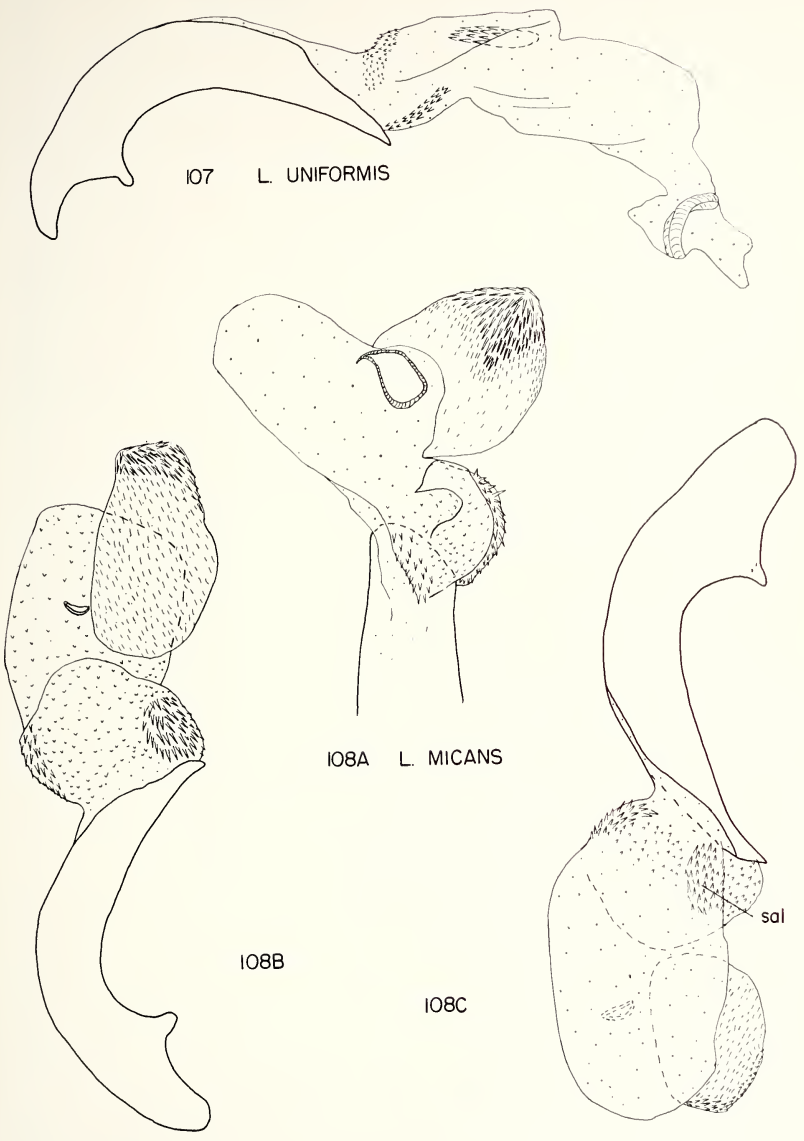
LOCALITIES. Arkansas. Calhoun Co.: Bayou Moro, Hy. 160 (UA); Lonoke Co.: Carlisle (MCZ). Unrecorded localities in Arkansas (CU). Florida. Duval Co.: Jacksonville (CAS). Louisiana. Evangeline Co.: Lake Chicot State Park (TLE). Texas. Unrecorded localities (MCZ).

DISCUSSION. See above.

19. **Loxandrus saccisecundaris** New Species
Figs. 54; 121 A, B, C

HOLOTYPE. ♂. Georgia. Frederick Blanchard Collection (MCZ).

DESCRIPTION. *Color.* Dorsal surface: black, shining; ventral surface: black except apex of segment 5 of abdomen which is dark brown.



FIGS. 107–108. Male genitalia, IS everted. 107. *L. uniformis* n. sp., left lateral aspect. 108 A. *L. micans* Chaud., dorsal aspect. 108 B. Same, left lateral aspect. 108 C. Same, right lateral aspect.

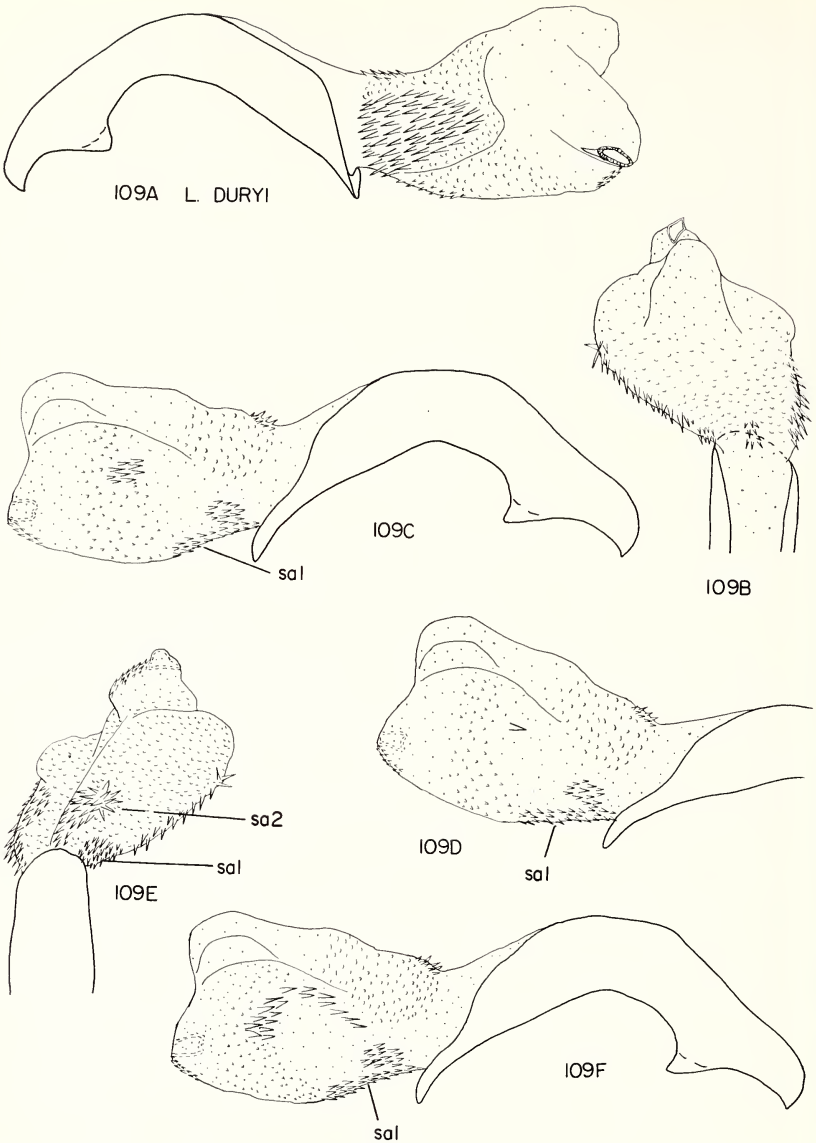


FIG. 109. Male genitalia, IS everted. 109 A. *L. duryi* Wright, left lateral aspect. 109 B. Same, dorsal aspect. 109 C. Same, right lateral aspect. 109 D. Same, apex of median lobe, left lateral aspect. 109 E. Same, apex of median lobe, ventral aspect. 109 F. Same, left lateral aspect.

Appendages: dark to light brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: complete. Frontal sulci: obscure, short, broad, shallow. Microsculpture: clypeus, frons and vertex isodiametric (sometimes weak). Mentum: apex of lobes narrowly rounded; tooth not as long as lobes; furrows and fovae absent; microsculpture slightly elongate. *Thorax.* Pronotum: microsculpture on disk present but weak, elongate, less elongate along lateral margins; lateral margins reflexed and evenly rounded their entire distance, not sinuate posteriorly, impunctate; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus just reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions sparsely punctate; area between impressions and lateral margins impunctate. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: impunctate; microsculpture elongate, more distinct laterally. Proepisternum: impunctate; microsculpture isodiametric. Proepimeron: impunctate; microsculpture isodiametric and slightly elongate. Mesosternum: impunctate; microsculpture slightly elongate. Mesepisternum: weakly punctate in anterior half; microsculpture elongate. Metasternum: punctate towards the lateral margins; microsculpture elongate, more distinct laterally. Metepisternum: weakly punctate; microsculpture elongate. Metepimeron: impunctate; microsculpture elongate, weak. *Legs.* Hind coxae: microsculpture on inner surface elongate: tarsal segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture isodiametric; segment 1 sparsely punctate laterally near the base; segments 1–5 rugose along the basal margin; ambulatory setae present on second abdominal sternite. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, slightly turned dorsally: 9 distinct scale groups are present; basal quarter of surface covered with small weakly sclerotized scales; sclerotized ring present, opening on the left side; a secondary sac everting near the midline on the left side. *Measurements.* (1 specimen). TL—7.4; WH—1.4; WP—2.4; WW—3.1.

DISTRIBUTION AND LOCALITY. Known from a single specimen from an unidentified locality in Georgia (MCZ).

DISCUSSION. See above.

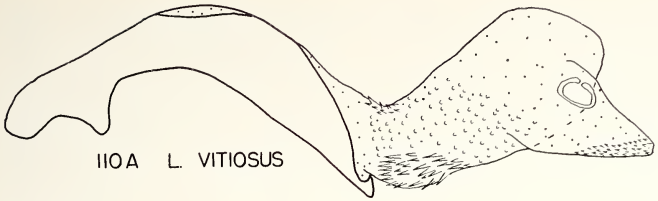
20. **Loxandrus extendus** New Species
Figs. 62; 131 A, B; 176

HOLOTYPE. ♂. Arkansas, undetermined locality. Strom. Frederick Blanchard Collection (MCZ). Paratypes. 3 ♂♂ (PU).

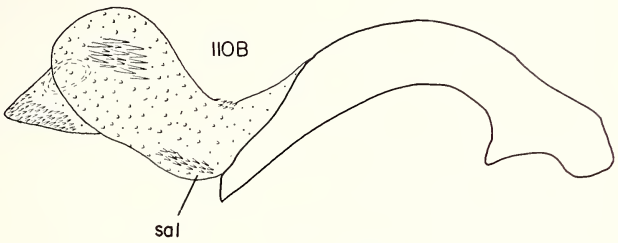
DESCRIPTION. *Color.* Dorsal: shining black. Ventral: mostly black, some areas dark brown. Appendages: dark brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: weak but complete. Frontal sulci: almost absent, short, broad, shallow. Microsculpture: clypeus, frons and vertex weak, isodiametric. Mentum: apex of lobes narrowly rounded; tooth not as long as lobes, apex rounded; furrows present; fovae obscure; microsculpture isodiametric, sometimes slightly elongate. *Thorax.* Pronotum: microsculpture vaguely present on disk, elongate, isodiametric along lateral margins; lateral margins evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate; area between basal impressions with only one puncture; area between basal impressions and lateral margins impunctate. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: impunctate; microsculpture isodiametric and elongate laterally becoming very elongate or absent medially. Proepisternum: impunctate; microsculpture isodiametric. Proepimeron: impunctate; microsculpture slightly elongate. Mesosternum: impunctate; microsculpture slightly elongate. Mesepisternum: weakly and sparsely punctate in the anterior half; microsculpture isodiametric to slightly elongate. Metasternum: weakly punctate towards lateral margin; microsculpture isodiametric to weakly elongate, more distinct toward lateral margin. Metepisternum: impunctate; microsculpture slightly elongate. Metepimeron: impunctate; microsculpture elongate. *Legs.* Hind coxae: microsculpture on inner surface elongate; tarsal segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1–2 isodiametric units wide;

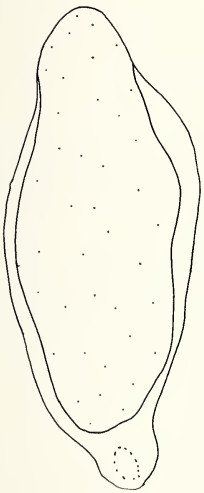
→

FIGS. 110–111. Male genitalia. 110 A. *L. vitiosus* n. sp., left lateral aspect, IS everted. 110 B. Same, right lateral view, IS everted. 110 C. Same, ventral aspect. 111 A. *L. major* Darl., dorsal aspect. 111 B. Same, left lateral aspect, IS everted.

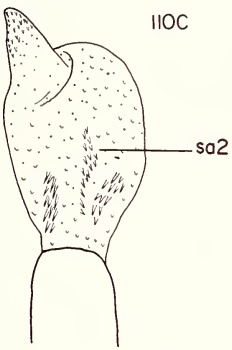


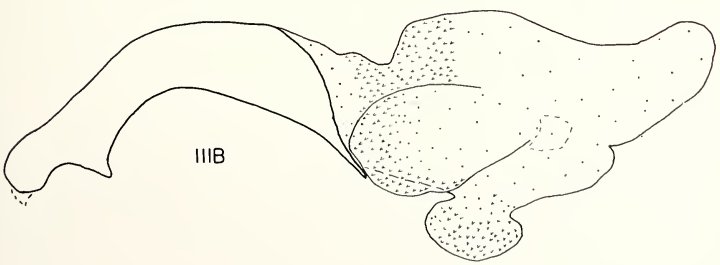
110A L. VITIOSUS





111A L. MAJOR





internal plica well-developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture distinct, isodiametric laterally, becoming elongate to absent medially; segment 1 sparsely punctate basally and laterally; segments 1–4 sparsely rugose laterally; ambulatory setae present on second abdominal sternite. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, directed slightly dorsally and turned at the apex towards the left side; 7 scale groups present; sclerotized ring present; a large extension of the main sac at the apex; most of surface of the sac covered with small weakly sclerotized scales. *Measurements.* (1 specimen). TL—7.5; WH—1.4; WP—2.3; WW—3.0.

DISTRIBUTION. Central United States.

LOCALITIES. Arkansas. Unrecorded locality (MCZ). Indiana. Dubois Co. (PU); Virgo Co. (PU).

DISCUSSION. See above.

21. **Loxandrus taeniatus** LeConte
Figs. 60; 127 A, B; 175

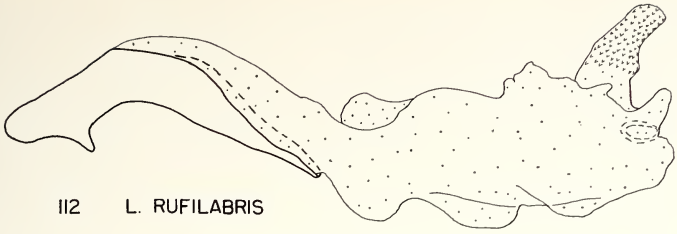
Loxandrus taeniatus LeConte 1852:252. ♂. Marked with a red type label in the MCZ collection. Type No. 5697. No data labels on this specimen but in the original description LeConte states that it is from Louisiana and was presented to him by Mr. Schaum.

DESCRIPTION. *Color.* Dorsal: black, iridescent. Ventral: dark brown to black. Appendages: dark or light to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: fine but complete. Frontal sulci: feebly present, shallow, broad. Microsculpture: clypeus, frons and vertex, isodiametric. Mentum: apex of lobes broadly rounded; tooth distinct, shorter than lobes, rounded at apex; furrows and fovae absent; microsculpture, isodiametric but slightly elongate. *Thorax.* Pronotum: elongate microsculpture present on disk (distinct in most specimens), isodiametric along lateral margins; lateral margin evenly rounded, not sinuate posteriorly, impunctate except (sometimes) near basal angles; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus

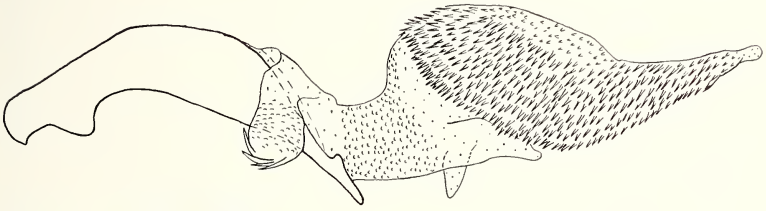
---

→

FIGS. 112–114. Male genitalia. 112. *L. rufilabris* Cast., left lateral aspect, IS everted. 113 A. *L. australiensis* Sloane, left lateral aspect, IS everted. 113 B. Same, dorsal aspect, IS everted. 114 A. *L. medius* Darl., left lateral aspect. 114 B. Same, left lateral aspect, IS everted. 114 C. Same, dorsal aspect, sac everted.

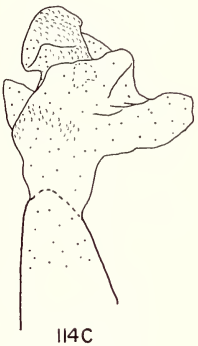


112 L. RUFILABRIS

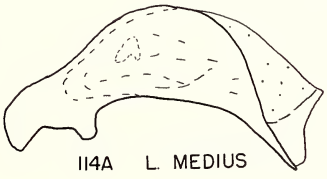


113A L. AUSTRALIENSIS

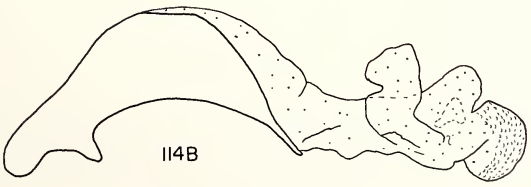
113B



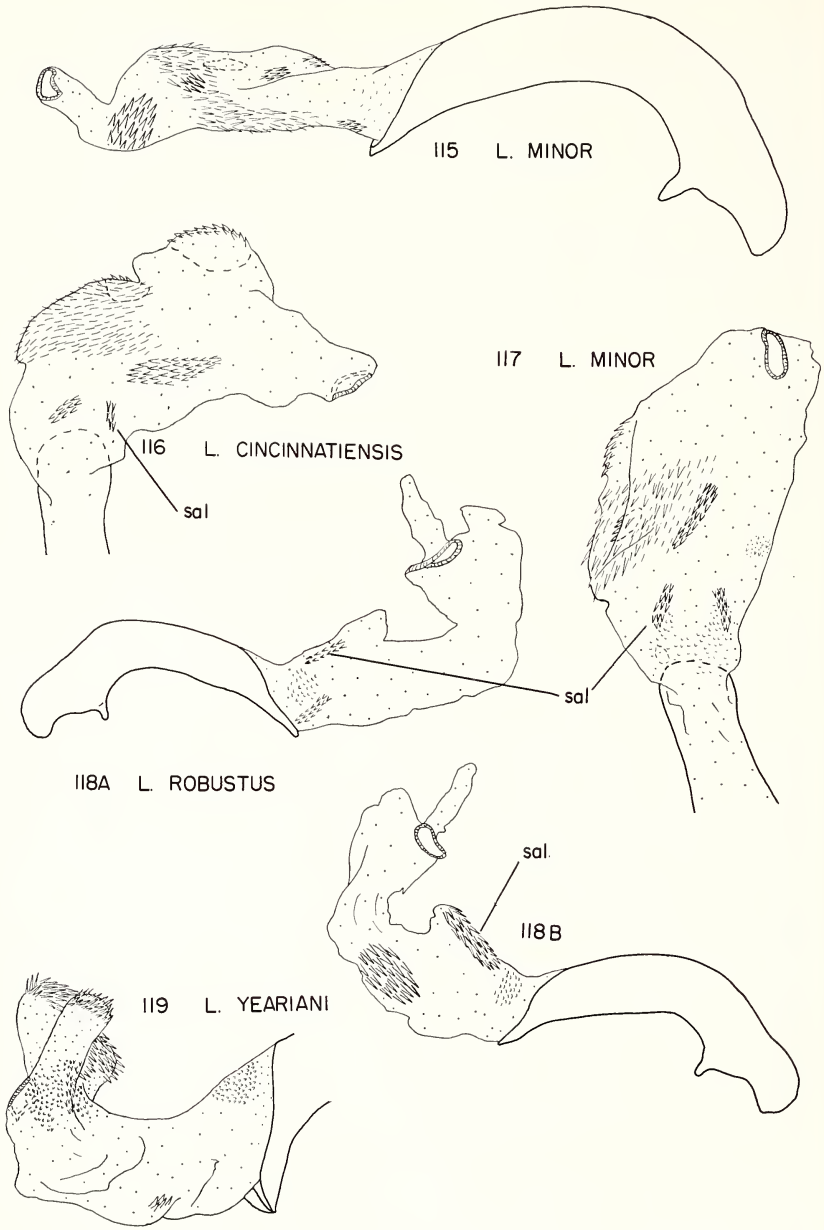
114C



114A L. MEDIUS



114B



FIGS. 115–119. Male genitalia, IS everted. 115. *L. minor* Chaud., right lateral aspect. 116. *L. cincinnatiensis* Casey, dorsal aspect, apex of median lobe. 117. *L. minor* Chaud., dorsal aspect, apex of median

reaching past the basal fovae but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, moderately deep, punctate or not; area between basal impressions sparsely punctate; area between basal impressions and lateral margins usually impunctate. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: impunctate; microsculpture where present, elongate. Proepisternum: impunctate; microsculpture isodiametric. Proepimeron: impunctate; microsculpture isodiametric and/or slightly elongate. Mesosternum: impunctate; microsculpture elongate. Mesepisternum: impunctate; microsculpture elongate. Mesepisternum: weakly punctate in groove only; microsculpture elongate. Metasternum: sometimes sparsely and weakly punctate laterally; microsculpture more distinct laterally and anteriorly, elongate. Metepisternum: punctate (sometimes sparse and weak); microsculpture isodiametric. Metepimeron: impunctate; microsculpture absent. *Legs.* Hind coxae: microsculpture on inner surface obscure, elongate; tarsal segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, elongate medially; impunctate; rugose on lateral-basal areas of segments 1–3. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially; 5 distinct scale groups; most of the apical quarter of the sac covered by moderately large scales but not forming a distinct group; remainder of the surface covered with small weakly sclerotized scales; one area on the right side distinctly free of scales; sclerotized ring present. *Measurements.* (16 specimens). TL—6.7 (6.2–7.5); WH—1.3 (1.2–1.4); WW—2.7 (2.5–2.8).

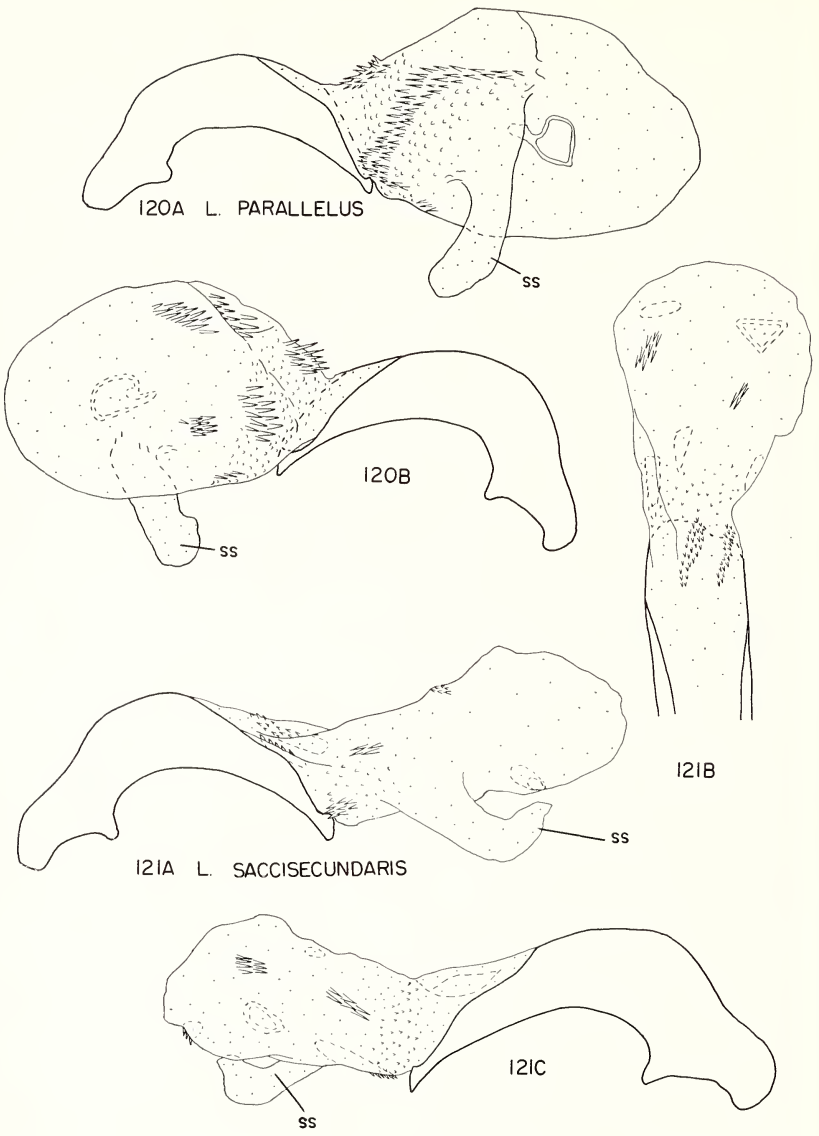
DISTRIBUTION. Southern United States.

LOCALITIES. Alabama. Mobile Co.: Calvert (CAS). Arkansas. Arkansas Co.: E. of Reydel, Hy. 11, Bayou Meto (UA). Georgia. Unrecorded localities (MCZ, UM, INHS). Louisiana. Beauregard Co.: Rosepine (UA); Evangeline Co.: Lake Chicot State Park (TLE); Iberia Co.: New Iberia (USNM); St. Martin Co. (UA). Mississippi. Hancock Co. (USNM). North Carolina. *Broadman (?). South Carolina. Sumpter Co.: Sumpter (GB).

DISCUSSION. See above.

←

lobe. 118 A. *L. robustus* n. sp., left lateral aspect. 118 B. Same, right lateral aspect. 119. *L. yeariani* n. sp., right lateral aspect, apex of median lobe.



FIGS. 120–121. Male genitalia, IS everted. 120 A. *L. parallelus* Casey, left lateral aspect. 120 B. Same, right lateral aspect. 121 A. *L. saccisecundaris* n. sp., left lateral aspect. 121 B. Same, dorsal aspect. 121 C. Same, right lateral aspect.

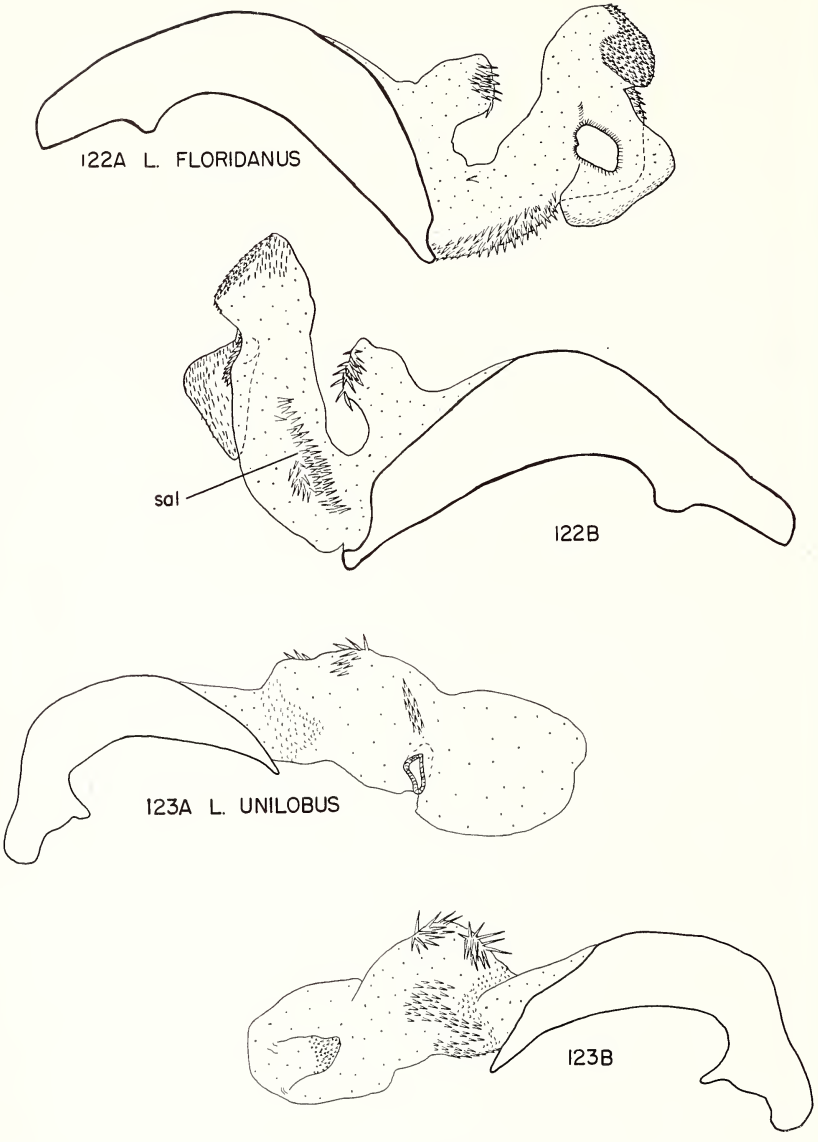
22. **Loxandrus floridanus** LeConte

Figs. 17; 58; 122 A, B; 171

Loxandrus floridanus LeConte, 1878:376. ♀. Florida, Capron; 24–4; Type No. 5694 (MCZ). There are 7 additional specimens in the series, 3 males and 4 females. See discussion.

Loxandrus scitus Casey, 1918:388. ♂. Florida, Dunedin. Type No. 47351 (USNM). One ♂ paratype.

DESCRIPTION. *Color.* Dorsal: black, shining. Ventral: usually black, sometimes dark brown. Appendages: femur and tibia usually black, sometimes dark brown; tarsi, palpi and antennae dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: obscure, shallow, broad. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth not as long as lobes; furrows shallow; fovae absent; microsculpture isodiametric or slightly elongate. *Thorax.* Pronotum: microsculpture on disk elongate, distinct; lateral margins evenly rounded their entire distance, not sinuate or oblique posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, shallow, punctate; area between basal impressions punctate; area between basal impressions and lateral margins punctate or not, when punctate sparsely so. Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture elongate, more distinct laterally. Proepisternum: microsculpture isodiametric. Proepimeron: microsculpture isodiametric and elongate. Mesosternum: microsculpture slightly elongate. Mesepisternum: microsculpture isodiametric. Metasternum: microsculpture elongate medially, isodiametric laterally. Metepisternum: microsculpture isodiametric. Metepimeron: microsculpture elongate, weak. *Legs.* Hind coxae: microsculpture on inner surface isodiametric. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae except basal portion of 7 distinct, trough 2–3 sometimes 4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; segment 1 weakly punctate basally or not, other segments impunctate; segments 1–4 weakly rugose laterally toward the base; ambulatory setae present on segment 2. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and is directed dorsally; seven more or less distinct



FIGS. 122–123. Male genitalia, IS everted. 122 A. *L. floridanus* LeC., left lateral aspect. 122 B. Same, right lateral aspect. 123 A. *L. unilobus* n. sp., left lateral aspect. 123 B. Same, right lateral aspect.

scale groups including those on the two secondary sacs present; two secondary sacs, one at the base on the dorsal surface and one toward the apex on the left lateral surface; sclerotized ring present, partially on the main sac and on the apical secondary sac. *Measurements.* (20 specimens). TL—8.0 (7.3–9.4); WH—1.6 (1.5–1.9); WP—2.5 (2.3–2.8); WW—3.2 (2.9–3.7).

DISTRIBUTION. Southern and Southeastern United States and West Indies.

LOCALITIES. UNITED STATES. Alabama. Mobile Co.: Delchamps (OSU, MCZ, USNM, CAS, GB); unrecorded locality (CU). Florida. Alachua Co.: Gainesville (CU); Charlotte Co.: Punta Gorda (CAS); Collier Co.: Everglade (USNM); Dade Co.: Biscayne (USNM), Biscayne Bay (AM), Hialeah (TLE), Homestead (MCZ); Duval Co.: Jacksonville (CAS, OSU); Hillsborough Co.: Tampa (MCZ); Lucie Co.: Capron (old Fort on 1861 map) (USNM); Manatee Co.: Oneco (GB); Osceola Co.: Kissimmee (AM); Palm Co.: Lake Worth (AM); Pinellas Co.: Dunedin (PU); Sarasota Co.: Myakka River State Park (GB). *Indian River (USNM). Unrecorded locality in Florida (MCZ). Louisiana. Calcasieu Co.: Sabine River Ferry (CU); Madison Co.: Tallulah (MCZ); Orleans Co.: New Orleans (MCZ, USNM, CAS); Plaquemines Co.: Myrtle Grove (INHS). Mississippi. Hancock Co.: Waveland (USNM); Jackson Co.: Ocean Springs (CU), Horn Island (CU). *Gulf View (USNM). Texas. Comal Co.: New Braunfels (CAS); Orange Co. (TAM). Unrecorded locality in Texas (MCZ). WEST INDIES. South Bimini Island (AM).

DISCUSSION. This species was described by LeConte (1878) from Capron and Enterprise, Florida. The material in the LeConte collection (MCZ) consists of the female type and seven additional specimens. The last specimen in the series is a female from Louisiana and was probably not part of the original type material. The three males in the series are all the same species. For this reason I am considering this a valid species.

The males and females appear to be distinct and can be identified by the characters given in the key. Too much reliance should not be placed on external characters in the females, however, and exact determinations should be based on examination of the male aedeagus. Specimens have been collected in February, March, April, May, June, July, October, November and December.

23. **Loxandrus agilis** (Dejean 1828)

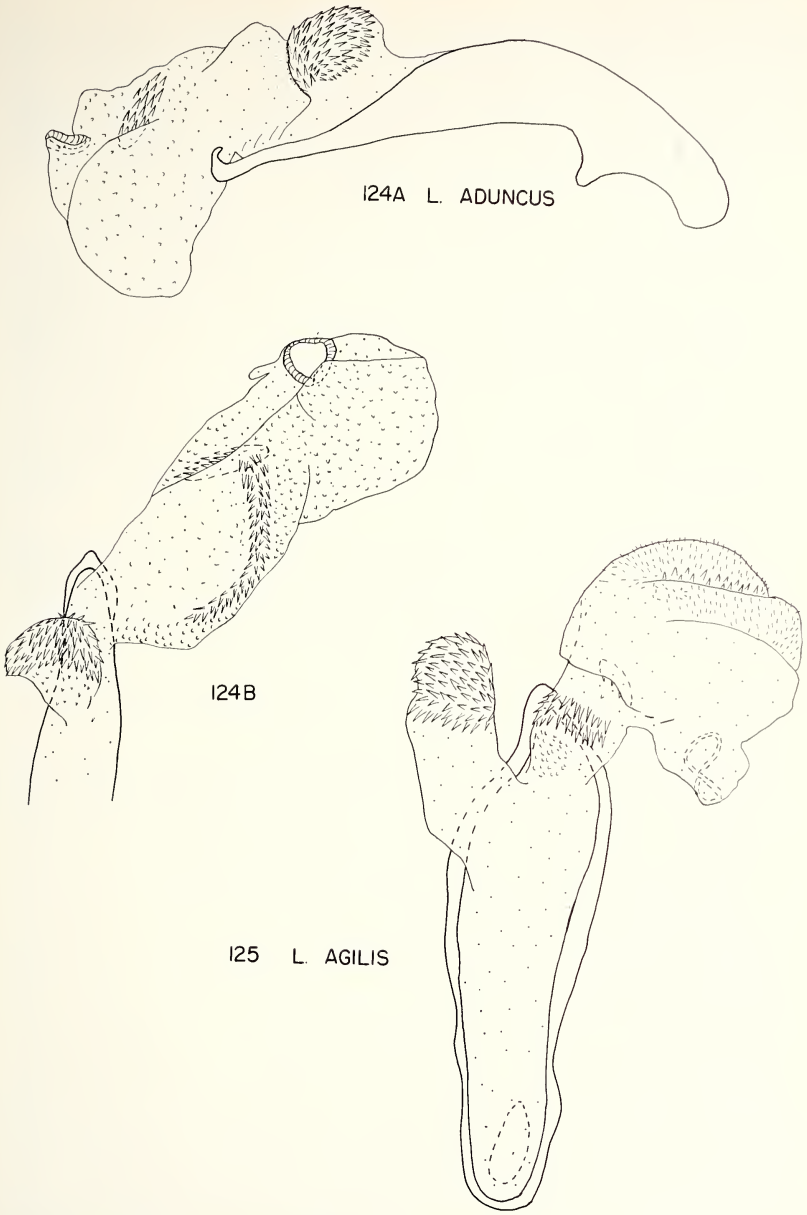
Figs. 13; 20 A, B, C; 21; 56; 125; 173

Feronia agilis Dejean 1828:244. *Lectotype* (here selected) . ♂. The first in a series of 5 specimens in the Chaudoir Collection. It is the only one

marked with a green Dejean determination label and is recorded from Boreal America (PMNH).

Loxandrus flavilimbus Blatchley, 1918:418. *Type.* ♂. Collected north of Dunedin, Florida, under a board near the border of a pond on January 1 (PU).

DESCRIPTION. *Color.* Dorsal: black, shining. Ventral: black to dark brown. Appendages: dark to reddish brown. *Head.* Clypeus: anterior margin straight. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: obscure, broad, shallow. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes rounded; tooth distinct, not as long as lobes; furrows shallow; fovae, if present, shallow, obscure; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture distinct, usually isodiametric, sometimes slightly elongate; lateral margins evenly rounded, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions shallow, elongate, punctate or not; area between basal impressions punctate; area between impressions and lateral margins punctate or not. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: impunctate; microsculpture elongate medially, isodiametric laterally. Proepisternum: impunctate, microsculpture distinct, isodiametric. Proepimeron: impunctate; microsculpture isodiametric and elongate. Mesosternum: impunctate; microsculpture feebly elongate. Mesepisternum: impunctate; microsculpture isodiametric. Metasternum: impunctate; microsculpture elongate medially, isodiametric laterally. Metepisternum: impunctate; microsculpture isodiametric. Metepimeron: impunctate; microsculpture distinct, isodiametric or feebly elongate. *Legs.* Hind coxae: microsculpture on inner surface isodiametric. Tarsi: segments 1–4 of hind tarsi and 1–3 of middle tarsi grooved dorso-laterally. *Elytra.* Microsculpture sometimes weakly present on the intervals, if so then it is very elongate; all striae distinct, trough 1 sometimes 2 isodiametric units wide; lateral margin distinctly sinuate apically; internal plica distinct; humeri rounded; microsculpture of epipleura usually present, elongate. *Abdominal sternites.* Microsculpture distinct, elongate medially, isodiametric laterally; impunctate; segments 1–3 rugose on the lateral and basal surfaces; ambulatory setae sometimes present on segment 2. *Aedeagus.* Median lobe: compressed dorso-ventrally; right lateral margin strongly sinuate apically; apex turned toward the right side, pointed. Internal sac: four distinct scale groups present; entire right side and most of the ventral surface of the sac covered with



FIGS. 124–125. Male genitalia, IS everted. 124 A. *L. aduncus* n. sp., right lateral aspect. 124 B. Same, dorsal aspect. 125. *L. agilis* (Dej.), dorsal aspect.

elongate scales that do not form a well defined group; remainder of the surface covered with small, weakly sclerotized scales; secondary sac everts from the dorsal surface of the membranous portion of the main lobe, scale group at its apex; sclerotized ring present. *Measurements.* TL—9.1 (8.0–9.8); WH—1.8 (1.6–1.8); WP—2.9 (2.5–3.1); WW —3.6 (3.2–3.8).

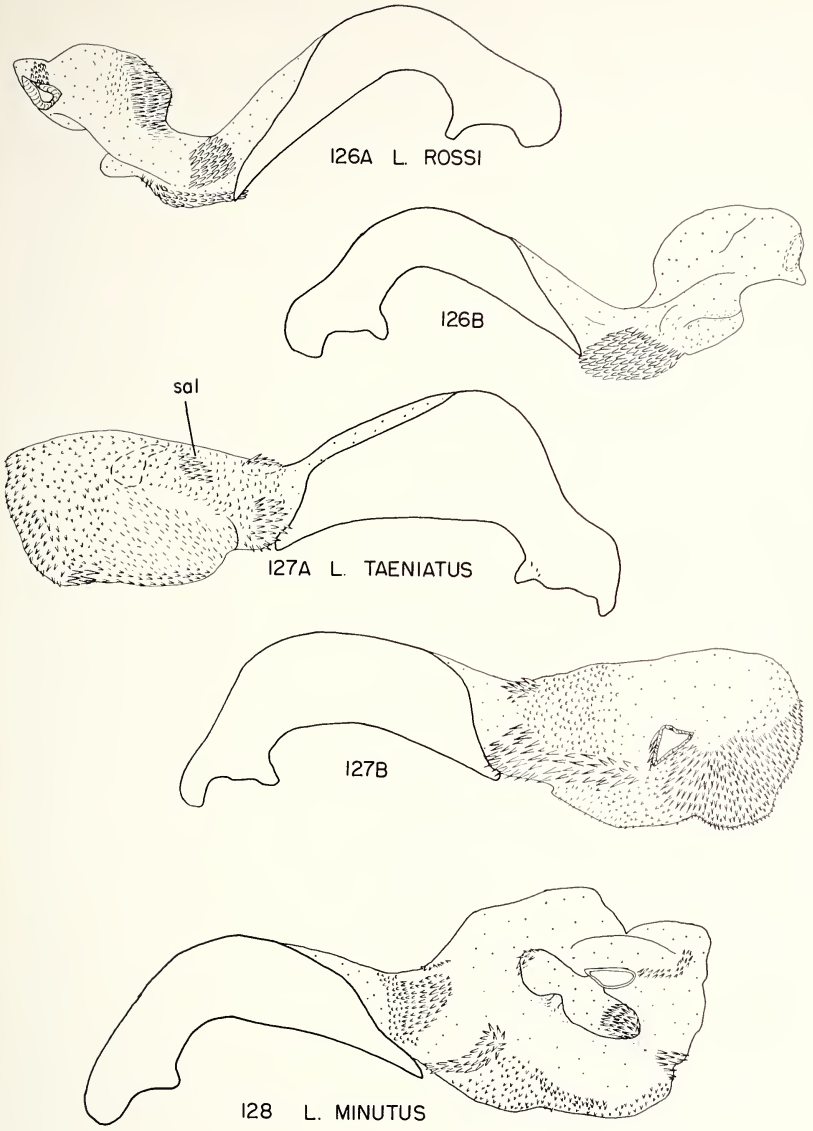
DISTRIBUTION. Southeastern United States west to Texas.

LOCALITIES. Florida. Alachua Co. (FSPB); Charlotte Co.: Punta Gorda (CAS); Desoto Co.: Arcadia (GB); Duval Co.: Mayport (FSPB), Jacksonville (CAS, OSU); Highlands Co.: Archbold Biological Station (CU, PSU), Brighton (MCZ), Highlands Hammock (TLE); Hillsborough Co.: Tampa (MSU, USNM, CU); Manatee Co.: Oneco (PU, GB); Orange Co.: Winter Park (MCZ), Titusville (CNC); Pinellas Co.: Dunedin (PU); Putnam Co.; Crescent City (USNM); Volusia Co.: Enterprise (MSU), Sanford (MCZ), Lake Helen (CAS). *Indian River (USNM). Unrecorded locality in Florida (CAS). Texas. *Mitten (MCZ).

DISCUSSION. The males and females of this species can be identified using external characters. The male aedeagus should be examined, however, when possible. This species has been collected in the months of February, March, April, May, June, August, and December.

THE *L. aduncus*, *L. cervicalis*, *L. parallelus*, *L. taeniatus* AND *L. spinilunatus* COMPLEX

DISCUSSION. These five species closely resemble each other in all external characters. They cannot be separated from one another except on the basis of characters associated with the male aedeagii. *L. parallelus*, described by Casey from Monroe, Louisiana, appears to have a more western distribution than the other four species under discussion. It has been collected in the months of April, June, July and August. *L. cervicalis* is known from several localities in Florida and one locality in Arkansas. It has been collected in January, March, August and October. *L. aduncus* is presently known from four localities in the Southeastern United States. Collecting data indicate this species being collected in January, February, May and June. The external characters of *L. taeniatus* are somewhat variable and the species is keyed out in several different places in the key. It is apparently a southern form although not reaching into Florida, and has been collected in the months of March, April, June and December. *L. spinilunatus* is known from only two male specimens from undetermined localities in Arkansas and Louisiana. There were no collecting data with the specimens indicating at what time of year they were taken.



FIGS. 126–128. Male genitalia, IS everted. 126 A. *L. rossi* n. sp., right lateral surface. 126 B. Same, left lateral surface. 127 A. *L. taeniatus* LeC., right lateral aspect. 127 B. Same, left lateral aspect. 128. *L. minutus* n. sp., left lateral aspect.

24. **Loxandrus aduncus** New Species
Figs. 57; 124 A, B; 174

HOLOTYPE. ♂. Florida. Winter Park; John George Gehring Collection (MCZ). Paratypes. 2 ♂♂ (MCZ); 1 ♂ (TLE); 3 ♂♂ (CU).

DESCRIPTION. *Color.* Dorsal: black, shining. Ventral: black to dark brown. Appendages: dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal suture: distinct, complete. Frontal sulci: obscure, short, broad, shallow. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, slightly shorter than lobes; furrows shallow; fovae absent; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture distinct, usually isodiametric but sometimes weakly elongate; lateral margins sparsely punctate in posterior quarter or less, evenly rounded their entire length, not sinuate; posterior angles broadly rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between basal impressions punctate; area between basal impressions and lateral margin sparsely punctate, most punctures confined to the posterior margin. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: microsculpture elongate; impunctate. Proepisternum and Proepimeron: microsculpture isodiametric; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture isodiametric; impunctate. Metasternum: microsculpture elongate medially, isodiametric laterally; impunctate. Metepisternum: microsculpture isodiametric; impunctate. Metepimeron: microsculpture elongate; impunctate. *Legs.* Hind coxae: microsculpture on inner surface elongate. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorsolaterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture distinct, elongate medially, isodiametric laterally; impunctate; base of segments 1–3 rugose, ambulatory setae sometimes present on second abdominal sternite. *Aedeagus.* Median lobe: apex forming a hook that is turned dorsally. Internal sac: three distinct scale groups are present on the main body of the sac; most of the remainder of the sac's surface is covered with small weakly sclerotized scales; a secondary sac everts on the dorsal membranous portion of the median lobe, the apex is covered with a scale group; sclerotized

ring present. *Measurements.* (7 ♂ specmens). TL—8.2 (7.8–8.4); WH—1.8 (1.7–1.8); WP—2.4 (2.2–2.6); WW—3.2 (3.0–3.3).

DISTRIBUTION. Extreme Southeastern United States.

LOCALITIES. Alabama. Mobile Co.: Mobile (MCZ). Florida. Highlands Co.: Archbold Bio. Sta. (CU), Highlands Hammock (TLE); Orange Co.: Winter Park (MCZ).

DISCUSSION. See above.

25. **Loxandrus parallelus** Casey
Figs. 4; 55; 120 A, B; 170

Loxandrus parallelus Casey 1918:386. Holotype. ♂. Type No. 47342. USNM. Casey states in the original description that he collected "a single example" at Monroe, Louisiana.

DESCRIPTION. *Color.* Dorsal: black, shining; elytra iridescent. Ventral: dark brown to black, shining. Appendages: dark to light brown or straw yellow. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures distinct, complete. Frontal sulci: obscure, short, shallow, broad. Microsculpture: clypeus, frons, and vertex isodiametric. Mentum: apex of lobes rounded; tooth distinct, shorter than lobes; furrows shallow; fovae absent; microsculpture slightly elongate. *Thorax.* Pronotum: microsculpture distinct, elongate; lateral margins evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but not complete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions punctate; area between impressions and lateral margins punctate or not. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: microsculpture elongate, becoming more distinct laterally; impunctate. Proepisternum, proepimeron, mesosternum and mesepimeron: microsculpture isodiametric; impunctate. Metasternum: microsculpture elongate laterally and around middle coxae, isodiametric in anterior median portion; impunctate. Metepisternum: microsculpture isodiametric; impunctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface distinct, elongate. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; all striae distinct, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–3 rugose at the base and 1–4 rugose laterally. *Aedeagus.* Median

lobe: not modified. Internal sac: everts in a median position and deflected downward; six distinct scale groups present; remainder of the surface of the primary sac is covered with very small, lightly sclerotized scales; a secondary sac everts on the left side; sclerotized ring present. *Measurements.* (20 specimens). TL—6.9 (6.5–7.4); WH—1.3 (1.2–1.4); WP—2.1 (1.9–2.3); WW—2.8 (2.5–3.0).

DISTRIBUTION. Mid-southern United States west to Texas.

LOCALITIES. Arkansas. Greene Co.: Paragould (MSU); Hempstead Co.: Hope (MCZ). Kentucky. No locality (AM). Louisiana. Caddo Co.: Shreveport (UA); East Baton Rouge Co.: Baton Rouge (UA); Evangeline Co.: Lake Chicot State Park (TLE). Texas. Brazos Co.: College Station (TAM). Navarra Co.: Corsicana (USNM).

DISCUSSION. See above.

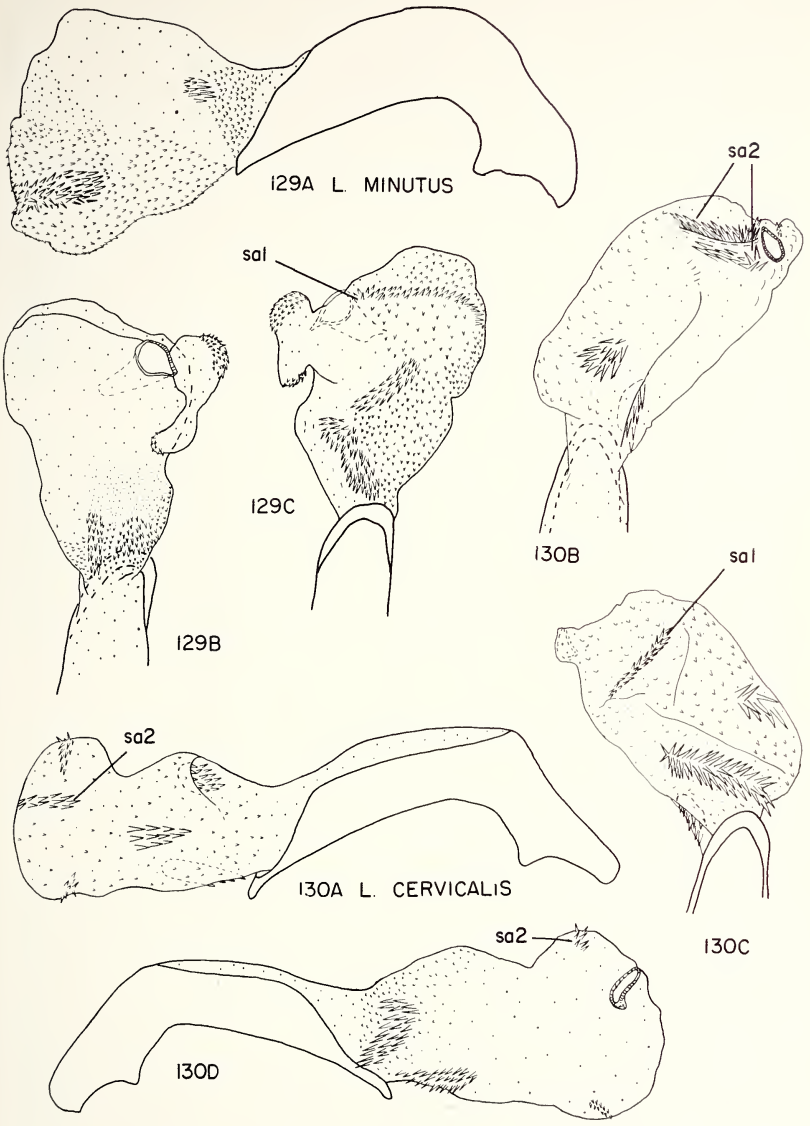
26. **Loxandrus cervicalis** Casey

Figs. 63; 130 A, B, C; 176

Loxandrus cervicalis Casey, 1918:385. Holotype. ♂. One male specimen from Sarasota, Florida. Type No. 47340. (USNM).

Loxandrus brunneus Blatchley, 1918:417. Holoype. ♂. Type locality, Lake Okeechobee, four miles southeast of Moore Haven, March 1–3 (PU).

DESCRIPTION. *Color.* Dorsal: black, shining, elytra iridescent. Ventral: black to dark brown. Appendages: mostly black to dark brown but sometimes straw yellow. *Head.* Clypeus: anterior margin usually straight, sometimes very slightly concave. Epistomal and subgenal sutures distinct, complete. Frontal sulci: short, broad, shallow. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth not as long as lobes; furrows and fovae absent; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture distinct, elongate; lateral margins evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching just past basal fovae but incomplete; median sulcus present, reaching anterior sulcus but not posterior margin; basal impressions elongate, sparsely punctate; area between basal impressions sparsely punctate; area between basal impressions and lateral margins impunctate. Scutellum: apex pointed; microsculpture isodiametric. N. B. Ventral surface of thorax impunctate. Prosternum: microsculpture elongate medially, becoming isodiametric towards the lateral margins. Proepisternum: microsculpture isodiametric. Proepimeron: microsculpture elongate. Mesosternum: microsculpture elongate. Mesepisternum: microsculpture elongate and isodiametric. Metasternum: microsculpture elongate or absent in median areas, isodiametric towards the lateral margins.



FIGS. 129–130. Male genitalia, IS everted. 129 A. *L. minutus* n. sp., right lateral aspect. 129 B. Same, dorsal aspect. 129 C. Same, ventral aspect. 130 A. *L. cervicalis* Casey, right lateral aspect. 130 B. Same, left lateral aspect. 130 C. Same, ventral aspect.

Metepisternum: microsculpture isodiametric. Metepimeron: microsculpture if present elongate. *Legs.* Hind coxae: microsculpture on inner surface elongate. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent; striae 7 weakly impressed basally, other striae all distinct, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, becoming isodiametric laterally; impunctate; segments 1 and 2 weakly rugose at base; ambulatory setae sometimes present on segment 2. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position; six distinct scale groups present; remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (17 specimens). TL—6.5 (6.2–7.2); WH—1.3 (1.2–1.5); WP—2.0 (1.9–2.2); WW —2.6 (2.5–2.9).

DISTRIBUTION. Southeastern United States, Florida to Arkansas.

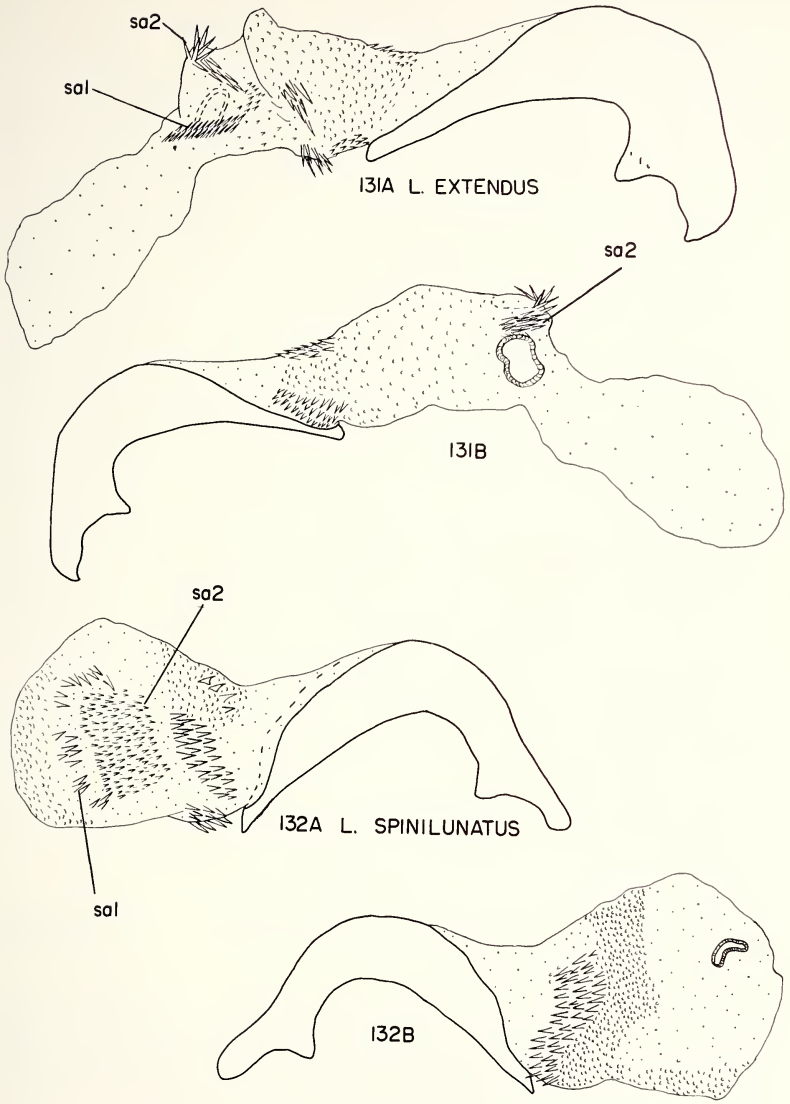
LOCALITIES. Arkansas. Lonoke Co.: Carlisle (CAS). Florida. DeSoto Co.: Arcadia (GB); Duval Co.: Jacksonville (OSU); Hernando Co.: Brooksville (CAS); Highland Co.: Archbold Biological Station, Lake Placid (CU, PSU); Hillsborough Co.: Tampa (USNM); Indian River Co.: Sebastian River (USNM); Levy Co.: No locality (FSPB); Pinellas Co.: Bellair (AM, USNM); Dunedin (PU); Sarasota Co.: Sarasota (CAS); Volusia Co.: New Smyrna (CAS). *Sand Pt. (USNM).

DISCUSSION. See above.

27. **Loxandrus spinilunatus** New Species
Figs. 64; 132 A, B

HOLOTYPE. ♂. Arkansas. Collector Stromb?; Frederick Blanchard Collection (MCZ). Paratype. 1 ♂ (UM).

DESCRIPTION. *Color.* Dorsal surface: black, iridescent; ventral surface: dark brown to black; appendages: dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: obscure but complete. Frontal sulci: obscure, short, broad, shallow. Microsculpture: clypeus, frons and vertex, sometimes weak, isodiametric. Mentum: apex of lobes narrowly rounded; tooth almost as long as lobes (mentum transverse); furrows absent; deep fovae present; microsculpture, where present, elongate. *Thorax.* Pronotum: microsculpture on disk distinct, slightly elongate; lateral margins evenly rounded, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal fovae but not complete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal



FIGS. 131–132. Male genitalia, IS everted. 131 A. *L. extendus* n. sp., right lateral aspect. 131 B. Same, left lateral aspect. 132 A. *L. spinilunatus* n. sp., right lateral aspect. 132 B. Same, left lateral aspect.

impressions elongate, moderately deep, punctate; area between impressions sparsely punctate; area between impressions and lateral margins impunctate. Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture elongate, more distinct laterally. Proepisternum: microsculpture isodiametric. Proepimeron: microsculpture isodiametric and elongate. Mesosternum: microsculpture elongate. Mesepisternum: microsculpture isodiametric. Metasternum: microsculpture isodiametric laterally, elongate medially. Metepisternum: microsculpture isodiametric. Metepimeron: microsculpture, elongate. *Legs.* Hind coxae: microsculpture on inner surface elongate. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae (except 7 toward base) distinct, punctate, trough 1 (sometimes 2) isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–4 rugose laterally near the base; ambulatory setae present on segment 2 (in one specimen). *Aedeagus.* Median lobe: not modified. Internal sac: six distinct scale groups arranged in complex manner; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (2 specimens). TL—7.5 (7.1–7.8); WH—1.4 (1.3–1.5); WP—2.4 (2.2–2.5); WW—2.9 (2.7–3.0).

DISTRIBUTION. Central Southern United States.

LOCALITIES. Arkansas. Undetermined locality. (MCZ). Louisiana. Unrecorded locality (UM).

DISCUSSION. See above.

28. **Loxandrus nocticolor** Darlington
Fig. 135; 144

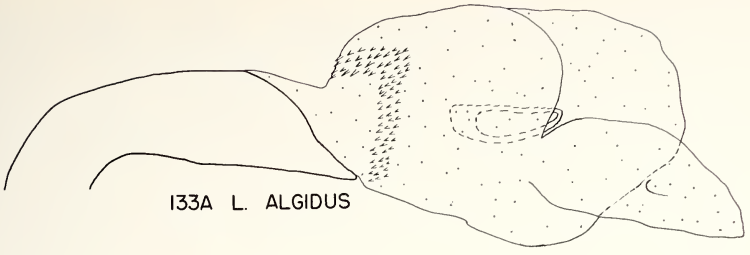
Loxandrus nocticolor Darlington 1934:91. *Holotype.* ♂. Cuba, Soledad (near Cienfuegos), October 21, 1926. P. J. Darlington, Jr., Coll. Type No. 19512 (MCZ).

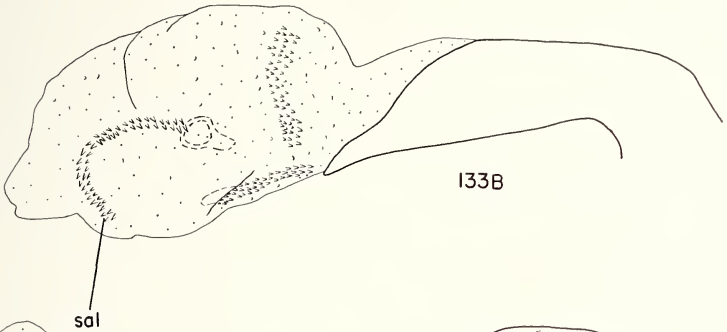
DESCRIPTION. *Color.* Dorsal: black, shining. Ventral: reddish-brown to black, shining. Appendages: black to reddish brown, some-

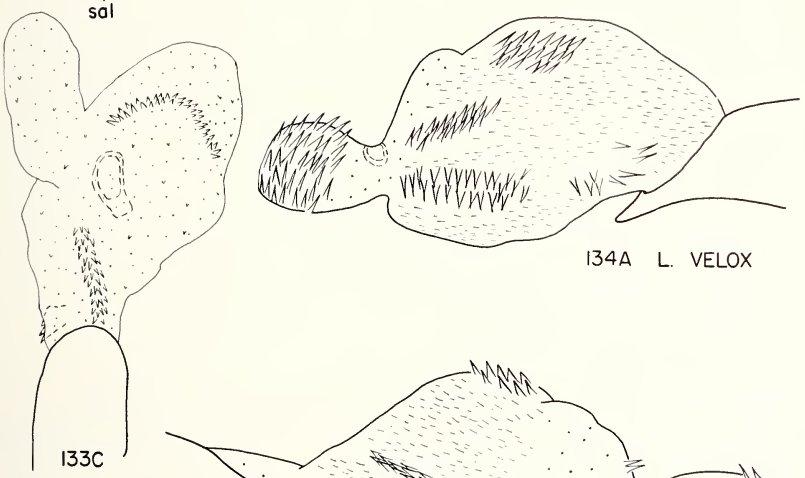
---

→

FIGS. 133–134. Male genitalia, IS everted, basal ¼ to ½ of median lobe not illustrated. 133 A. *L. algidus* n. sp., left lateral aspect. 133 B. Same, right lateral aspect. 133 C. Same, ventral aspect. 134 A. *L. velox* (Dej.), right lateral aspect. 134 B. Same, left lateral aspect.


133A L. ALGIDUS


133B
sal


134A L. VELOX
133C
134B

times tinged with yellow. *Head.* Clypeus: anterior margin, almost straight. Epistomal and subgenal suture: complete, weak laterally. Frontal sulci: obscure, broad, shallow. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes rounded; tooth distinct, apex rounded; furrows and fovae absent; microsculpture distinct, slightly elongate. *Thorax.* Pronotum: microsculpture present and isodiametric along the reflexed lateral margins and in the basal impressions, otherwise absent; lateral margins evenly rounded their entire distance, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus incomplete; posterior marginal sulcus reaching only to basal impressions; median sulcus not reaching anterior or posterior margins; basal impressions moderately deep, broad, elongate, punctate; area between impressions sparsely punctate; area between impressions and lateral margins with a few punctures at most. Scutellum: microsculpture weak, isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture elongate medially, isodiametric laterally. Proepisternum and proepimeron: microsculpture isodiametric and elongate. Mesosternum: microsculpture slightly elongate. Mesepisternum: microsculpture isodiametric anteriorly becoming elongate posteriorly and absent in posterior half to quarter. Metasternum and Metepisternum: microsculpture absent or very elongate. Metepimeron: microsculpture absent. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–4 of middle and hind tarsi grooved on outside lateral margin only. *Elytra.* Microsculpture on intervals absent; all striae distinct, impunctate, trough 3–4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–4 sparsely rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: no distinct scale groups present, much of the sac's surface covered with small, weakly sclerotized scales; sclerotized ring absent. *Measurements.* (1 ♀ specimen). TL—10.6; WH—2.0; WP—3.0; WW—4.1.

DISTRIBUTION. West Indies.

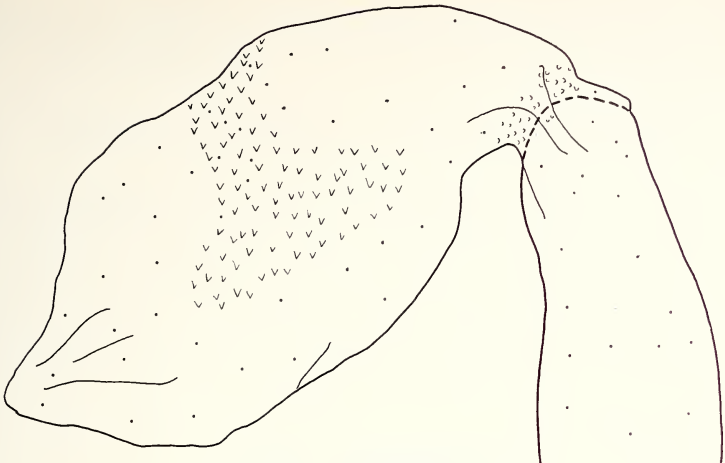
LOCALITIES. WEST INDIES. Cuba. Soledad (near Cienfuegos).

DISCUSSION. This species was originally described by Darlington in 1934. I have examined the holotype and found it to be a valid

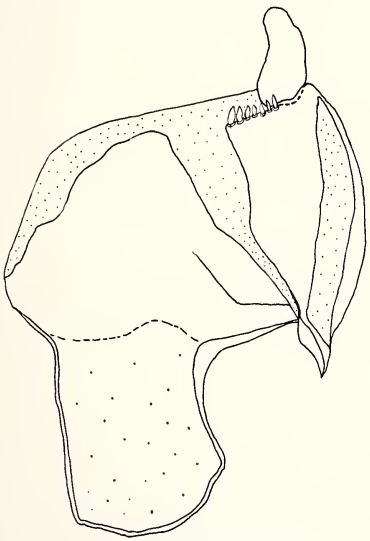
---

→

FIGS. 135–137. 135. Male genitalia, IS everted, dorsal aspect, *L. noctícolor* Darl. Figs. 136–137. Female genitalia, ventral aspect. 136. *L. rectus* (Say). 137. *L. pravitubus* n. sp.



135 L. NOCTICOLOR



136 L. RECTUS

137 L. PRAVITUBUS

species. The above description is based on a female given to me by Dr. Darlington. The external characters of this species appear to be rather distinct.

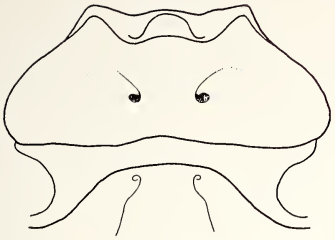
THE *L. rossi*, *L. algidus*, *L. parallelus*, *L. unilobus*, *L. velox* AND *L. taeniatus* COMPLEX

These six species closely resemble one another and canot be distinguished using external characters. Identification is based on characters associated with the male genitalia. *Loxandrus parallelus*, *L. unilobus* and *L. taeniatus* have been keyed out in other places in the key and discussed previously. The description of *L. algidus* is based on two specimens collected in Maryland from an undetermined locality. There were no data with the specimens indicating at what time of the year they were collected. The description of *L. rossi* is based on seven specimens from Arkansas, Georgia, and Alabama. It has been collected in June at all three localities. *L. velox* was described by Dejean in 1828 from specimens sent to him by LeConte. The type locality was given only as "Amer. Sept." The specimens in the Paris Museum are the only ones belonging to this species I have seen. There are 2 males and 2 females in the series. One of the females is recorded from Louisiana. The description used in this paper is based on notes taken on the Paris Museum type.

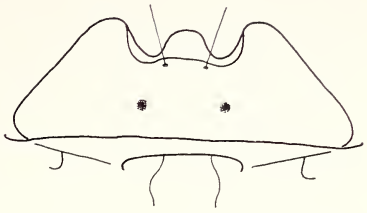
29. **Loxandrus rossi** New Species
Figs. 61; 126 A, B; 174

HOLOTYPE. ♂. Arkansas. Greene County, Paragould, J. Eichemeri, Collector, June 14, 1958, (MSU). *Paratypes*. 2 ♂♂ (CAS); 1 ♂ (USNM); 1 ♂ (MCZ); 1 ♂ (TLE); 1 ♂ (UA).

DESCRIPTION. *Color*. Dorsal: black, shining. Ventral: dark to reddish brown. Appendages: dark to reddish brown. *Head*. Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: obscure but complete. Frontal sulci: almost absent, broad, shallow. Microsculpture: clypeus, fovae and vertex isodiametric. Mentum: apex of lobes rounded; tooth not as long as lobes; furrows and fovae absent; microsculpture slightly elongate. *Thorax*. Pronotum: microsculpture on disk elongate; lateral margin evenly reflexed the entire distance, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, moderately deep, punctate; area between basal impressions sparsely punctate; area between basal impressions and lateral margins usually impunctate.

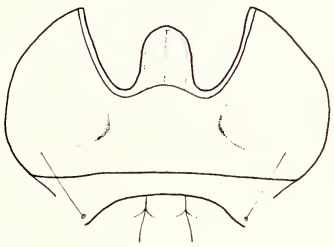


138 L. MICANS

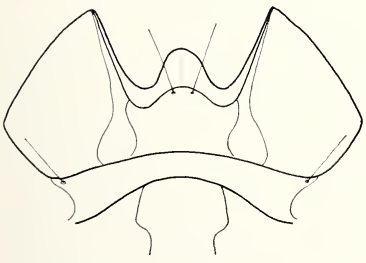


139 L. PACTINULLUS

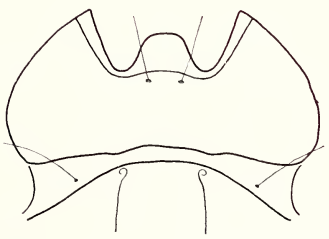
140 L. DURYI



141 L. INFIMUS



142 L. SAPHYRINUS



143 L. MINUTUS

FIGS. 138–143. Mentum. 138. *L. micans* Chaud. 139. *L. pactinullus* n. sp. 140. *L. duryi* Wright. 141. *L. infimus* Bates. 142. *L. saphyrinus* (Chaud.). 143. *L. minutus* n. sp.

Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture where present elongate. Proepisternum: microsculpture elongate and isodiametric. Mesosternum: microsculpture slightly elongate. Mesepisternum: microsculpture elongate. Metasternum, Metepisternum and Metepimeron: microsculpture elongate. *Legs.* Hind coxae: microsculpture on inner surface elongate. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent on intervals; all striae distinct, punctate, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–4 rugose laterally near the base; ambulatory setae present on segment 2. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position; directed dorsally; four distinct scale groups present; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present, opens on the right side. *Measurements.* (8 specimens). TL—6.9 (6.7–7.2); WH—1.3 (1.2–1.4); WP—2.2 (1.7–1.9); WW—2.7 (2.6–2.9).

DISTRIBUTION. Southern United States.

LOCALITIES. Alabama. *Tumblin Gap (CAS, MCZ, USNM). Arkansas. Greene Co.: Paragould (MSU). Georgia. Bibb Co.: 5 mi. SE. Macon (TLE).

DISCUSSION. See above.

30. **Loxandrus algidus** New Species

Figs. 66; 133 A, B, C; 176

HOLOTYPE. ♂. *Maryland.* Otto Lugger Collection (UM). Paratypes. 1 ♂ (UM).

DESCRIPTION. *Color.* Dorsal: black, shining, elytra iridescent. Ventral: black to dark brown. Appendages: dark to light brown, sparsely tinged with black. *Head.* Clypeus: anterior margin slightly concave. Epistomal suture: distinct, complete. Subgenal suture: obscure but complete. Frontal sulci: obscure, shallow, broad, short. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, not as long as lobes; furrows more or less absent; fovae absent; microsculpture slightly elongate. *Thorax.* Pronotum: microsculpture absent or very weak,

---

→

FIGS. 144–146. Geographical distribution maps. 144. *L. infimus* Bates, *L. nocticolor* Darl. 145. *L. elongatus* n. sp. 146. *L. rectangulus* LeC.


144 L. INFIMUS●
L. NOCTICOLOR▲
145 L. ELONGATUS●
146 L. RECTANGULUS●

slightly elongate if visible; lateral margins evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, moderately deep, broad, punctate; area between basal impressions sparsely punctate; area between impressions and lateral margins impunctate. Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface impunctate. Prosternum: microsculpture absent medially, elongate laterally. Proepisternum and proepimeron: microsculpture elongate. Mesosternum: microsculpture absent or very elongate. Mesepisternum: microsculpture isodiametric anteriorly, elongate medially. Metasternum: microsculpture absent medially, weakly present, elongate, laterally. Metepisternum: microsculpture absent or very elongate. Metepimeron: microsculpture absent. *Legs.* Hind coxae: microsculpture on inner surface absent or very elongate. Tarsi: segments 1–3 of middle and hind tarsi and sometimes 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae, except basal quarter of 7, distinct, punctate, trough 1 (sometimes 2) isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, becoming more isodiametric laterally; impunctate; segments 1–4 weakly rugose laterally towards the base; segment 2 with ambulatory setae. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, only slightly directed dorsally; five distinct scale groups present; most of the remainder of the sac's surface covered with small weakly sclerotized scales; a secondary sac everts from the left lateral side; sclerotized ring present. *Measurements.* (2 specimens). TL—6.2 (6.0–6.4); WH—1.3 (None); WP—2.0 (1.9–2.0); WW— 2.5 (none).

DISTRIBUTION. Eastern United States.

LOCALITIES. Known from one undetermined locality in Maryland (UMIN).

DISCUSSION. See above.

31. **Loxandrus crenatus** LeConte

Figs. 40; 104; 162

Loxandrus crenatus LeConte 1852:252. ♂. No locality label. MCZ. Type No. 5701 (MCZ). Four additional specimens in the MCZ series from Tampa, Capron and Enterprise, Florida.

DESCRIPTION. *Color.* Dorsal: reddish-brown, shining. Ventral: reddish-brown, shining. Appendages: reddish-brown to straw yellow.

Head. Clypeus: anterior margin straight. Epistomal suture: complete. Subgenal suture: usually present, sometimes obscure or absent. Frontal sulci: obscure or absent, broad, shallow; anterior tentorial pits in this species deep. Microsculpture: clypeus, frons and vertex weak, isodiametric. Mentum: apex of lobes pointed or narrowly rounded; tooth distinct, almost as long as lobes; furrows shallow; fovae deep, distinct; microsculpture absent or very elongate. *Thorax.* Pronotum: microsculpture absent; lateral margins weakly sinuate posteriorly; posterior angles acute, slightly turned outward; anterior marginal sulcus absent; posterior marginal sulcus reaching only to basal impressions; median sulcus not reaching anterior or posterior margins; basal impressions moderately deep, elongate, punctate; area between basal impressions with only 1–2 punctures if any; area between basal impressions and lateral margin impunctate. Scutellum: microsculpture absent; apex pointed. N. B. Entire ventral surface without microsculpture. Prosternum, proepisternum, proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: coarsely punctate in anterior quarter. Metasternum: coarsely punctate laterally. Metepisternum: coarsely punctate. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, distinctly punctate, microsculpture in trough usually absent, if present 1–2 units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; basal margin of segment 1 punctate; segments 1–4 rugose laterally or not. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, turned to the left side and coiled at the apex; 1 small distinct scale group present; sclerotized ring is questionable, much of the apex appears to be sclerotized, the sclerotized ring seems to be in this area; most of the remainder of the sac's surface covered with small weakly sclerotized scales. *Measurements.* (15 specimens). TL—5.8 (4.9–6.2); WH—1.2 (1.0–1.3); WP—1.8 (1.5–1.9); WW—2.3 (2.0–2.5).

DISTRIBUTION. Southern United States.

LOCALITIES. Alabama. Mobile Co.: Mobile (CAS, USNM), Spring Hill (CAS). Florida. Duval Co.: Jacksonville (CAS); Highlands Co.: Archbold Biological Station at Lake Placid (CU, PSU), Highlands Hammock (TLE); Hillsborough Co.: Tampa (USNM); Lucie Co.: Capron (Ft. Capron on old maps?) (USNM); Manatee Co.: Oneco (GB); Pinellas Co.: Dunedin (PU); Polk Co.: Lakeland (AM); Sarasota Co.: Myakka River State Park (TLE); Taylor Co.: Steinhatchee (USNM); Volusia Co.: Coronado Bch. (CU), Enterprise (MSU). *Sand Point

(USNM). *Haw Crk. (USNM). *Royal Palm (PU). Unrecorded localities (MCZ, MSU, USNM). Georgia. Decatur Co.: Brawbridge (CAS). Louisiana. Vernon Co.: Rosepine (UA). Unrecorded locality (UM). Mississippi. Perry Co.: Richton (CU). South Carolina. Florence Co.: Rainwater (USNM). No state, no locality (MCZ).

DISCUSSION. This is one of the more distinct species of smaller *Loxandrus*. Once seen it is difficult to confuse it with other species in the genus. Its highly shining surface, distinct punctate striae and brown color are characteristic. It has been collected in the months of February, March, April, May, June, August, September and November. The specimens from Rosepine, Louisiana, were collected in a black light trap.

THE *L. micans*, *L. vitiosus* AND *L. duryi* COMPLEX

This is another group of closely related *Loxandrus* species. The external characters are very similar and identification must be based on characters associated with the aedeagi of the males. Even these characters show a great deal of resemblance. *Loxandrus micans* was described by Chaudoir from specimens from Opelousas, Louisiana. Two additional localities, Memphis, Tennessee, and the White River-Interstate 40 highway intersection, Arkansas, are known for this species. It has been collected in March, May and December. *L. vitiosus* is known from a number of localities throughout the Eastern United States. It has been collected in the months of January, March, April, June, July, September and December. *L. duryi* was described by Wright from Clermont Co., Ohio. Present data indicate that there is also a distinct population in Louisiana and Texas. It has been collected in the months of January, February, March, May, June, July and August.

32. **Loxandrus micans** Chaudoir
Figs. 39; 108 A, B, C; 165

Loxandrus micans Chaudoir 1868:342. *Holotype.* ♂. The first specimen in the series of three bears a red type label plus a small data label. The specimen is from Opelousas, Louisiana, taken here to be the type locality.

DESCRIPTION. *Color.* Dorsal surface: black or dark brown, shining; sometimes with central orange spot apically on the elytra;

→

FIGS. 147–148. Geographical distribution maps. 147. *L. celeris* (Dej.). 148. *L. cubanus* Tschit., *L. remotus* n. sp.


147 L. CELERIS ●


148 L. CUBANUS ▲
L. REMOTUS ●

elytra iridescent. Ventral surface: black or dark brown. Appendages: dark to light brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal suture: obscure medially, absent laterally. Subgenal suture: obscure. Frontal sulci: obscure, shallow, broad. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes rounded; tooth large, broadly rounded at apex, almost as long as lobes; furrows absent; fovae distinct, deep; microsculpture isodiametric and elongate. *Thorax.* Pronotum: microsculpture absent on the disk, weakly present laterally; lateral margins evenly rounded their entire length, not sinuate posteriorly, weakly punctate in posterior quarter to half; posterior angles rounded; anterior marginal sulcus incomplete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus present but not reaching anterior or posterior margins; basal impressions moderately deep, elongate, narrow, punctate; area between basal impressions sparsely punctate; area between basal impressions and lateral margins with only 1–2 punctures. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: microsculpture absent medially, weakly present laterally; impunctate. Proepisternum and proepimeron: microsculpture absent; impunctate. Mesosternum: microsculpture isodiametric; impunctate. Mesepisternum: microsculpture absent; anterior three quarters punctate. Metasternum: microsculpture absent except around middle coxae; punctate toward lateral margin. Metepisternum: microsculpture absent; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 1–2 isodiametric units wide or totally absent; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture weak, elongate; segment 1 punctate along basal margin; segments 1–5 rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, slightly directed dorsally: 3 distinct scale groups and possibly a fourth on the main sac; a secondary sac protrudes from the left side of the main sac; secondary sac with a scale group at its apex; sclerotized ring present on the left dorso-lateral surface. *Measurements.* (3 specimens). TL —6.3 (6.1–6.5); WH—1.3 (none); WP—2.1 (2.0–2.1); WW—2.6 (none).

DISTRIBUTION. Eastern United States.

LOCALITIES. Arkansas. Prairie Co.: Rest stop on Interstate 40 at White River bridge (UA). Tennessee. Shelby Co.: Memphis (USNM).

DISCUSSION. See above.

33. **Loxandrus vitiosus** New Species
Figs. 41; 110 A, B, C; 167

HOLOTYPE. ♂. Arkansas. Howard Co., 4 mi. W. Mineral Springs, Rte. 27, July 12, 1968. River bottom debris, R. T. Allen and J. W. Stewart (UA). Paratypes. 5 ♂♂ (CAS); 10 ♂♂ (CU); 1 ♂ (GB); 12 ♂♂ (MCZ); 1 ♂ (NCSC); 2 ♂♂ (OSU); 4 ♂♂ (UA); 6 ♂♂ (USNM); 1 ♂ (PU); 2 ♂♂ (CU).

DESCRIPTION. *Color.* Dorsal: black shining; apical area of elytra sometimes with an orange spot. Ventral: black to dark brown. Appendages: black to dark brown or dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: vaguely present. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: transverse; lobes narrowly rounded; tooth distinct, blunt at apex, almost as long as lobes; furrows absent; fovae distinct, deep; microsculpture elongate. *Thorax.* Pronotum: microsculpture usually absent; if present, elongate; lateral margins sparsely punctate posteriorly, evenly rounded their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal fovae but incomplete; median sulcus reaching anterior sulcus or not, never reaching posterior margin; basal impressions elongate, moderately deep, punctate; area between basal impressions sparsely punctate; area between basal impression and lateral margins punctate or not; if punctate, punctures near lateral or posterior margins. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture absent medially, elongate toward the lateral margin; impunctate. Proepisternum and proepimeron: microsculpture weak, elongate; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture usually absent; if present, elongate; punctate in anterior half. Metasternum: microsculpture present only laterally and around mesocoxae, elongate; punctate laterally. Metepisternum: microsculpture, if present, elongate; punctate. Metepimeron: microsculpture usually absent or very elongate; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent or weak and elongate. Tarsi: segments 1–3 and sometimes 4 (obscure) grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; striae 1–6 and 8 distinct, punctate, basal quarter of striae 7 not as distinct as others, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, becoming elongate and then absent medially; basal and lateral areas of segment 1

and sometimes 2 punctate; segments 1–4 with basal and lateral areas rugose. *Aedeagus*. Median lobe: not modified. Internal sac: everts in a median position, slightly directed dorsally; 5 distinct scale groups on main sac; secondary sac everts toward the apex on the left side; secondary sac with a group of small scales at its apex; most of the remainder of the sac's surface covered with small, weakly sclerotized scales; sclerotized ring present, on left lateral surface. *Measurements*. (20 specimens). TL—6.4 (6.0–7.0); WH—1.4 (1.2–1.4); WP—2.2 (1.9–2.4); WW—2.7 (2.5–3.0).

DISTRIBUTION. Eastern United States west to Missouri, Arkansas, and Louisiana.

LOCALITIES. Alabama. Mobile Co.: Delchamps (CAS), Mobile (MCZ, OSU), Mt. Vernon (CU); Tuscaloosa Co.: Tuscaloosa (GB). Arkansas. Howard Co.: 4 mi. W. Mineral Springs, Rte. #27 (UA). District of Columbia. Washington (MCZ, USNM). Florida. Unrecorded locality (OSU). Louisiana. East Baton Rouge Co.: Baton Rouge (UA). Mississippi. George Co.: Lucedale (CU); Green Co.: Leaksville (CU). Missouri. St. Louis Co.: St. Louis (MCZ). North Carolina. Hoke Co. (NCSC). Pennsylvania. Dauphin Co.; Harrisburg (CAS, MCZ, USNM). *Philadelphia Neck (OSU). Unrecorded localities in Pennsylvania (MCZ, USNM). Ohio. Hocking Co. (PU). Tennessee. Smith Co.: Elmwood (CAS). Virginia. Southampton Co.: Boykins (MCZ). *Blackpond (MCZ).

DISCUSSION. See above.

34. **Loxandrus duryi** Wright

Figs. 42; 109 A, B, C, D, E, F; 166

Loxandrus duryi Wright 1939:1. Holotype. Not examined. Wright stated in his original description "Holotype male and female are in my collection." Mr. Charles Oehler (personal communication) of the Cincinnati Museum of Natural History informs me that he has been unable to locate the type specimen of this species. I have, however, examined paratypes and numerous specimens from the type locality. Based on a study of this material, I am tentatively assuming the holotype to be the same as the paratypes and other specimens collected at the type locality. The type locality is near Goshen, Ohio, in Clermont County.

→

FIGS. 149–151. Geographical distribution maps. 149. *L. discolor* n. sp., *L. spinigrandis* n. sp., *L. tropicus* n. sp., *L. lepidus* n. sp. 150. *L. whiteheadi* n. sp., *L. unispinus* n. sp. 151. *L. balli* n. sp.


149 L. DISCOLOR ●
L. SPINIGRANDIS ☆
L. TROPICUS ▲
L. LEPIDUS □
150 L. WHITEHEADI ●
L. UNISPINUS ▲
151 L. BALLI ●

DESCRIPTION. *Color.* Dorsal: black, shining, elytra sometimes with central orange spot near the apex. Ventral: usually black, sometimes dark to light brown. Appendages: dark to light brown to straw yellow. *Head.* Clypeus: anterior margin feebly concave. Epistomal and subgenal suture: finely produced but complete. Frontal sulci: obscure, short, shallow. Microsculpture; clypeus, frons and vertex weak, isodiametric. Mentum: apex of lobes rounded; tooth as long as or almost as long as lobes, truncate at apex; furrows absent; fovae distinct, deep; microsculpture isodiametric and elongate. *Thorax.* Pronotum: microsculpture absent; lateral margins evenly rounded, not sinuate posteriorly; sometimes weakly punctate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal fovae but incomplete; median sulcus present as a fine line, reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, moderately deep, punctate; area between basal impressions sparsely punctate; area between basal impressions and lateral margins usually impunctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture present only along lateral margins and procoxae; impunctate. Proepisternum and Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture isodiametric to elongate; impunctate. Mesepisternum: microsculpture elongate; punctate in anterior half. Metasternum: microsculpture more evident laterally, elongate; punctate laterally. Metepisternum: microsculpture weak, elongate; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface weak, elongate. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially, isodiametric laterally; impunctate; segments 1–3 rugose laterally and basally. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position, slightly directed dorsally; 5 distinct scale groups present; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present, opening on the left side. *Measurements.* (17 specimens). TL—7.0 (6.8–7.3); WH—1.4 (1.3–1.5); WP—2.3 (2.1–2.3); WW—2.8 (2.6–2.9).

DISTRIBUTION. Eastern United States west to Texas.

→

FIGS. 152–154. Geographical distribution maps. 152. *L. elnae* n. sp., *L. fraus* n. sp. 153. *L. sculptilis* Bates. 154. *L. pactinullus* n. sp.


152 L. ELNAE ●
L. FRAUS ✶
153 L. SCULPTILIS ●
154 L. PACTINULLUS ●

LOCALITIES. Indiana. Marion Co. (PU); St. Joseph Co.: Elkhart (MCZ); Virgo Co. Louisiana. Caddo Co.: Shreveport (UA); Evangeline Co.: Lake Chicot State Park (TLE). Ohio. Ashtabula Co.: Conneaut (PU); Athens Co.: Athens (UMIN); Clermont Co.: Goshen (CNC, USNM). Hamilton Co.: Cincinnati (UM); Licking Co.: Heborn (MSU); Putnam Co.: Ottawa TWP, Sec. 85, Blanchard River (PU); Washington Co.: Maritta (MSU). Unrecorded locality in Ohio (OSU). Pennsylvania. Allegheny Co. (CU). Texas. Dallas Co.: Dallas (MSU). Unrecorded locality in Texas (MCZ).

DISCUSSION. See above.

35. **Loxandrus spinigrandis** New Species
Figs. 26; 83 A, B; 149

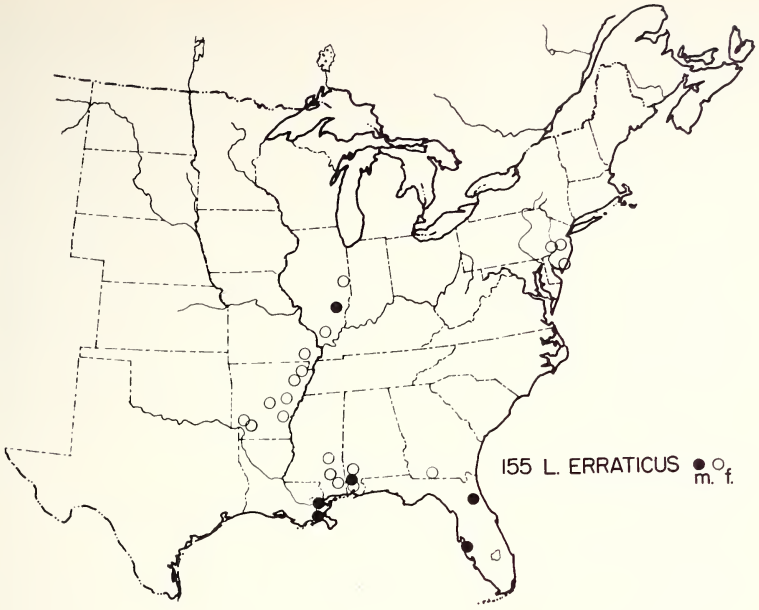
HOLOTYPE. ♂. Canal Zone, Barro Colorado Island, 1947. Zetek, Collector, Lot 47-4230 (USNM). Paratypes. 1 ♂ 5 ♀♀ (USNM).

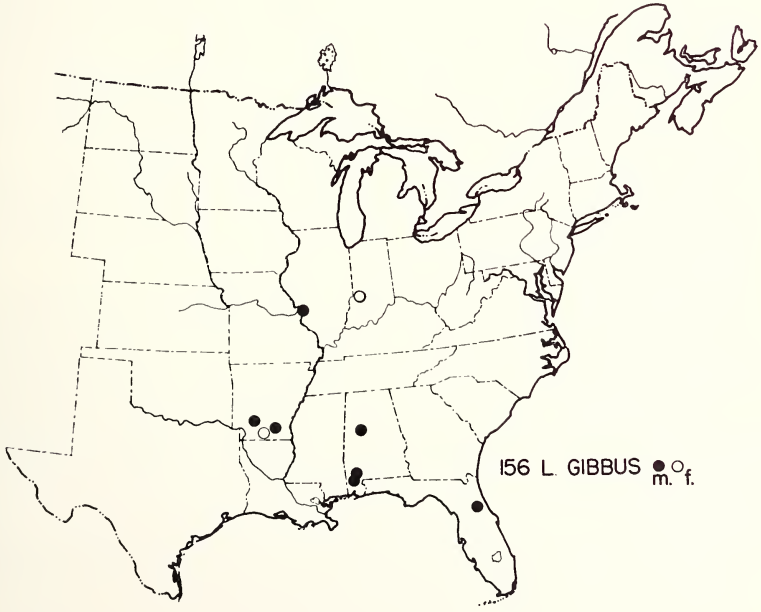
DESCRIPTION. *Color.* Dorsal: head usually black sometimes reddish brown to light yellow; pronotum black to reddish brown, lateral margins sometimes lighter in color than disk; elytra black to dark brown, a yellow spot near the humerus and towards the apex; apical spot may be faint or absent. Ventral: black to dark brown, apex of last abdominal segment yellow. Appendages: dark brown to yellow. *Head.* Clypeus: anterior margin straight. Epistomal suture: distinct, complete. Subgenal suture: usually distinct, sometimes obscure in females. Frontal sulci: shallow, broad, short. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: lobes narrowly rounded; tooth distinct, not as long as lobes, rounded at apex; furrows present shallow; fovae present or absent, when present small and shallow; microsculpture absent. *Thorax.* Pronotum: microsculpture absent; lateral margins evenly rounded, not sinuate posteriorly, punctate their entire length or at least posterior three quarters; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus not reaching past basal impressions; median sulcus present, not reaching anterior marginal sulcus or posterior margin; basal impressions elongate, moderately impressed, punctate; area between impressions and between impressions and lateral margins sparsely punctate. Scutellum: microsculpture absent; apex pointed. N. B. Entire ventral surface without microsculpture. Prosternum: impunctate. Proepisternum: punctate. Proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: punctate in anterior quarter. Metaster-

---

→

FIGS. 155–156. Geographical distribution maps. 155. *L. erraticus* Dej. 156. *L. gibbus* n. sp.


155 L. ERRATICUS ● m. ○ f.


156 L. GIBBUS ● m. ○ f.

num: punctate laterally. Metepisternum: punctate. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi grooved dorsolaterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 1 isodiametric unit wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 punctate and rugose at base; segments 2–5 finely rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, deflected to the right side and coiled towards the apex; two parallel rows of large spines extending the length of the sac; distinct scale groups absent; most of the sac's surface covered with small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (7 specimens). TL—7.6 (7.0–8.2); WH—1.5 (1.5–1.7); WP—2.5 (2.2–2.7); WW—3.3 (3.1–3.6).

DISTRIBUTION. Central America.

LOCALITIES. CANAL ZONE. Barro Colorado Island (USNM).

DISCUSSION. This species closely resembles *L. discolor* and *L. whiteheadi* in many external characters. It can readily be separated from these two species on the basis of the broadly explinate posterior lateral areas of the pronotum. This character is similar to the same condition that occurs in the distantly related *L. saphyrinus. L. spinigrandis* has been collected in the months of January, February, July, August, September and October.

36. **Loxandrus discolor** New Species
Figs. 15; 29 A, B; 82 A, B; 149

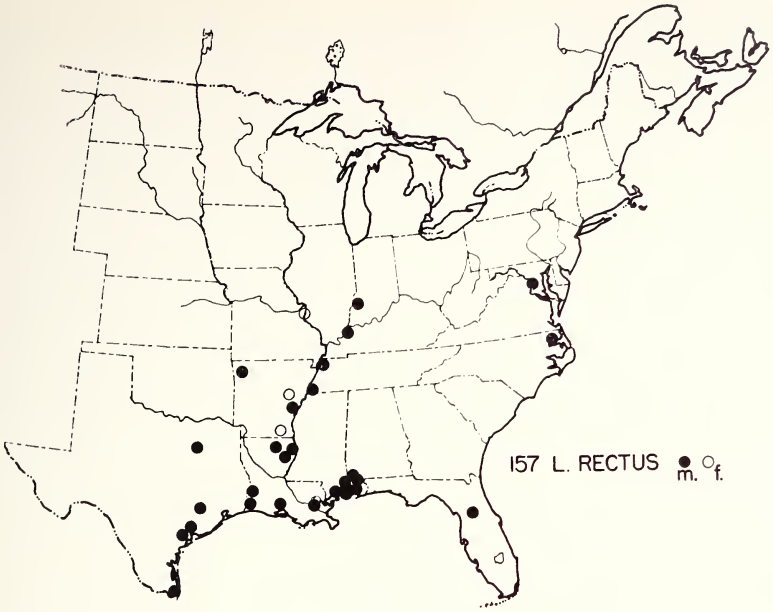
HOLOTYPE. ♂. Canal Zone, Barro Colorado Island. May, 1941. James Zetek, Collector, collected at black light. Lot No. 41-20602 (USNM). Paratypes. 2 ♂♂ 2 ♀♀ (USNM).

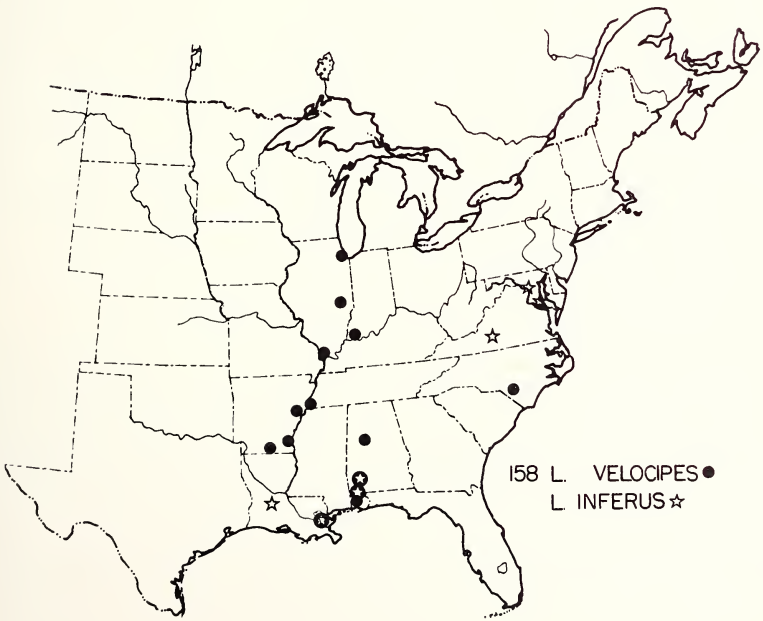
DESCRIPTION. *Color.* Dorsal: head, dark brown, labrum in female sometimes straw yellow; pronotum, disk dark brown, lateral margins light brown to straw yellow; elytra dark to light brown, a yellow spot near the humeri and towards the apex. Ventral: dark to reddish brown. Appendages: dark brown to yellow. *Head.* Clypeus: anterior margin straight. Epistomal and subgenal sutures: distinct,

---

→

FIGS. 157–158. Geographical distribution maps. 157. *L. rectus* (Say). 158. *L. velocipes* Casey, *L. inferus* n. sp.


157 L. RECTUS ● m. ○ f.


158 L. VELOCIPES ●
L. INFERUS ☆

complete. Frontal sulci: moderately deep, broad, short. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, rounded at apex; furrows shallow, broad; fovae present or absent; if present, small and puncture-like; microsculpture elongate. *Thorax.* Pronotum: Microsculpture absent; lateral margins almost evenly rounded their entire length, not sinuate posteriorly, coarsely and densely punctate in the posterior half to three quarters; posterior angles distinct, acute; anterior marginal sulcus complete; posterior marginal sulcus reaching well past basal impressions, almost complete in some specimens; median sulcus distinct but not reaching anterior marginal sulcus or posterior margin; basal impressions deep, elongate, punctate; area between impressions punctate; area between impressions and lateral margins sparsely punctate. Scutellum: microsculpture isodiametric; apex pointed. N. B. Entire ventral surface without microsculpture. Prosternum: impunctate. Proepisternum: punctate. Proepimeron: impunctate. Mesosternum: impunctate. Mesepisternum: punctate in anterior quarter to half. Metasternum: punctate laterally. Metepisternum: punctate. Metepimeron: impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 3–4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture absent; segment 1 rugose and punctate along the basal margin and toward the lateral margin; segments 2–3 weakly rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, directed dorsally; no distinct scale groups present; most of the sac's surface covered with small weakly sclerotized scales; sclerotized ring absent. *Measurements.* (5 specimens). TL—7.0 (6.7–7.4); WH—1.4 (1.3–1.5); WP—2.2 (2.1–2.4); WW—3.2 (3.1–3.3).

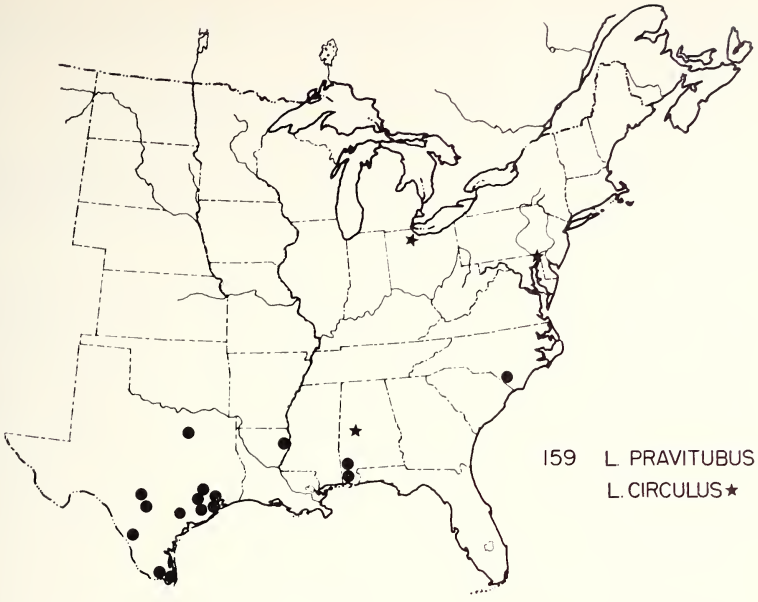
DISTRIBUTION. Central America.

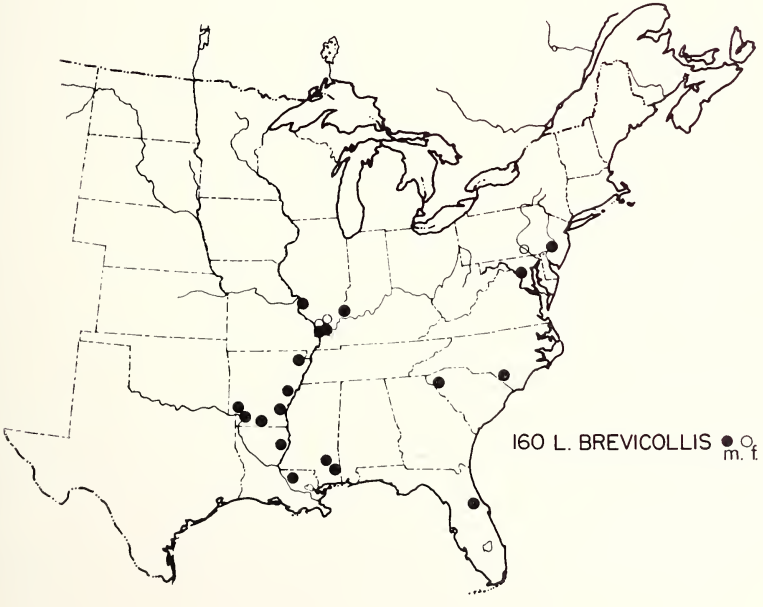
LOCALITIES. CANAL ZONE. Barro Colorado Island (USNM).

DISCUSSION. *L. discolor* can be distinguished from *L. whiteheadi* by the more numerous and larger punctures along the lateral margins of the pronotum. The internal sac of the aedeagus is very similar to the internal sac of *L. whiteheadi.* However, the characters given in the key seem to be constant and serve to help distinguish these two species.

→

FIGS. 159–160. Geographical distribution maps. 159. *L. pravitubus* n. sp., *L. circulus* n. sp. 160. *L. brevicollis* (LeC.).


159 L. PRAVITUBUS
L. CIRCULUS★


160 L. BREVICOLLIS ● ○ m. f.

L. discolor has been collected in April and May on Barro Colorado Island.

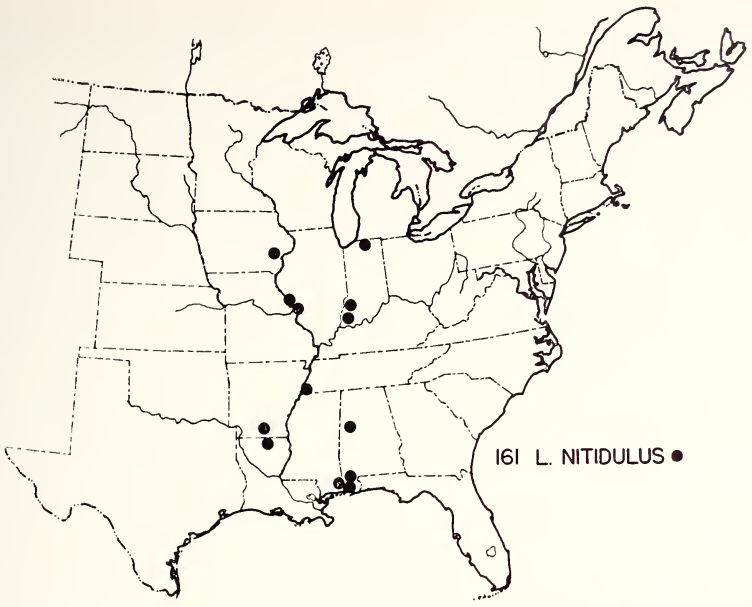
37. **Loxandrus saphyrinus** (Chaudoir)
Figs. 19 A, B, C; 22; 36 A, B; 106; 164

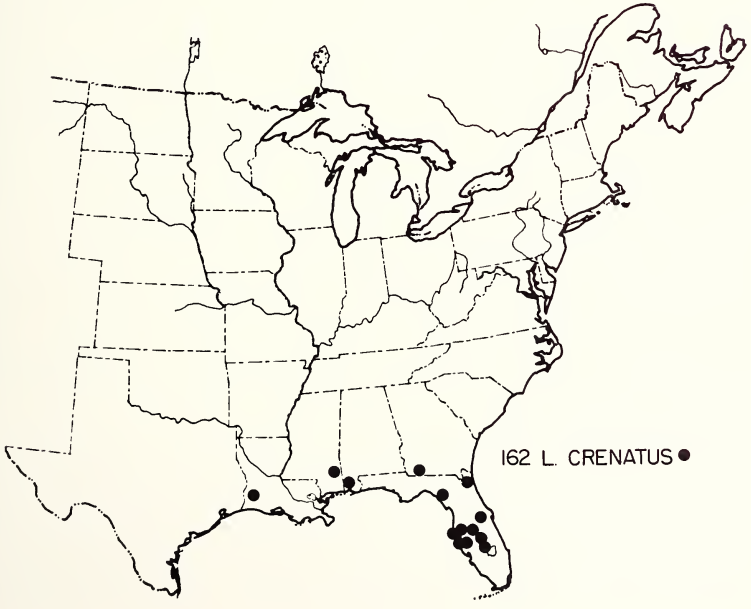
Megalostylus saphyrinus Chaudoir 1843:766. *Lectotype* (here designated). ♂. The first specimen in a series of 3 specimens is a male and is designated the lectotype. The other two specimens are female. Louisiana is listed as the locality on the determination label.

DESCRIPTION. *Color.* Entire body black, iridescent; appendages, dark to light brown, femora sometimes black. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: complete. Frontal sulci: abbreviated, broad, shallow. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes pointed; tooth large, shorter than lobes, apex rounded; furrows obscure; fovae distinct; microsculpture obscure, elongate. *Thorax.* Pronotum: microsculpture absent on disk, present along lateral margins and in basal impressions; lateral margins narrowly reflexed in anterior two thirds, becoming broadly explinate in posterior third, punctate or not, evenly rounded, not sinuate posteriorly; posterior angles broadly rounded; anterior marginal sulcus incomplete; posterior marginal sulcus present, reaching to or only slightly past basal impressions; median sulcus present, not reaching anterior or posterior marginal sulci; basal impressions elongate, shallow but distinct, punctate or not; area between basal impressions usually punctate; area between basal impressions and lateral margin punctate or not. Scutellum: apex pointed; microsculpture mostly absent, sometimes vaguely present near apex, if so, elongate. Prosternum, Proepisternum, Proepimeron: impunctate; microsculpture absent. Mesosternum: impunctate; microsculpture elongate. Mesepisternum: punctate in the anterior three quarters; microsculpture vague, elongate. Metasternum: punctate toward lateral margins; microsculpture present only in sulci and punctures. Metepisternum: punctate; microsculpture present only in sulci and punctures. Metepimeron: impunctate; microsculpture absent. *Legs.* Hind coxae: microsculpture usually absent, if present, isodiametric; tarsal segments 1–3 of middle and hind tarsi (sometimes 4 of hind tarsi) grooved dorso-laterally. *Elytra.* Microsculpture absent; striae 6 and 7 not as distinct as 1–5, trough 4–5 isodiametric units wide; internal plica well-developed; humeri rounded;

→

FIGS. 161–162. Geographical distribution maps. 161. *L. nitidulus* (LeC.). 162. *L. crenatus* LeC.


161 L. NITIDULUS


162 L. CRENATUS

microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture, where present, isodiametric; segments 1–4 rugose and punctate laterally, less so posteriorly. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, turned dorsally; one scale group on the right lateral side of the sac, posterior to the midline (sometimes reduced to a single scale); at least ½ of the sac's surface covered with very small, weakly sclerotized scales, these sometimes becoming more distinct on the ventral surface at the base of the sac; sclerotized ring present. *Measurements.* (20 ♂♂ specimens). TL—11.6 (10.7–12.3); WH—2.5 (2.2–2.6); WP—3.8 (3.4–4.0); WW—4.6 (4.0–4.9).

DISTRIBUTION. Southeastern United States, west to Oklahoma and South-central Texas.

LOCALITIES. Alabama. Mobile Co.: Mobile (MCZ), Mt. Vernon (OSU); Randolph Co.: Wadley (USNM). *Chestong (OSU). Arkansas. Arkansas Co.: 5 mi. E. Dewitt (UA); Ashley Co.: 6 mi. W. Crossett (UA); Hempstead Co.: Hope (CAS); Washington Co.: 5 mi. S. Fayetteville (MSU). *Southwest Arkansas, unrecorded locality (AM). Florida. Charlotte Co.: Punta Gorda (CAS); Hendry Co.: LaBelle (KU); Hernando Co.: Brooksville (CAS, MCZ); Highlands Co.: Archbold Biological Station, Lake Placid (CU, PSU); Hillsborough Co.: Plant City (FSPB); Tampa (CU, MCZ, MSU, PU, USNM); Leon Co.: Lake Jackson (?), unrecorded locality (CU); Manatee Co.: Oneco (GB); Marion Co. (AM, CAS, CU); Orange Co.: Winter Park (MCZ); Osceola Co.: Kissimmee (USNM); Palm Co.: Canal Point (PU); Pinellas Co.: St. Petersburg (PU). Sarasota Co.: Sarasota (PU); Seminole Co.: Sanford (MCZ); Taylor Co.: Steinhatchee (USNM), Lake Okeechobee (PU). *Cedar Keys (USNM). *Oette (AM). *Ouecee (PU). Unrecorded locality in Florida (CAS, CNHM, CU, INHS, MCZ, OSU, USNM). Georgia. Thomas Co.: Thomasville (AM, USNM). Unrecorded locality (MCZ). Louisiana. East Baton Rouge Co.: Baton Rouge (MSU); Evangeline Co.: Lake Chicot State Park (TLE); Vernon Co.: Rosepine (UA). Unrecorded locality in Louisiana (AM, MCZ). Mississippi. Adams Co.: Natchez (CAS); Perry Co.: New Augusta (CU). *Lake View (CU). North Carolina. Johnston Co.: Clayton (NCSC); Hope Co.: Unrecorded locality (NCSC). South Carolina. Pickens Co.: Clemson (MSU). Tennessee. Unrecorded locality (UMIN). Texas. Brazos Co.: College Station (TAM); Calhoun Co.: Alligator Head (USNM); Colorado Co.: Columbus (MCZ, USNM), Skull Creek (UMIN).

DISCUSSION. *L. saphyrinus* is one of the larger *Loxandrus* species. It is very distinct and can readily be distinguished from other *Loxandrus* species by the characters given in the key. I have collected it in very wet habitats under leaf debris along the margins of streams. I have also taken it under leaf debris in relatively dry habitats and at

black light traps. It has been collected in all months of the year except October and November.

38. **Loxandrus lucens** Chaudoir
Figs. 37 A, B; 105; 163

Loxandrus lucens Chaudoir 1868:342. *Lectotype*, here selected. The second specimen in a series of 3. A male with a Texas locality label. The first specimen in the series is a male but has no data labels. The third specimen is a female from New Orleans and probably not part of the original type material. The type locality given by Chaudoir was Havre, Texas.

DESCRIPTION. *Color.* Dorsal: black, shining, elytra iridescent. Ventral: black to dark brown. Appendages: dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: obscure, weak. Frontal sulci: almost absent, broad, shallow. Microsculpture: clypeus, weak, isodiametric; frons and vertex, distinct, isodiametric. Mentum: apex of lobes rounded; tooth distinct, rounded at apex; furrows absent or ill-defined; fovae absent; microsculpture slightly elongate. *Thorax.* Pronotum: microsculpture on disk absent, present in the reflexed portion of the pronotum; lateral margins evenly rounded their entire length, not sinuate posteriorly; posterior angles broadly rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past the basal fovae but incomplete; median sulcus reaching anterior sulcus but not posterior margin; basal impressions elongate, moderately deep, punctate; area between impressions sparsely punctate; area between impressions and lateral margins usually impunctate. Scutellum: microsculpture elongate; apex pointed. Prosternum: microsculpture distinct laterally, elongate; impunctate. Proepisternum: microsculpture absent; punctures weak, shallow. Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture weak, elongate; impunctate. Mesepisternum: microsculpture usually absent; punctate in anterior half to three quarters. Metasternum: microsculpture distinct laterally, elongate; punctate laterally. Metepisternum: microsculpture absent; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface, if present, elongate. Tarsi: segments 1–3 of middle and hind tarsi and sometimes 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; striae 1–6 and 8 distinct, 7 less so, all striae punctate, trough 1–2 sometimes 3 isodiametric units wide; internal plica distinct; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, elongate medially; segment 1 punctate at base,

laterally; segments 1–4 rugose at the base, laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts to the left side; no distinct scale groups on the main body of the sac; most of the surface is covered with small weakly sclerotized scales; a secondary bulbous sac everts in the basal half of the main sac, apex with a distinct scale group; sclerotized ring present. *Measurements.* (7 specimens). TL—9.1 (8.5–9.7); WH—1.9 (1.8–2.1); WP—3.0 (2.7–3.2); WW—3.6 (3.3–3.9).

DISTRIBUTION. Southern United States.

LOCALITIES. Alabama. Mobile Co.: Calvert (CAS). *Tumblin Gap (USNM), Arkansas. Arkansas Co.: E. Rydell, Bayou Meto (UA); Prairie Co.: (KU). Kentucky. Henderson Co.: Henderson (CU). Louisiana. Franklin Co.: Chase (UA); Orleans Co.: New Orleans (CAS) (♀ only). Tennessee. Shelby Co.: Memphis (CAS). Unrecorded locality in Tennessee (UM). Texas. Calhoun Co.: Alligator Head (USNM) (♀ only). Dallas Co.: Dallas (GB, MSU) (♀♀ only).

DISCUSSION. This species closely resembles *L. uniformis* in most external characters. The shape of the lateral margin of the pronotum serves to distinguish *L. lucens* from *L. uniformis.* This is a rather weak character and one that is hard to distinguish by one who is not familiar with *Loxandrus.* A more reliable identification can be made by examining the aedeagii of the two species. *L. lucens* has been collected in February, March, May, July and August.

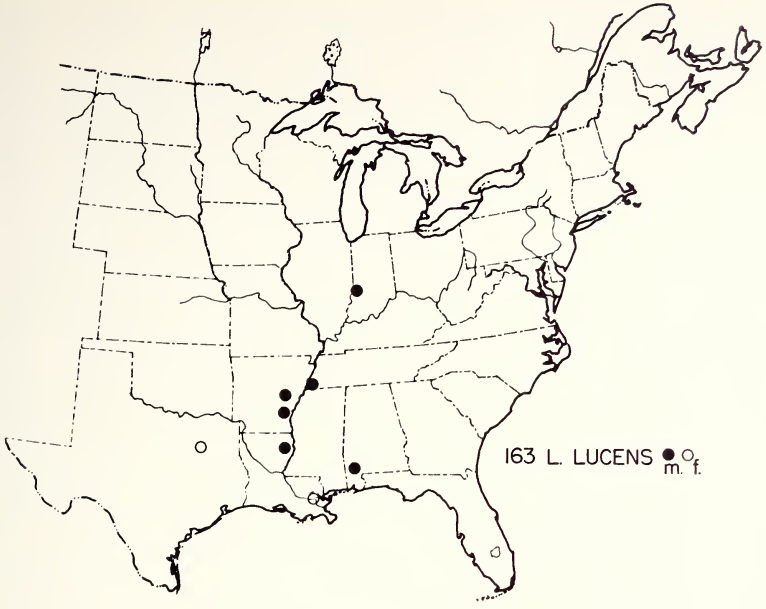
39. **Loxandrus uniformis** New Species
Figs. 38 A, B; 107; 165

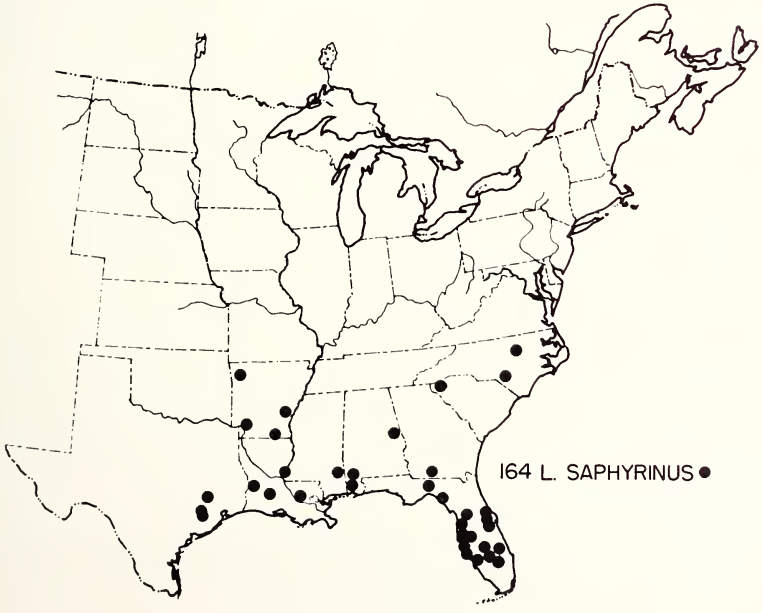
HOLOTYPE. ♂. Alabama. Mobile, November 6, 1939. Van Dyke Collection (CAS). *Paratypes.* 5 ♂♂ 1 ♀ (CU); 1 ♂ (MCZ); 1 ♂ (GB); 1 ♂ (PU); 1 ♂ (INHS).

DESCRIPTION. *Color.* Dorsal: black or dark brown, shining, elytra iridescent. Ventral: black to dark brown, shining. Appendages: dark to light brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal suture: weak but complete. Subgenal suture: present or absent. Frontal sulci: obscure, broad, shallow. Microsculpture: clypeus, frons and vertex weak, isodiametric. Mentum: apex of lobes rounded; tooth distinct, apex rounded; furrows absent or shallow; fovae absent; microsculpture slightly elongate. *Thorax.*

→

FIGS. 163–164. Geographical distribution maps. 163. *L. lucens* Chaud. 164. *L. saphyrinus* (Chaud.).


163 L. LUCENS ● ○ m. f.


164 L. SAPHYRINUS ●

Pronotum: microsculpture absent on disk, sometimes vaguely present along reflexed lateral margin; lateral margins more or less evenly rounded their entire length, not sinuate posteriorly; posterior angles narrowly rounded; anterior marginal sulcus usually incomplete; posterior marginal sulcus reaching to or slightly past basal impressions; median sulcus distinct but not reaching anterior or posterior marginal sulci; basal impressions moderately deep, elongate, punctate; area between basal impressions sparsely punctate; area between basal impressions and lateral margins usually impunctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture distinct toward lateral margin, elongate; impunctate. Proepisternum: microsculpture absent; punctate (sometimes weakly punctate). Proepimeron: microsculpture absent; impunctate. Mesosternum: impunctate. Mesepisternum: microsculpture absent; anterior half punctate. Metasternum: microsculpture absent; punctate laterally. Metepisternum: microsculpture absent; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent or very elongate. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct punctate, trough 2–3 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture distinct, elongate laterally, becoming absent medially; segments 1–4 and sometimes 5 punctate and rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position; four distinct scale groups present; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (8 specimens). TL—9.5 (8.5–10.1); WH—1.8 (1.6–1.9); WP—2.9 (2.6–3.1); WW—3.7 (3.4–3.8).

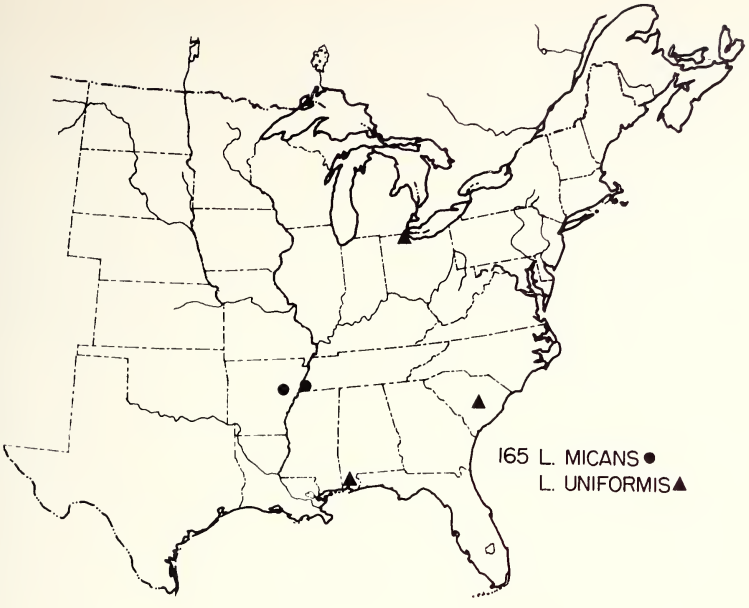
DISTRIBUTION. Eastern United States.

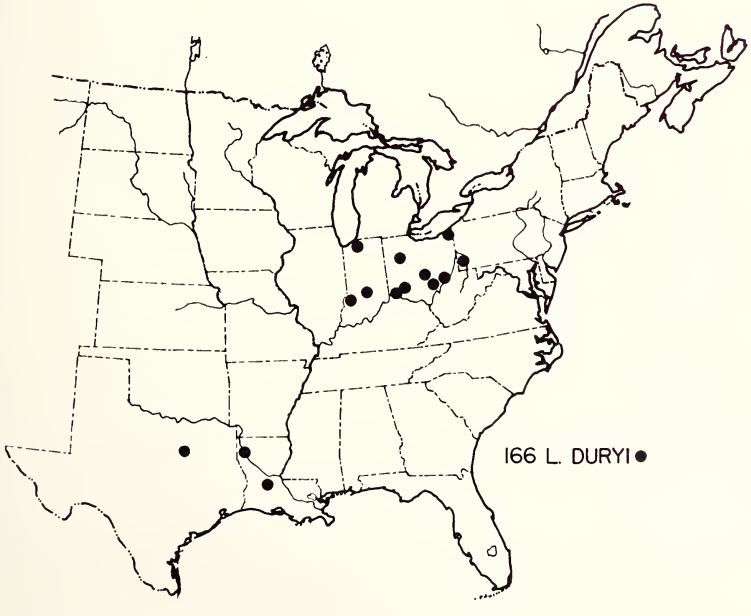
LOCALITIES. Alabama. Mobile Co.: Mobile (CAS, CU). Arkansas. Unrecorded locality (INHS). Ohio. Lucas Co. (PU). South Carolina. Sumpter Co.: Sumpter (GB). Virginia. Unrecorded locality (MCZ).

DISCUSSION. See discussion of *L. lucens*. *L. uniformis* has been collected in November and March.

→

FIGS. 165–166. Geographical distribution maps. 165. *L. micans* Chaud., *L. uniformis* n. sp. 166. *L. duryi* Wright.


165 L. MICANS●
L. UNIFORMIS▲


166 L. DURYI●

40. **Loxandrus minutus** New Species
Figs. 65 A, B; 128; 129 A, B, C; 175

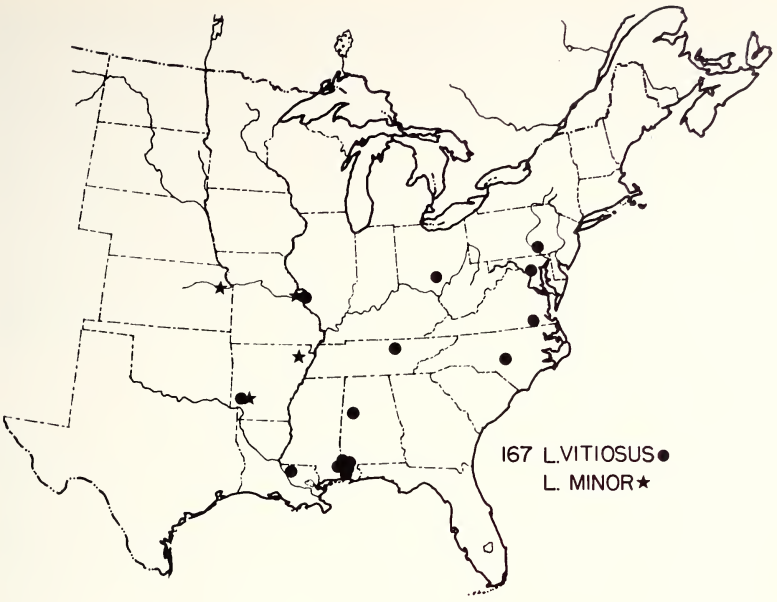
HOLOTYPE. ♂. Florida. Sarasota Co., Myakka River State Park. March 24, 1954. George E. Ball (MCZ). *Paratypes.* 37 ♂♂ 33♀♀ (GB); 1 ♂ 1 ♀ (UA); 3 ♂♂ (MCZ); 1 ♂ (USNM); 2 ♂♂ (CU); 4 ♂♂ (FSPB); 1 ♂ (UM); 1 ♂ (OSU); 4 ♂♂ (CAS); 2 ♂♂ (PU).

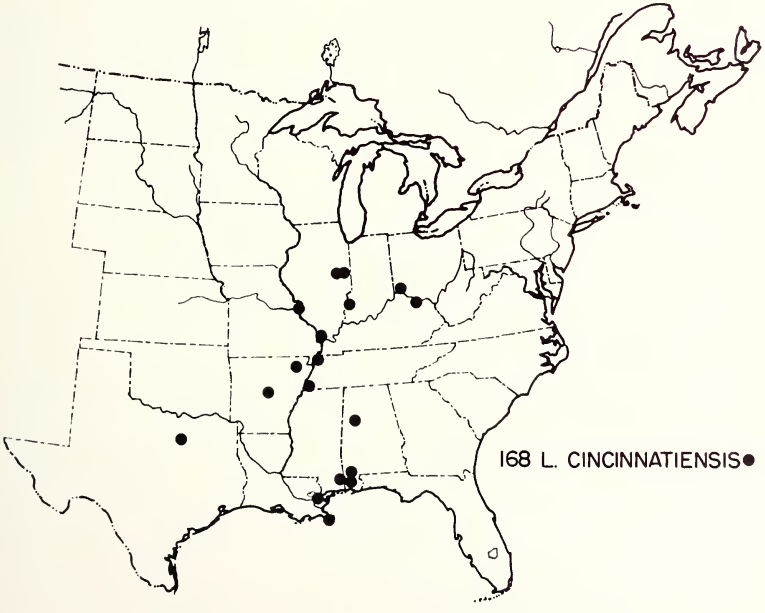
DESCRIPTION. *Color.* Dorsal: black, shining. Ventral: usually wholly black, sometimes dark brown. Appendages: black to dark brown. *Head.* Clypeus: anterior margin straight or slightly concave. Epistomal suture: obscure but usually present. Subgenal suture: present or absent. Frontal sulci: almost absent, obscure, broad, shallow. Microsculpture: clypeus, frons and vertex, isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, shorter than lobes; furrows obscure, shallow; fovae absent; microsculpture isodiametric or slightly elongate. *Thorax.* Pronotum: microsculpture present, elongate on the disk, isodiametric anteriorly, along the reflexed lateral margins and in the basal impressions; lateral margins sparsely punctate posteriorly, evenly curved their entire length, not sinuate posteriorly; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus usually incomplete (vaguely complete in a few specimens); median sulcus reaching anterior marginal sulcus or not, never reaching posterior margin; basal impressions moderately deep, elongate, punctate; area between basal impressions and lateral margins usually impunctate. Scutellum: apex pointed; microsculpture isodiametric. Prosternum: microsculpture elongate or absent medially, isodiametric along the lateral margins; impunctate. Proepisternum and Proepimeron: microsculpture mostly isodiametric, sometimes elongate laterally; impunctate. Mesosternum: microsculpture slightly elongate; impunctate. Mesepisternum: microsculpture isodiametric; sparsely punctate anteriorly. Metasternum: microsculpture elongate or absent medially, isodiametric towards the lateral margins; impunctate. Metepisternum: microsculpture isodiametric; impunctate. Metepimeron: microsculpture elongate or absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface elongate. Tarsal segments: 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent on intervals; striae 7 not as distinct basally as 1–6; all striae punctate, trough 1–2 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of

---

→

FIGS. 167–168. Geographical distribution maps. 167. *L. vitiosus* n. sp., *L. minor* (Chaud.). 168. *L. cincinnatiensis* Casey.


167 L.VITIOSUS●
L. MINOR★


168 L. CINCINNATIENSIS●

epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, elongate or absent medially; segment 1 sometimes punctate at the base; segments 1–3 rugose along the basal margin laterally; ambulatory setae sometimes present on second segment. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position; seven distinct scale groups present; two small secondary sacs on the left side of the sac, everting near the sclerotized ring, both with a small group of scales at the apex. Most of the remainder of the sac's surface is covered with very small, weakly sclerotized scales; sclerotized ring present. *Measurements.* (20 specimens). TL—6.4 (6.0–6.9); WH—1.3 (1.2–1.4); WP—2.1 (1.9–2.2); WW—2.7 (2.6–2.9).

DISTRIBUTION. Southeastern United States.

LOCALITIES. Florida. Alachua Co.: Gainesville (FSPB); Hernando Co.: Brooksville (CAS); Highlands Co.: Highlands Hammock (FSPB); Hillsborough Co.: Tampa (MCZ, USNM); Manatee Co.: Oneco (GB); Marion Co.: Micanopy (CU); Pinellas Co.: Dunedin (PU, UM); Sarasota Co.: Myakka River State Park (CU, FSPB, GB), Sarasota (PU), unrecorded locality (CAS, MCZ). Unrecorded locality in Florida (OSU). Georgia. Pierce Co.: Little Satilla River, at junction with U.S. - 301 (GB).

DISCUSSION. The smaller size and more rounded posterior angles of the pronotum serve to distinguish *L. minutus* from other species with which it might be confused. Positive identification, however, should be based on an examination of the male aedeagus. It has been collected in the months of January, February, March, April, June, October and November.

41. **Loxandrus velocipes** Casey

Figs. 47; 99 A, B; 158

Loxandrus velocipes 1918:390. *Holotype.* ♂. District of Columbia. Type No. 47346 (USNM).

DESCRIPTION. This species resembles *L. inferus* in all external characters. The reader is referred to the description of *L. inferus.* The two species differ only in the presence of one additional scale group on the right lateral surface of the internal sac in *L. velocipes* which is absent in *L. inferus. Measurements.* (20 specimens). TL—9.8 (9.0–10.1); WH—1.9 (1.7–2.0); WP—3.0 (2.8–3.3); WW—3.9 (3.6–4.1).

DISTRIBUTION. Eastern United States.

LOCALITIES. Alabama. Mobile Co.: Calvert (CAS), Mobile (OSU), Mt. Vernon (CU); Tuscaloosa Co.: Tuscaloosa (GB). Arkansas. Arkansas Co.: White River National Wildlife Refuge, White River Chute (UA); Drew Co.: 5 mi. Northwest Dermott, 7 Devils Swamp (UA); Union Co.: Little Corne Bayou, Hy. 169 (UA). Southwest Arkansas, unrecorded locality (AM). Illinois. Alexander Co.: Cashe River Bottom (RTB); Champaign Co.: Brownfield Woods (3 mi. N. Champaign) (UA); Cook Co.: Palos Park (UM). *Kahokia (MCZ). *Horseshoe Lake (INHS). *Indiana.* Posey Co. (PU). Louisiana. Orleans Co.: New Orleans (MCZ). Unrecorded locality (UM). Minnesota. Houston Co. (UMIN). Missouri. Unrecorded locality (USNM). North Carolina. Robeson Co.: Lumberton (USNM). Tennessee. Shelby Co.: Memphis (UM). Virginia. Unrecorded locality (USNM).

DISCUSSION. See above and discussion of *L. inferus.*

42. **Loxandrus inferus** New Species
Fig. 158

HOLOTYPE. ♂. Virginia. Nelson Co., Rossyln, March 30, 1925. C. E. White, Collector (MCZ). *Paratypes.* 6 ♂♂ (USNM); 2 ♂♂ (MCZ); 1 ♂ (CU); 1 ♂ (OXU); 1 ♂ (INHS); 1 ♂ (TLE); 1 ♂ (MSU); 1 ♂ (CAS).

DESCRIPTION. *Color.* Dorsal: black, shining, elytra iridescent. Ventral: black shining. Appendages: yellow to dark brown. *Head.* Clypeus: anterior margin straight or slightly concave. Epistomal and subgenal sutures: weak. Frontal sulci: shallow, short, obscure. Microsculpture: clypeus, frons and vertex, distinct, isodiametric. Mentum: apex of lobes narrowly rounded; tooth large, apex truncate; furrows present; fovae absent; microsculpture distinct, isodiametric or slightly elongate. *Thorax.* Pronotum: microsculpture (usually) distinct, elongate; lateral margins punctate along basal quarter, evenly rounded, not sinuate posteriorly; posterior angles subacute; anterior marginal sulcus complete; posterior marginal sulcus incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, narrow, deep, punctate; area between basal impressions and between impressions and lateral margins punctate. Scutellum: microsculpture distinct, isodiametric; apex pointed. Prosternum: microsculpture isodiametric; impunctate. Proepisternum: microsculpture isodiametric; impunctate. Proepimeron: microsculpture isodiametric; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture elongate; anterior half punctate. Metasternum: microsculpture elongate; punctate laterally. Metepisternum: microsculpture elongate; punctate. Metepimeron: microsculpture weak, elongate; impunctate.

Legs. Hind coxae: microsculpture on inner surface elongate. Tarsal segments 1–3 (and often 4) of middle and hind tarsi grooved dorsolaterally. Elytra. Microsculpture on intervals absent; all striae distinct, trough 3–4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, becoming elongate medially; segment 1 punctate along basal margin laterally; segments 1–4 usually rugose along basal margin laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and is directed dorsally; 4 distinct scale groups are present; small weakly sclerotized scales cover most of remainder of the sac's surface; sclerotized ring present. *Measurements.* (15 specimens). TL—9.7 (9.1–10.1); WH —1.8 (1.7–1.9); WP—3.0 (2.7–3.2); WW—3.8 (3.6–4.0).

DISTRIBUTION. Eastern United States.

LOCALITIES. Alabama. Mobile Co.: Calvert (CAS), Mt. Vernon (CU, OSU). District of Columbia. Washington (USNM, INHS). Georgia. Unrecorded locality (MSU). Louisiana. Evangeline Co.: Lake Chicot State Park (TLE); Orleans Co.: New Orleans (MCZ). Maryland. St. Marys Co.: Pinsy Pt. (USNM). Virginia. Nelson Co.: Rossyln (MCZ).

DISCUSSION. *L. inferus* and *L. velocipes* are two very closely related species. They appear to be alike in all external characters and can be separated only on the basis of characters associated with the male genitalia. *L. velocipes* has one scale group on the right lateral surface of the internal sac that is not found in *L. inferus*. The geographical ranges of the two species overlap. *L. inferus* has been collected in the months of March, May, June and July. *L. velocipes* has been collected in the months of January, March, April, May, June, July and October. I have collected the latter species under very wet leaf debris in Arkansas and at a black light trap in Illinois.

43. **Loxandrus remotus** New Species

Figs. 5; 70 A, B; 77 A, B; 148

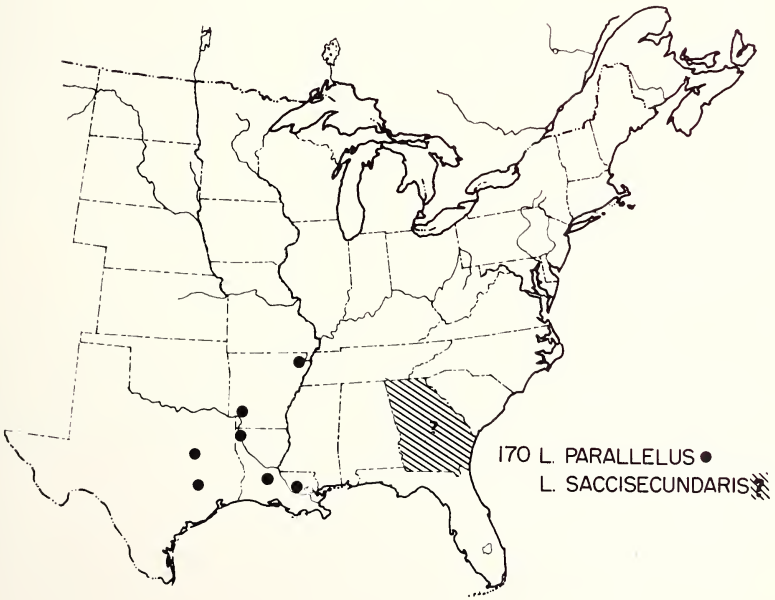
HOLOTYPE. ♂. Canal Zone, Paraiso. May 24, 1911. August Busck (USNM). *Paratypes.* 1 ♂ 1 ♀ (USNM).

DESCRIPTION. *Color.* Dorsal: usually black, sometimes dark brown, shining. Ventral: black to dark brown, shining. Appendages: black to dark brown to light yellow. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: distinct, complete.

→

FIGS. 169–170. Geographical distribution maps. 169. *L. robustus* n. sp., *L. yeariani* n. sp. 170. *L. parallelus* Casey, *L. saccisecundaris* n. sp.


169 L. ROBUSTUS ●
L. YEARIANI ✱


170 L. PARALLELUS ●
L. SACCISECUNDARIS

Frontal sulci: deep, broad, slightly diverging posteriorly. Microsculpture: clypeus, frons and vertex weak, isodiametric. Mentum: transverse; apex of lobes pointed; tooth distinct, apex obscurely indented, weak parallel carina on the tooth; furrows absent; fovae deep, distinct; microsculpture isodiametric and/or elongate. *Thorax.* Pronotum: microsculpture, elongate on disk, isodiametric along lateral margins and in basal impressions; entire surface impunctate; lateral margins feebly sinuate posteriorly; posterior angles acute; anterior marginal sulcus complete; posterior marginal sulcus absent; median sulcus almost reaching anterior marginal sulcus but not reaching posterior margin; basal impressions deep, elongate, continuous with a secondary posterior marginal sulcus, impunctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum and Proepisternum: microsculpture elongate if present; impunctate. Proepimeron: microsculpture isodiametric and/or elongate; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture elongate if present; anterior half punctate. Metasternum: microsculpture absent; punctate laterally. Metepisternum: microsculpture absent; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 2–3 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture elongate if present; segments 1–6 punctate laterally; segments 1–5 rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position; several distinct scale groups present; remainder of the sac's surface covered with small weakly sclerotized scales; a small secondary sac everting on both the right and left lateral surface at the base of the primary sac; sclerotized ring absent. *Measurements.* (3 specimens). TL—8.8 (8.5–9.2); WH—1.7 (1.7–1.8); WP—2.7 (2.6–2.7); WW—3.9 (3.7–4.0).

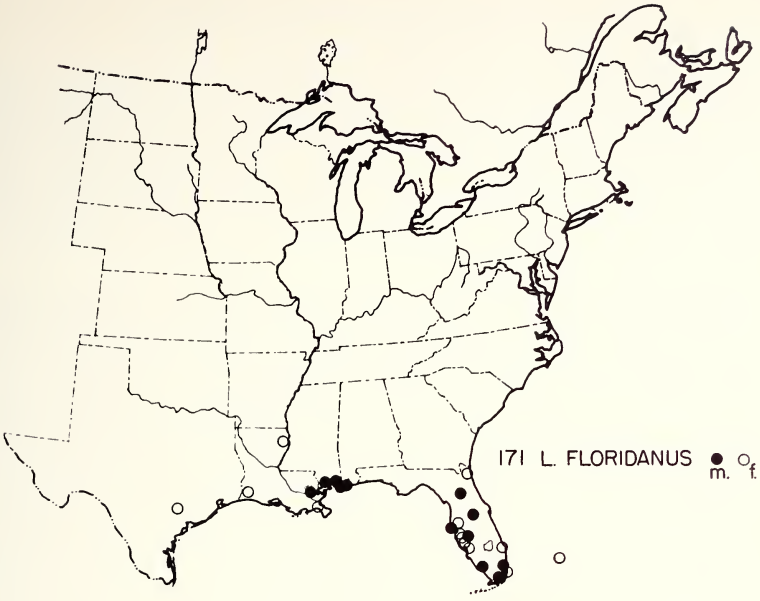
DISTRIBUTION. Central America.

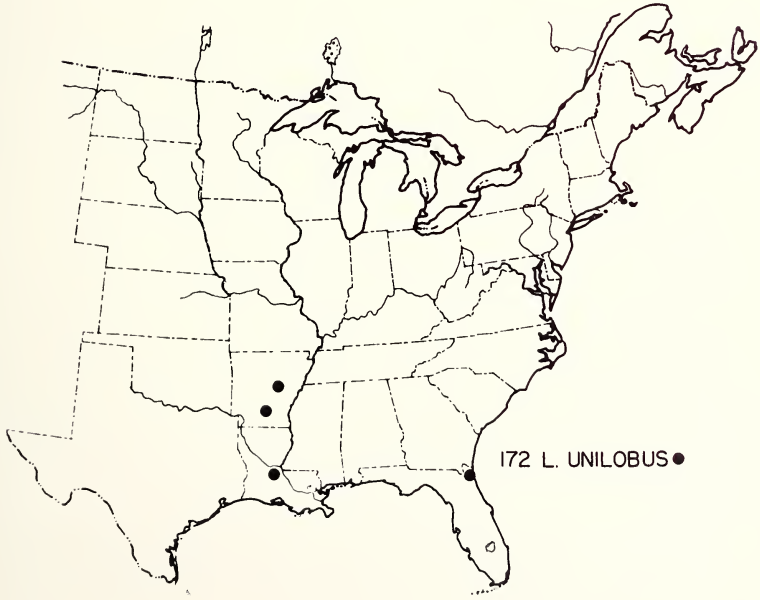
LOCALITIES. CANAL ZONE. Corazal, La Chorrera, Paraiso (USNM).

DISCUSSION. This species is known from three specimens collected in the Canal Zone. The position of this species in the key does not indicate its true phylogenetic relationships. The reader is referred to the section on phylogeny for a further discussion. It has been collected in the months of April and May.

→

FIGS. 171–172. Geographical distribution maps. 171. *L. floridanus* LeC. 172. *L. unilobus* n. sp.


171 L. FLORIDANUS ● m. ○ f.


172 L. UNILOBUS ●

44. **Loxandrus brevicollis** (LeConte)
Figs. 14; 18 A, B; 48; 101 A, B, C, D; 160

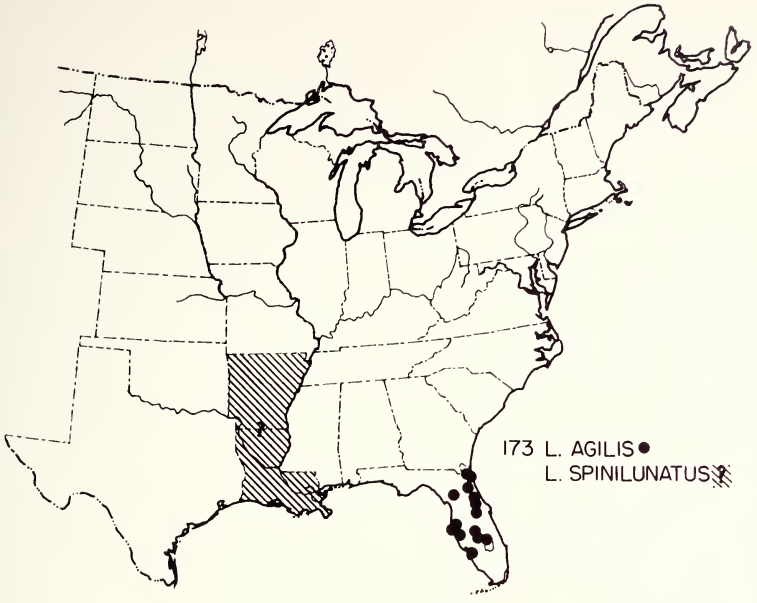
Argutor brevicollis LeConte 1848:338. *Holotype.* ♀. Type No. 5695. (MCZ). There are three specimens in the type series. The first and second specimens are female and the third specimen is a male. None of the specimens have data labels and LeConte did not give a specific locality in the original description. I am here selecting Enterprise, Florida, as the type locality. See my discussion concerning types for my reasons for considering this a valid species.

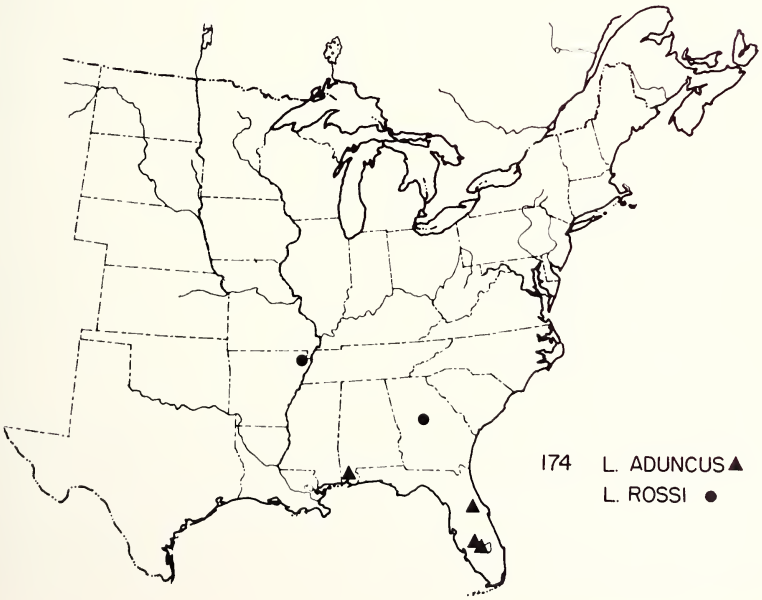
DESCRIPTION. *Color.* Dorsal and ventral: black, shining. Appendages: dark brown to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal suture: distinct, complete. Subgenal suture: obscure but complete. Frontal sulci: almost absent, shallow, broad. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: lobes narrowly rounded; tooth large, distinct; furrows shallow; fovae faintly present (in some specimens); microsculpture isodiametric or elongate. *Thorax.* Pronotum: microsculpture absent on disk, present along the lateral margins; lateral margins rounded in the anterior half becoming somewhat parallel posteriorly, appearing sinuate in some specimens; posterior angles acute; anterior marginal sulcus complete; posterior marginal sulcus reaching to basal impressions, incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions elongate, moderately deep, punctate; area between basal impressions punctate; area between basal impressions and lateral margins punctate or not. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture elongate medially, isodiametric laterally. Proepisternum: microsculpture elongate; punctate or not. Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture absent; anterior three quarters punctate. Metasternum: microsculpture elongate if present; punctate laterally. Metepisternum: microsculpture absent; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface elongate if present. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate,

---

→

FIGS. 173–174. Geographical distribution maps. 173. *L. agilis* (Dej.), *L. spinilunatus* n. sp. 174. *L. aduncus* n. sp., *L. rossi* n. sp.


173 L. AGILIS
L. SPINILUNATUS?


174 L. ADUNCUS
L. ROSSI

trough 1–2 isodiametric units wide; internal plica distinct; humeri rounded; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture elongate medially on segments 2–6 and along the posterior margin of segments 3–6, isodiametric on other areas of the sternites; segment 1 sometimes punctate basally; segments 1–4 weakly rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac; everts medially and slightly directed dorsally; six distinct scale groups in the basal half of the sac; most of the sac's surface in the basal half covered with very small weakly sclerotized scales, apical half more or less free of these small scales; a secondary sac everts on the left lateral surface; sclerotized ring present. *Measurements.* (20 specimens). TL—10.6 (9.8–11.5); WH—2.0 (1.8–2.2); WP—3.4 (3.2–3.6); WW—4.3 (4.0–4.6).

DISTRIBUTION. Eastern United States. Gulf of Mexico north to Illinois and Pennsylvania.

LOCALITIES. Alabama. *Tumblin Gap (USNM). Arkansas. Arkansas Co.: White River National Wildlife Refuge (UA); Drew Co.: 3 mi. NW. Dermott, 7 Devils Swamp (UA); Greene Co.: Paragould (MSU); Howard Co.: 4 mi. W. Mineral Springs, Rte. 27 (UA); Lafayette Co.: Battle Lake, 7 mi. SW. Lewisville (UA); Union Co.: Little Corne Bayou, Hy. 169 (UA). Unrecorded locality in Arkansas (INHS). District of Columbia. Washington (INHS). Florida. Volusia Co.: Enterprise (USNM). Georgia. Unrecorded localities (MSU, USNM). Illinois. Jackson Co.: Carbondale (USNM); Johnson Co.: Goreville (MSU); Union Co.: Alto Pass (CNHM). Williamson Co.: Herrin (RTB). Indiana. Knox Co.: Unrecorded locality (PU). *Ent. Recon. Sta., Hovey Lake (PU). Louisiana. East Baton Rouge Co.: Baton Rouge (UA); Franklin Co.: Chase (UA). Massachusetts. Unrecorded locality (MCZ). Mississippi. George Co.: Lucedale (CU); Jones Co.: 4.2 mi. E. Laurel, Rte. 84. Bogue Home Creek (UA); Perry Co.: Richton (CU). Missouri. Butler Co.: Lake Wappapello, Poplar Bluff (CU); St. Louis Co.: St. Louis (UM). North Carolina. Robeson Co.: Lumberton (USNM). *Boardman (USNM). Oklahoma. Unrecorded locality (USNM). Pennsylvania. Daphin Co.: Harrisburg (MCZ); Delaware Co.: Essington (CAS). Unrecorded locality in Pennsylvania (MCZ, USNM). South Carolina. Anderson Co.: Clemson (MSU). Tennessee. Unrecorded locality (UMIN). State unknown (MCZ, RTB).

DISCUSSION. This is one of the larger and more distinct *Loxandrus* species. The males and females can usually be identified by using external characters. I have found it under wet leaf debris along the banks of streams and other bodies of water. It has also been collected at light traps. It has been collected in the months of February, March, April, May, June, July and August.

45. **Loxandrus erraticus** (Dejean)

Figs. 45; 95 A, B; 155

Feronia erratica Dejean 1828:24. *Holotype.* ♂. The first specimen in the second row of a series of 12 specimens. Bears the large green Dejean determination label, and a small green ♂ label (MNHP). Recorded from Boreal America. Other specimens in the series have locality labels from New Orleans (Louisiana?), and Cuba.

DESCRIPTION. *Color.* Dorsal: black, shining, elytra iridescent. Ventral: black, sometimes dark brown, shining. Appendages: usually dark to light brown, sometimes femora black. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal suture: complete. Frontal sulci: obscure, broad, shallow. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes narrowly rounded; tooth distinct, apex broadly rounded; furrows present; fovae present or not; microsculpture isodiametric or slightly elongate. *Thorax.* Pronotum: microsculpture usually absent on disk, present along the reflexed lateral margins, isodiametric; lateral margins rounded in anterior half becoming somewhat parallel posteriorly, slightly sinuate near the basal angles, punctate posteriorly; posterior angles acute; anterior marginal sulcus complete or not; posterior marginal sulcus reaching to or slightly past basal impressions; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between basal furrows and between furrows and lateral margin punctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum, proepisternum, proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture elongate if present; anterior three quarters punctate. Metasternum: microsculpture elongate where present; punctate laterally. Metepisternum: microsculpture elongate; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface weak, elongate. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 3–4 isodiametric units wide; internal plica well developed; humeri somewhat pointed; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture distinct, isodiametric laterally, becoming elongate medially; segment 1 punctate basally; segments 1–4 rugose along the basal margin laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position; two distinct scale groups present, one elongate group in the apical half on the right lateral surface, and one large scale group almost encircling the entire sac;

remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (20 specimens). TL —9.8 (9.2–10.2); WH—1.9 (1.7–2.0); WP—3.0 (2.7–3.2); WW—3.9 (3.6–4.2).

DISTRIBUTION. Southeastern United States, north to Illinois.

LOCALITIES. Alabama. Mobile Co.: Calvert (CAS), Mobile (CU, MCZ, OSU), Mt. Vernon (CU); Tuscaloosa Co.: Tuscaloosa (GB). Arkansas. Arkansas Co.: 5 mi. E. Dewitt, Hy. 153 (UA); Greene Co.: Paragould (MSU); Hempstead Co.: Hope (MCZ); Howard Co.: 4 mi. W. Mineral Springs, Rte. 27 (UA). Jackson Co.: 5 mi. S. Newport (RTB); Prairie Co.: Rest Area, Hy. 40 at White River Bridge (UA); Pulaski Co.: Little Rock (MCZ). Unrecorded locality (INHS). Florida. Manatee Co.: Oneco (GB); Putnam Co.: Crescent City (USNM). Georgia. Thomas Co.: Thomasville (OSU). Illinois. Jackson Co.: Carbondale (INHS); Richland and Lawrence Co.: Wabash Valley (MCZ); Vermillion Co.: Oakwood (INHS). *Goreham (GB, MCZ). Kentucky. *Saborn (MCZ). Louisiana. Orleans Co.: New Orleans (USNM, UM); Plaquemines Co.: Myrtle Grove (INHS). Unrecorded locality in Louisiana (MCZ, UM, USNM). Mississippi. George Co.: Lucedale (CU); Jones Co.: 2 mi. E. Laurel, Rte. 84, Bogue Home Creek (UA); Perry Co.: Richton (CU). Missouri. Butler Co.: Lake Wappapello, Poplar Bluff (CU). New Jersey. Atlantic Co.: Atlantic City (MCZ); Burlington Co.: Riverton (OSU). North Carolina. *Boardman (USNM). *Lumberton (USNM). *Washington (MCZ). Pennsylvania. Delaware Co.: Essington (CAS). *Delfor (USNM). South Carolina. Unrecorded localities (MCZ). State unknown (AM, RTB, MCZ, USNM, UMIN).

DISCUSSION. This species is similar to *L. gibbus* in most external characters. Most of the specimens I have studied can be separated using the external characters presented in the key. The characters associated with the aedeagus are characteristic of the species. I have collected this species under leaf debris near the edge of streams and small pools of water. It has been collected in the months of March, May, June and December.

46. **Loxandrus gibbus** New Species

Figs. 6; 46; 96 A, B; 97; 156

HOLOTYPE. ♂. Alabama. Tuscaloosa, July 18, 1950. George E. Ball, Collector (MCZ). *Paratypes.* 5 ♂♂ (OSU); 3 ♂♂ (CAS); 1 ♂ (UA).

DESCRIPTION. *Color.* Dorsal: black, shining, elytra iridescent. Ventral: black to dark brown. Appendages: dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and

subgenal sutures: obscure, fine. Frontal sulci: almost absent, shallow, broad, short. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes pointed; tooth distinct, rounded at apex; furrows and fovae absent; microsculpture elongate. *Thorax.* Pronotum: microsculpture on disk usually absent or very elongate if present, isodiametric along lateral margins; lateral margins rounded in anterior half, becoming oblique in posterior half, not sinuate, punctate in posterior quarter; posterior angles distinct, narrowly rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions and between impressions and lateral margins punctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture elongate, more distinct laterally; impunctate. Proepisternum: microsculpture elongate; weakly punctate. Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture elongate; anterior three quarters punctate. Metasternum: microsculpture elongate where present; punctate laterally. Metepisternum: microsculpture very elongate; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi and segment 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 2–3 isodiametric units wide; internal plica distinct; humeri rounded or weakly dentate; microsculpture of epipleura absent. *Abdominal sternites.* Microsculpture distinct, isodiametric laterally, elongate medially; segments 1–3 punctate along basal margin laterally; segments 1–4 weakly rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: sac, when everted, directed to the left side; 6 distinct scale groups present; a secondary bulbous sac near the midline on the left lateral surface, a scale group on one surface; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present on the dorsal surface. *Measurements.* (10 specimens). TL—8.6 (8.2–9.2); WH—1.5 (1.5–1.6); WP—2.6 (2.5–2.7); WW—3.3 (3.2–3.5).

DISTRIBUTION. Southern United States north to Missouri.

LOCALITIES. Alabama. Mobile Co.: Calvert (CAS), Mt. Vernon (OSU), Mobile (OSU); Tuscaloosa Co.: Tuscaloosa (GB). *Salco (OSU). Arkansas. Ashley Co.: Hamburg (CNC); Hempstead Co.: Hope (CU); Union Co.: Little Corne Bayou, Hy. 169 (UA). Florida. Volusia Co.: Enterprise (USNM). Indiana. Virgo Co.: Unrecorded lo-

cality (PU). Louisiana. Franklin Co.: Chase (UA). Unrecorded locality in Louisiana (USNM). Missouri. St. Louis Co.: St. Louis (CAS). North Carolina. *Boardman (USNM). Tennessee. Unrecorded locality (USNM).

DISCUSSION. *Loxandrus gibbus* is most similar to *L. erraticus* in external apearances. It is usually smaller and positive identification can be made by examining the male genitalia. It has been collected in the months of February, March, May, July, August and September.

THE *L. nitidulus*, *L. robustus*, *L. cincinnatiensis*, *L. minor*, AND *L. circulus* COMPLEX

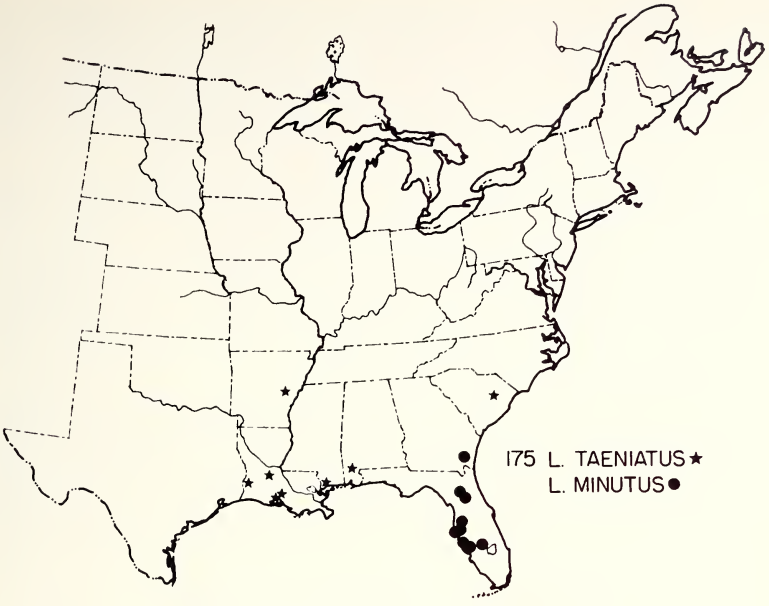
This group of medium size *Loxandrus* species closely resemble one another in external appearances and are closely related phylogenetically. They have in common all external characters, especially a more or less quadrate pronotum with distinct, narrowly rounded hind angles. The aedeagi of the five species are quite similar also.

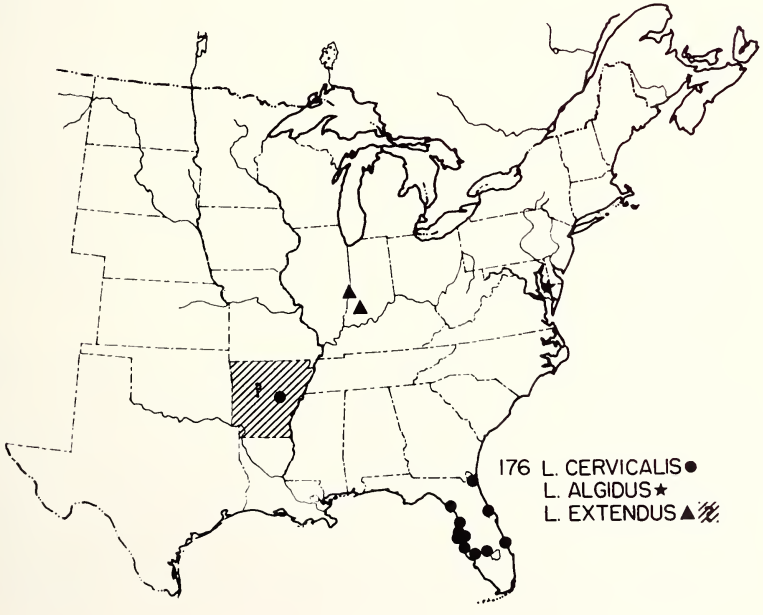
Loxandrus nitidulus is presently known from more specimens and more localities than the other four species. The aedeagus of this species is most like *L. circulus* but has one less scale group on the internal sac. *L. nitidulus* has been collected in the months of March, April, May, June, July and October.

Loxandrus circulus is known from only eight specimens. Six of the specimens are from the Washington, D. C. area (1 marked Md., the remainder D. C.), one from Wood Co., Ohio, and one specimen was taken in Bibb County, Alabama. The Alabama specimen lacks a small scale group on the ventral surface of the IS of the aedeagus that lies between two large scale groups (Fig. 102 D, SA 1). It also has a strong scale group on the left dorso-lateral margin not present in three of the specimens from Washington (Fig. 102 A, SA 2). Three of the four Washington specimens have a small group of scales on the ventral surface of the sac of the aedeagus that lies between the two larger groups (Fig. 102 D, SA 1). One specimen from Washington appears to be intermediate between the one from Alabama and the three remaining Washington specimens by having the small group of ventral scales represented as several weakly sclerotized scales. The specimen from Wood Co., Ohio, has the ventral scale group SA 1 (Fig. 102 D) absent as well as a larger scale group SA 3 (Fig. 102 B)

→

FIGS. 175–176. Geographical distribution maps. 175. *L. taeniatus* LeC., *L. minutus* n. sp. 176. *L. cervicalis* Casey, *L. algidus* n. sp., *L. extendus* n. sp.


175 L. TAENIATUS ★
L. MINUTUS ●


176 L. CERVICALIS ●
L. ALGIDUS ★
L. EXTENDUS ▲

on the right lateral surface of the sac. However, the scale group SA 2 (Fig. 102 A) is distinct in the Wood Co. specimen. Because of the small number of specimens available and because of the seemingly intermediate condition of two specimens, I have chosen to call this group one species. Further collecting will no doubt resolve the problem.

Loxandrus minor and *L. cincinnatiensis* differ by only one scale group on the IS of the male aedeagus. *L. minor* is known from a number of localities in the central part of the United States. It has been collected in April. *L. cincinnatiensis* is known from a number of localities and appears to be confined to areas west of the Appalachian Mountains. It has been collected in the months of March, April, May, June and November.

Loxandrus robustus is known from several localities in Arkansas and from one locality in Indiana. The scale groups and their arrangement on the IS of the aedeagus of this species are very characteristic and cannot be confused with other species in this complex. This species has been collected in May, July and August. The Arkansas specimens were found under leaf debris.

47. **Loxandrus nitidulus** (LeConte)
Figs. 12; 49; 103 A, B, C; 161

Argutor nitidulus LeConte 1848:239. Holotype. ♀. Type number 5696. First specimen in a series of 4 specimens. Second specimen is a male. Specimens 3 and 4 are females (MCZ).

DESCRIPTION. *Color.* Dorsal: black, shining; elytra iridescent. Ventral: black, shining. Appendages: black to dark or reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: finely produced, complete. Frontal sulci: obscure, broad, shallow, short. Microsculpture: clypeus, frons and vertex: isodiametric. Mentum: apex of lobes narrowly rounded;

→

FIGS. 177–178. Geographical distribution maps. 177. All known localities for all *Loxandrus* species in the Continental United States. Ad . . . Adirondak Mountains; Ap . . . Appalachian Mountains; Ar . . . Arbuckle Mountains; CA . . . Cincinnati Arch; CP . . . Cumberland Plateau; DA . . . Driftless Area; IO . . . Illinois Ozarks; NU . . . Northeastern Uplands; Ou . . . Ouachita Mountains; OP . . . Ozark Plateau; PP . . . Piedmont Plateau; WI . . . Wichita Mountains. After Ross, 1965. 178. All known localities for all *Loxandrus* species occurring in Middle America and the West Indies.

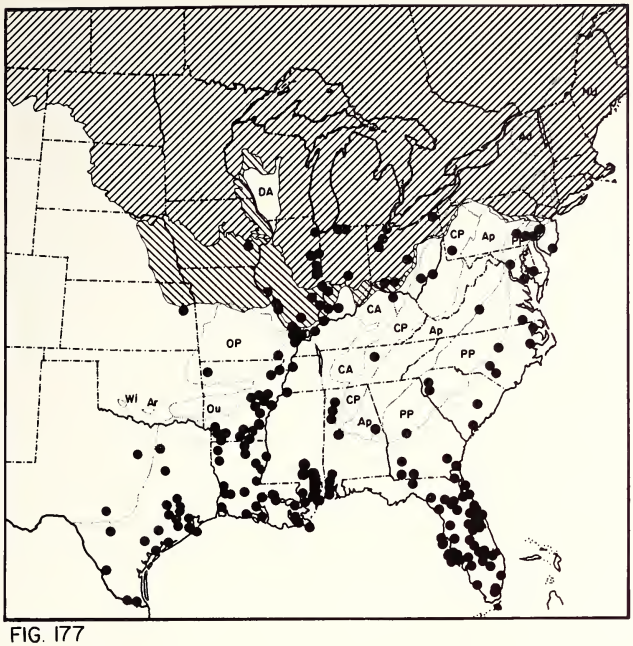


FIG. 177

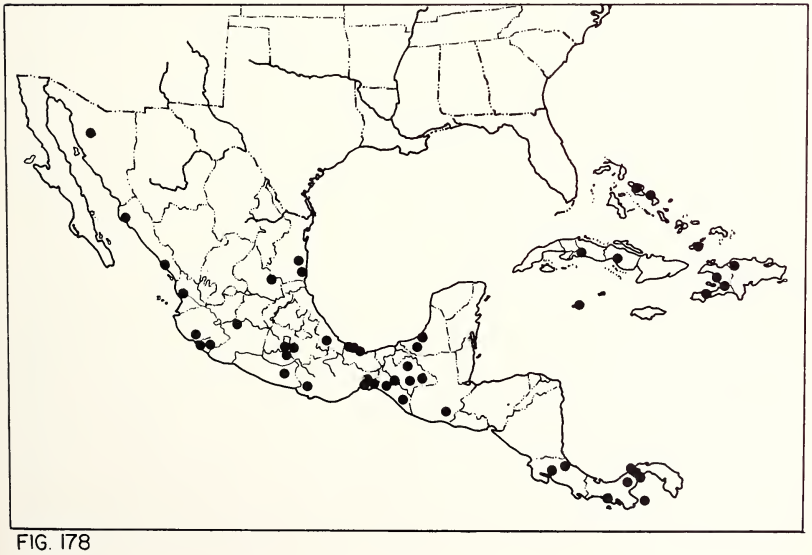


FIG. 178

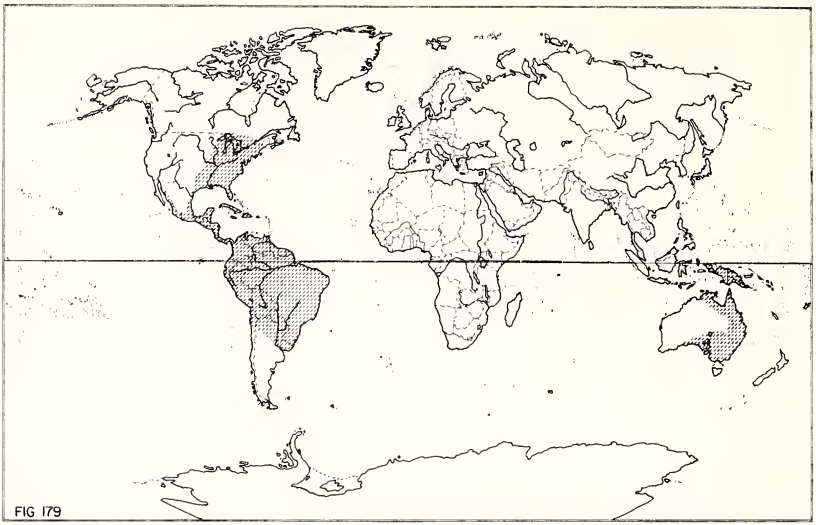


FIG. 179. Geographical distribution of the genus *Loxandrus* throughout the world.

tooth distinct, apex rounded; furrows present; fovae present or absent; microsculpture elongate. *Thorax.* Pronotum: microsculpture on disk absent, present along reflexed lateral margin, isodiametric; lateral margins evenly rounded, not sinuate posteriorly, sparsely punctate posteriorly; posterior angles subacute; anterior marginal sulcus complete; posterior marginal sulcus reaching slightly past basal furrows, incomplete; median sulcus reaching anterior sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions punctate; area between impressions and lateral margins sparsely punctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture elongate; impunctate. Proepisternum: microsculpture elongate; punctate or not. Proepimeron: microsculpture elongate if present; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture elongate; anterior three quarters punctate. Metasternum: microsculpture absent or obscure; punctate laterally. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 2–3 isodiametric units wide; internal plica well developed;

humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, becoming more elongate medially and on posterior segments and absent medially on segments 2–5; segments 1–3 sparsely punctate laterally; segments 1–5 weakly rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts in a median position, directed dorsally; 6 distinct scale groups; a band of scales in the basal half completely encircling the sac; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (20 specimens). TL—9.1 (7.6–10.4); WH—1.7 (1.4–2.0); WP—2.9 (2.3–3.3); WW—3.6 (3.0–4.1).

DISTRIBUTION. Eastern United States, south to the Gulf Coast, north to Illinois and Indiana, west to Iowa and Arkansas.

LOCALITIES. Alabama. Mobile Co.: Mobile (MCZ, OSU), Mt. Vernon (CU, OSU); Tuscaloosa Co.: Tuscaloosa (GB). Arkansas. Calhoun Co.: Bayou Moro, Hy. 160 (UA). Unrecorded locality in Arkansas (MCZ, INHS). Florida. Unrecorded locality (MCZ). Illinois. Calhoun Co.: Kampsville (USNM, MCZ). *Bureau (CAS). *Kahokia (MCZ). Unrecorded locality in Illinois (INHS, MCZ, MSU). Indiana. Elkhart Co.: Elkhart (CAS); Knox Co.: Unrecorded locality (CAS, PU); Viggo Co.: Unrecorded locality (CAS). Iowa. Johnson Co.: Iowa City (USNM). Unrecorded locality in Iowa (USNM). Louisiana. Union Co.: Farmerville (UA). Unrecorded locality in Louisiana (UM). Mississippi. George Co.: Lucedale (CU). Missouri. St. Louis Co.: St. Louis (INHS). Tennessee. Shelby Co.: Memphis (USNM).

DISCUSSION. See above.

48. **Loxandrus robustus** New Species
Figs. 53; 118 A, B; 169

HOLOTYPE. ♂. Arkansas. Lonoke Co., Carlisle; Liebeck Collection (MCZ). Paratypes. 2 ♂♂ (MCZ); 1 ♂ (UM); 1 ♂ (CU); 6 ♂♂ (UA); 1 ♂ (PU).

DESCRIPTION. *Color.* Dorsal: black, shining; elytra iridescent. Ventral: black or dark brown. Appendages: dark to reddish brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: obscure, shallow, short. Microsculpture: clypeus, frons and vertex distinct, isodiametric. Mentum: apex of lobes pointed; tooth distinct, apex rounded; furrows shallow; fovae absent; microsculpture isodiametric and elongate. *Thorax.* Pronotum: microsculpture on disk absent or very weak, distinct and isodiametric along the reflexed lateral margin; lateral margin evenly rounded, not sinuate posteriorly, punctate posteriorly;

posterior angles narrowly rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions sparsely punctate; area between impressions and lateral margins sparsely punctate or not. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture isodiametric laterally, elongate medially. Proepisternum: microsculpture isodiametric; impunctate. Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture slightly elongate; impunctate. Mesepisternum: microsculpture elongate; anterior three quarters punctate. Metasternum: microsculpture elongate where present; punctate laterally. Metepisternum: microsculpture elongate; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface weak, elongate. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture absent on intervals; all striae distinct, punctate, trough 2–3 isodiametric units wide; internal plica distinct; humeri rounded; microsculpture of epipleura isodiametric. *Abdominal sternites.* Microsculpture isodiametric laterally, elongate medially; segment 1 sparsely punctate laterally; segments 1–5 rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and is directed dorsally; 4 distinct scale groups present; most of remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (5 specimens). TL—9.6 (9.4–9.8); WH—1.7 (1.7–1.8); WP—2.9 (2.8–3.0); WW—3.9 (3.8–4.0).

DISTRIBUTION. Southern United States.

LOCALITIES. Arkansas. Aransas Co.: White River National Wildlife Refuge, White River Chute Area (UA); Ashley Co.: 6 mi. W. Crossett (UA); Howard Co.: 4 mi. W. Mineral Springs, Rte. 27 (UA); Prairie Co.: Interstate 40 at White River Bridge (UA); Lonoke Co.: Carlisle (MCZ). Unknown localities in Arkansas (CU, MCZ). Indiana. Dubois Co.: Locality unknown (PU).

DISCUSSION. See above.

49. **Loxandrus cincinnatiensis** Casey

Figs. 52; 116; 168

Loxandrus cincinnatiensis Casey 1924:80. Holotype. ♂. Type No. 47355. (USNM). 1 female paratype.

DESCRIPTION. *Color.* Dorsal: black, shining: elytra iridescent. Ventral: black or dark brown. Appendages: legs black or dark

brown; palpi and antennae dark to light brown. *Head.* Clypeus: anterior margin straight. Epistomal suture: finely produced, complete. Subgenal suture: obscure or absent. Frontal sulci: obscure, broad, shallow. Microsculpture: clypeus, frons and vertex isodiametric, weak. Mentum: apex of lobes rounded: tooth distinct, apex rounded; furrows present, shallow; fovae distinct; microsculpture elongate. *Thorax.* Pronotum: microsculpture on the disk absent, isodiametric along the reflexed lateral margins; lateral margins evenly rounded, not sinuate posteriorly, sparsely punctate posteriorly; posterior angles narrowly rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior marginal sulcus or not, not reaching posterior margin; basal impression moderately deep, elongate, sparsely punctate; area between impressions sparsely punctate; area between impressions and lateral margins sparsely punctate or not. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture more distinct laterally, elongate; impunctate. Proepisternum: microsculpture elongate; obscurely punctate or not. Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture obscure, elongate; impunctate. Mesepisternum: microsculpture elongate; anterior three quarters punctate. Metasternum: microsculpture distinct laterally, elongate; punctate laterally. Metepisternum: microsculpture elongate; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 3–4 isodiametric units wide; internal plica well developed; humeri rounded; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture isodiametric laterally, elongate or absent medially; segments 1 and 2 sparsely punctate laterally; segments 1–3 weakly rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts towards the left, slightly directed ventrally; 5 distinct scale groups present; the right lateral surface is almost entirely covered by an ill-defined group of elongate scales; most of the remainder of the sac's surface covered by small, weakly sclerotized scales; sclerotized ring present. *Measurements.* (20 specimens). TL—9.2 (8.1–10.1); WH—1.7 (1.4–1.9); WP—2.9 (2.4–3.3); WW —3.7 (3.2–4.1).

DISTRIBUTION. Eastern United States from the Gulf of Mexico north to Illinois, Ohio west to Missouri, Arkansas and Texas.

LOCALITIES. Alabama. Mobile Co.: Mobile (OSU), Mobile or Mt. Vernon (MCZ); Tuscaloosa Co.: Tuscaloosa (GB). Arkansas. Jackson Co.: 5 mi. S. Newport (RTB); Pulaski Co.: Little Rock (MCZ). Illinois.

Alexander Co.: Cairo (CU); Champaign Co.: Urbana, Brownfield Woods (UA), Trelease Woods (RTB); Vermillion Co.: Kickapo State Park (RTB). Indiana. Knox Co.: Unrecorded locality (PU). Kentucky. Mason Co.: Maysville (CU). Louisiana. Orleans Co.: New Orleans (MCZ); Plaquemines Co.: Narin (USNM). Unknown localities in Louisiana (UM, USNM). Mississippi. George Co.: Lucedale (CU). Missouri. St. Louis Co.: St. Louis (MCZ). Ohio. Hamilton Co.: Cincinnati (MCZ, UM, OSU). South Carolina. Unrecorded locality (USNM). Tennessee. Lake Co.: Reelfoot Lake (RTB). Shelby Co.: Memphis (USNM). Unknown locality in Tennessee (UM). Texas. Dallas Co.: Dallas (MSU). No state and no locality (MCZ).

DISCUSSION. See above.

50. **Loxandrus minor** (Chaudoir)
Figs. 51; 115; 117; 167

Megalostylus minor Chaudoir 1843:766. Holotype. ♂. The first specimen in a series of two specimens is a male and bears a red type label. Louisiana is given as the type locality. The second specimen in the series is a female from Texas.

DESCRIPTION. *Color.* Dorsal: black, shining; elytra iridescent. Ventral: black to dark brown. Appendages: dark to light brown. *Head.* Clypeus: anterior margin slightly concave. Epistomal and subgenal sutures: distinct, complete. Frontal sulci: obscure, broad, shallow, short. Microsculpture: clypeus, frons and vertex, isodiametric; weak on the clypeus. Mentum: apex of lobes narrowly rounded; furrows absent; fovae deep, distinct; microsculpture elongate. *Thorax.* Pronotum: microsculpture on disk absent, distinct, isodiametric along reflexed lateral margins; lateral margin evenly rounded in anterior half, oblique in posterior half, not sinuate; posterior angles subacute; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but incomplete; median sulcus reaching anterior sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between basal impressions and between impressions and lateral margins sparsely punctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture elongate, more distinct laterally; impunctate. Proepisternum: microsculpture isodiametric; punctures weakly present or not. Proepimeron: microsculpture elongate and isodiametric; impunctate. Mesosternum: microsculpture elongate or absent; anterior three quarters punctate. Metasternum: microsculpture elongate if present; punctate laterally. Metepisternum: microsculpture elongate; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculp-

ture on inner surface absent distally, obscurely present (elongate) proximally. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 2–4 isodiametric units wide; internal plica distinct; humeri rounded; microsculpture of epipleura isodiametric. *Abdominal sternites.* Microsculpture distinct, isodiametric laterally, elongate medially; segments 1–3 obscurely punctate laterally; segments 1–4 rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially and is slightly turned to the left side; 6 distinct scale groups present; most of the remainder of the sac's surface covered with small weakly sclerotized scales; sclerotized ring present. *Measurements.* (2 specimens). TL—9.0 (8.4–9.6); WH—1.7 (1.6–1.7); WP—2.9 (2.8–3.0); WW—3.7 (3.6–3.7).

DISTRIBUTION. Southern United States.

LOCALITIES. Arkansas. Jackson Co.: 5 mi. S. Newport (RTB); Hempstead Co.: Hope (MCZ). Illinois. Alexander Co.: Cairo (CU). Kansas. Douglas Co.: Lawrence (CAS). Louisiana. Unknown locality (UM).

DISCUSSION. See above.

51. **Loxandrus circulus** New Species
Figs. 10; 50; 102 A, B, C, D, E; 159

HOLOTYPE. ♂. District of Columbia. Roland Hayward, Collector (MCZ). Paratypes. 1 ♂ (GB); 1 ♂ (USNM); 2 ♂♂ (INHS).

DESCRIPTION. *Color.* Dorsal: black, shining; elytra iridescent. Ventral: black, shining. Appendages: black to dark or reddish brown. *Head.* Clypeus: anterior slightly concave. Epistomal sulcus: distinct, complete. Subgenal suture: obscure, finely produced. Frontal sulci: obscure, broad, shallow, short. Microsculpture: clypeus, frons and vertex isodiametric. Mentum: apex of lobes rounded; furrows and fovae absent; microsculpture isodiametric. *Thorax.* Pronotum: microsculpture on disk usually absent, elongate if present; lateral margins evenly rounded, not sinuate posteriorly, sparsely punctate posteriorly; posterior angles subacute; anterior marginal sulcus complete; posterior marginal sulcus reaching to just past basal impressions; median sulcus reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate, punctate; area between impressions sparsely punctate; area between impressions and lateral margins impunctate. Scutellum: microsculpture isodiametric; apex pointed. Prosternum: microsculpture elongate medially, isodiametric laterally;

impunctate. Proepisternum: microsculpture elongate; punctate. Proepimeron: microsculpture elongate; impunctate. Mesosternum: microsculpture elongate; impunctate. Mesepisternum: microsculpture absent; anterior three quarters punctate. Metasternum: microsculpture usually absent, elongate if present; punctate laterally. Metepisternum: microsculpture absent; punctate. Metepimeron: microsculpture absent; impunctate. *Legs.* Hind coxae: microsculpture on inner surface absent, elongate and/or isodiametric. Tarsi: segments 1–3 of middle and hind tarsi and 4 of hind tarsi grooved dorso-laterally. *Elytra.* Microsculpture on intervals absent; all striae distinct, punctate, trough 2–3 isodiametric units wide; internal plica well developed; humeri weakly dentate; microsculpture on epipleura absent. *Abdominal sternites.* Microsculpture distinct, isodiametric laterally, elongate medially; segments 1–3 punctate laterally; segments 1–6 rugose laterally. *Aedeagus.* Median lobe: not modified. Internal sac: everts medially, directed dorsally; 8 or 9 distinct scale groups present; most of the remainder of the sac is covered with small weakly sclerotized scales; sclerotized ring present; see discussion for comments on variation. *Measurements.* (5 specimens). TL—9.1 (8.8–9.9); WH—1.7 (1.7–1.9); WP—2.9 (2.8–3.3); WW—3.6 (3.4–4.0).

DISTRIBUTION. Eastern United States, Washington, D. C., south to Alabama.

LOCALITIES. Alabama. Bibb Co.: Unrecorded locality (GB). District of Columbia. Washington (CNC, INHS, MCZ, USNM). Maryland. Unrecorded locality (UM). Ohio. Wood Co.: Unrecorded locality (PU).

DISCUSSION. See above.

52. **Loxandrus velox** (Dejean)

Feronia velox Dejean 1828:245. *Lectotype*, here designated. The first specimen, a male, in a series of four specimens in the Dejean collection in the Paris Museum. The first specimen bears a small green label. LeConte is given as the collector. Three additional specimens, two females and one male, are in the series.

DESCRIPTION. *Color.* Dorsal and ventral: black. Legs: dark brown. Antennae: dark brown. Palpi: dark to light brown. *Head.* Clypeus: weakly concave. Epistomal and subgenal sutures: not visible. Frontal sulci: obscure, short, shallow. Mentum: apex of lobes rounded; tooth not visible; furrows and fovae absent. *Thorax.* Pronotum: microsculpture if present weak and elongate; lateral margins not visible; posterior angles rounded; anterior marginal sulcus complete; posterior marginal sulcus reaching past basal impressions but

not complete; median sulcus weak, reaching anterior marginal sulcus but not posterior margin; basal impressions moderately deep, elongate; entire pronotum impunctate. Ventral surface: impunctate; microsculpture mostly absent but where visible, elongate. Scutellum: apex acutely pointed. *Legs.* Hind coxae: microsculpture on inner surface appears to be absent. *Elytra.* Microsculpture on intervals absent; all striae, except base of 7, distinct, punctate; trough appears to be 1 isodiametric unit wide; internal plica distinct; humeri rounded. *Abdominal sternites.* Microsculpture not visible; segments 1–2 weakly rugose basally; impunctate. *Aedeagus.* Median lobe: apex indented. Internal sac: everts in a median position; 7 scale groups present; a secondary sac everts apically; sclerotized ring present on the dorsal surface. *Measurements.* None.

DISTRIBUTION. "Boreal America" (MNHP).

DISCUSSION. See above.

POSTULATED ANCESTRAL AND DERIVED STATES OF CHARACTERS IN THE GENUS *LOXANDRUS*

There are several basic tenets that must be followed in working out the phylogenetic relationships of a group of organisms. The following list is a brief summary of the more important tenets that should be followed. These tenets and the basic philosophy relating to them are discussed in greater detail by Ross (1937, 1956, 1959, 1965, 1967) and Hennig (1966).

(1) The derived and ancestral states of at least some characters are postulated after a study of taxa believed to be closely related to the taxon under consideration.

(2) Utilizing these characters a hypothetical ancestor is postulated for the group with which one is working.

(3) It must be assumed that derived states of characters which are found in the group of organisms under study came about through a logical and orderly progression from ancestral to derived.

(4) The various species of the group are compared with one another and those species sharing derived characters in common are tentatively assumed to have risen from a common ancestor.

(5) On a strictly logical basis, species are grouped into distinctive phylogenetic lines arising from a common ancestor only on the basis of shared characters.

(6) Derived characters must originate from ancestral characters and not the opposite.

(7) One must strive to account for all the derived conditions of the characters the least number of times.

As mentioned previously, in order to ascertain the ancestral and derived states of various characters in *Loxandrus* it was necessary to determine the state of the characters in closely related groups. The closely related groups utilized in this study are listed below. A detailed diagnosis of each group can be found in Allen, 1969.

Tribe AMARINI

Genus *Amara* Bonelli 1809
A. cupreolata Putz. 1866
A. impuncticollis Say 1823

Tribe AGONINI

Genus *Calathus* Bonelli 1809
C. (*Calathus*) *opaculus* LeC. 1854

Genus *Agonum* Bonelli 1809
A. (*Circinalia*) *pallipes* Casey 1920
A. (*s. str.*) *decorus* (Say) 1823
A. (*s. str.*) *extensicollis* (Say) 1823
A. (*s. str.*) *punctiformis* (Say) 1823

Tribe PTEROSTICHINI

Genus *Stomis* Schellenberg 1806
S. pumicatus Panzer 1796

Genus *Trigonognatha* Motschoulsky 1857
T. coracinus (Say) 1825

Genus *Abaris* Dejean 1831
A. aequenoctialis Chaudoir 1852

Genus *Oxycrepis* Reiche 1843
O. intercepta Chaudoir 1873

Genus *Piesmus* LeConte 1852
P. monedulus German 1824

Genus *Dyschromus* Chaudoir 1835
D. nitidipennis Putzeys 1846

Genus *Pterostichus* Bonelli 1809
P. (*Cylandrocharis*) *rostrata* (Newman) 1838
P. (*Cylandrocharis*) *grandiceps* (LeConte) 1848
P. (*Holciophorus*) *lama* Mentries 1844
P. (*Pherypes*) *tarsalis* LeConte 1873
P. (*Hypherpes*) *californicus* (Dejean) 1828
P. (*Hypherpes*) *congestus* Menetres 1844
P. (*Hypherpes*) *validus* Dejean 1831
P. (*Hypherpes*) *brunneus* Dejean 1831
P. (*Monoferonia*) *diligendus* (Chaudoir) 1866
P. (*Gastrellaris*) *honestus* (Say) 1825

P. (*Poecilus*) *chalcites* Say 1823
P. (*Poecilus*) *lucublandus* Say
P. (*Poecilus*) *occidentalis* Dejean
P. (*Poecilus*) *texanus* LeConte 1863
P. (*Bothiopterus*) *pennsylvanicus* (LeConte) 1863
P. (*Bothiopterus*) *adstrictus* (Eschscholtz) 1823
P. (*Bothiopterus*) sp.
P. (*Lophoglossus*) sp.
P. (*Euferonia*) *coracina* Newman 1838
P. (*Euferonia*) sp.
P. (*Refonia*) *moesta* (Say) 1823
P. (*Metamelanius*) *ebeninus* Dejean 1828
P. (*Melanius*) *caudicalis* Say 1823
P. (*Melanius*) *corvinus* Dejean 1828
P. (*Melanius*) *luctuosus* Dejean 1828
P. (*Dysidius*) *purpuratus* LeConte 1852
P. (*Dysidius*) *mutus* Say 1823
P. (*Argutor*) sp.
P. (*Abacidus*) *hamiltoni* (Horn) 1880
P. (*Abacidus*) *permundus* (Say) 1834
P. (*Abacidus*) *sculptilis* (LeConte) 1852
P. (*Gastrosticta*) *subacuta* Casey 1918
P. (*s. str.*) *herculaneus* Mannerheim 1843
P. (*s. str.*) *mandibularis* Kirby 1850
P. (*s. str.*) *adoxus* Say 1825
P. (*s. str.*) *stygicus* Say 1823
P. (*s. str.*) *relictus* Newman 1838

Genus *Evarthrus* LeConte 1852
E. sordalis LeConte 1848
E. seximpressus LeConte 1848
E. nonnitens LeConte 1873
E. incisus LeConte 1873

Armed with the information concerning the state of characters in groups closely related to the genus *Loxandrus* and using the philosophical principles and basic tenets previously set forth it is now possible to postulate the ancestral and derived state of some characters found in *Loxandrus*.

The external surface of all areas and sclerites usually has a characteristic microsculpture in groups related to *Loxandrus*. This microsculpturing can be an isodiametric pattern (Figs. 11 A, B; 16 A, B, C; 20 A, B, C; 21) or an elongate pattern (Figs. 13; 14; 15; 17; 18 A, B; 19 A, B, C; 22), the latter consisting of short fine parallel lines. In either case it is distinct. The prosternum, proepisternum, proepimeron, mesepisternum, metasternum, metepisternum, and metepimeron usually have microsculpturing of the elongate type. This elongate type

that is distinct is considered the ancestral state for these sclerites in *Loxandrus*. If the microsculpture is isodiametric, reduced or absent in species of *Loxandrus* it is considered derived.

The head, mesosternum, pronotum, scutellum, and elytra usually have microsculpturing of the isodiametric type. This is considered the ancestral state for these morphological parts and an elongate microsculpture or the absence of microsculpturing is considered derived for these areas in *Loxandrus*.

The sclerites on the ventral surface of the thorax can be either punctate or impunctate. In the majority of the groups related to *Loxandrus* the following condition exists: (1) the prosternum, proepisternum, proepimeron, mesosternum, mesepimeron, and metepimeron are impunctate (Figs. 20 A, B, C); (2) the mesepisternum (anterior ¾ to ½), and the lateral area of the metasternum are punctate (Figs. 19 A, B, C). Therefore, in the first group of six sclerites, the impunctate state is considered ancestral and a punctate state is derived, and in the second group of two sclerites the punctate state is considered ancestral and an impunctate state derived in *Loxandrus*.

In most of the genera and subgenera examined the intercoxal process of the prosternum is not margined. The unmargined state of the intercoxal process is considered ancestral and the margined state is considered derived in *Loxandrus*.

The color of most of the species examined was entirely black or dark brown. When another color other than black or dark brown is encountered among the species of *Loxandrus* it is considered derived.

In most genera and subgenera closely related to *Loxandrus* the internal plica on the lateral, apical margin of each elytron is present and well developed. This state is considered ancestral. When the internal plica is reduced or absent among species of *Loxandrus* it is considered a derived state of the character.

The internal sac of the aedeagus of the males in the genera and subgenera closely related to *Loxandrus* has various structures present or absent, i.e. scales, scale groups, and/or sclerites. These various arrangements can be divided into the following five generalized divisions: (1) the surface of the membraneous sac can be completely devoid of scales, scale groups and sclerites; (2) the surface of the membraneous sac can have scales covering varying amounts of the surface but no distinct scale groups or sclerites (Fig. 82 A); (3) the surface of the membraneous sac can be devoid of scale groups but have certain areas sclerotized (Fig. 94 A); (4) the surface of the membraneous sac can be devoid of sclerotized areas but possess scale groups (Fig. 10); (5) the surface of the membraneous sac can have a combination of sclerotized areas and scale groups (Fig. 10).

The information derived from the study of genera and subgenera closely related to *Loxandrus* indicates that the ancestral state of the internal sac of the aedeagus of male *Loxandrus* was a sac with scales present and sclerites absent. Whether or not the scales were in well defined groups is not clear.

In some species of *Loxandrus* there occurs a sclerotized ring, usually near the apex of the internal sac. I believe that this ring is associated with the gonopore because in some species I have been able to trace the ejaculatory duct to this ring and I believe it is connected to the ring (Fig. 10 – SR). I have not been able to find the gonopore in those species of *Loxandrus* without a sclerotized ring. Therefore I have some reservations as to what the true relationship of the sclerotized ring is to the ejaculatory duct, i.e. sclerotized gonopore or not. Among those groups I have studied the sclerotized ring is a unique, derived adaptation in *Loxandrus*.

In most of the genera and subgenera examined the tooth of the mentum is short and not as long as the lobes of the mentum. In some species of *Loxandrus* the lobes of the mentum are short and the tooth is as long as the lobes or almost as long as the lobes. This gives the mentum a transverse appearance (Figs. 138; 139; 140). This transverse state is considered the derived condition in *Loxandrus*.

In all of the groups studied ambulatory setae were absent on the second abdominal sternite. This is considered the ancestral condition. When ambulatory setae do occur on the second abdominal sternite it is considered a derived condition.

It should be noted here that *Loxandrus* species from other parts of the world have been included where material was available for study. These species have not been incorporated into the key nor has a description been provided. These species and others will be treated in subsequent papers. The following is a list of species represented in the phylogeny but not treated in the taxonomic section of this paper. Their general area of distribution is indicated.

Loxandrus longiformis Sloane 1898 Australia
Loxandrus amplicolis Sloane 1903 Australia
Loxandrus subiridescens M'Leay 1869 Australia
Loxandrus australiensis Sloane 1895 Australia
Loxandrus rufilabris Castleneau 1867 Australia
Loxandrus atronitens M'Leay 1869 Australia
Loxandrus major Darlington 1962 New Guinea
Loxandrus medius Darlington 1962 New Guinea
Loxandrus latus Darlington 1962 New Guinea
Loxandrus subrectus Darlington 1962 New Guinea
Loxandrus negrei Straneo 1964 South America
Loxandrus tucumanus Dejean 1831 South America
Loxandrus dubius Curtis 1839 South America

THE PHYLOGENETIC RELATIONSHIPS AMONG THE SPECIES OF *LOXANDRUS*

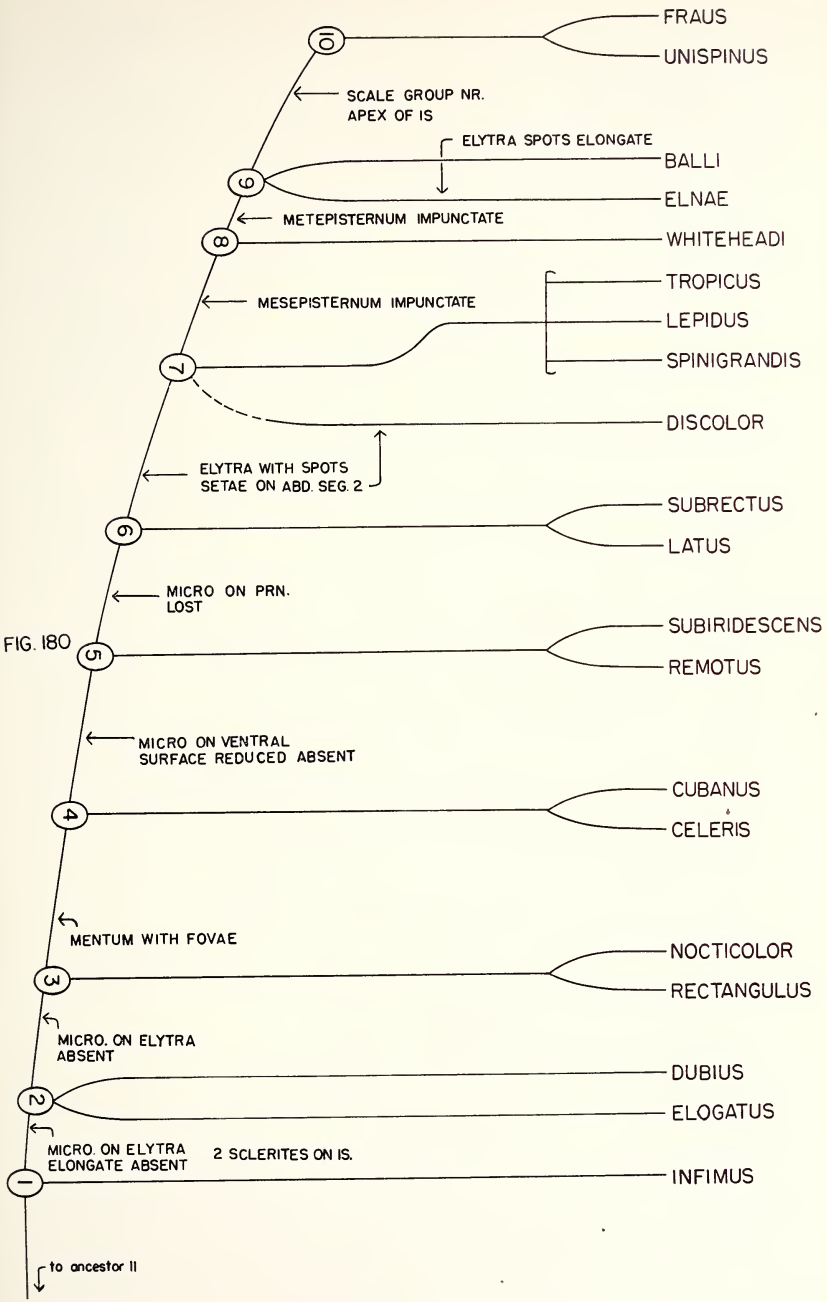
The following discussion annotates Figures 180, 181 and 182. Based on the information concerning the ancestral and derived states of various characters in the genus *Loxandrus* it is possible to postulate certain characteristics that the progenitor of this group probably possessed as follows. The microsculpture of prosternum, proepisternum, proepimeron, mesepisternum, metasternum, and metepimeron was distinct, fine, elongate parallel lines (Figs. 19 A, B, C). Microsculpture of head, mesosternum, pronotum, scutellum, and elytra was distinct, isodiametric (Figs. 16 A, B, C; 20 A, B, C). The prosternum, proepimeron, mesosternum, mesepimeron, and metepimeron were impunctate (Figs. 20 A, B, C). The mesepisternum (anterior ¾ to ½) and the lateral areas of the metasternum were punctate (Figs. 19 A, B, C). The trough of the striae on the elytra were 1–2 isodiametric units wide (Figs. 11 A, B; 13). The intercoxal process of the prosternum was not margined. The mentum was not transverse and did not possess fovae. The second abdominal sternite lacked ambulatory setae. The color was a uniform black or dark brown. The internal sac of the aedeagus was devoid of sclerites and of a sclerotized ring toward the apex (Fig. 9). The sac probably possessed scales on the surface but there was only one defined scale group, if any. The internal plica near the apex of the elytra was present and well developed.

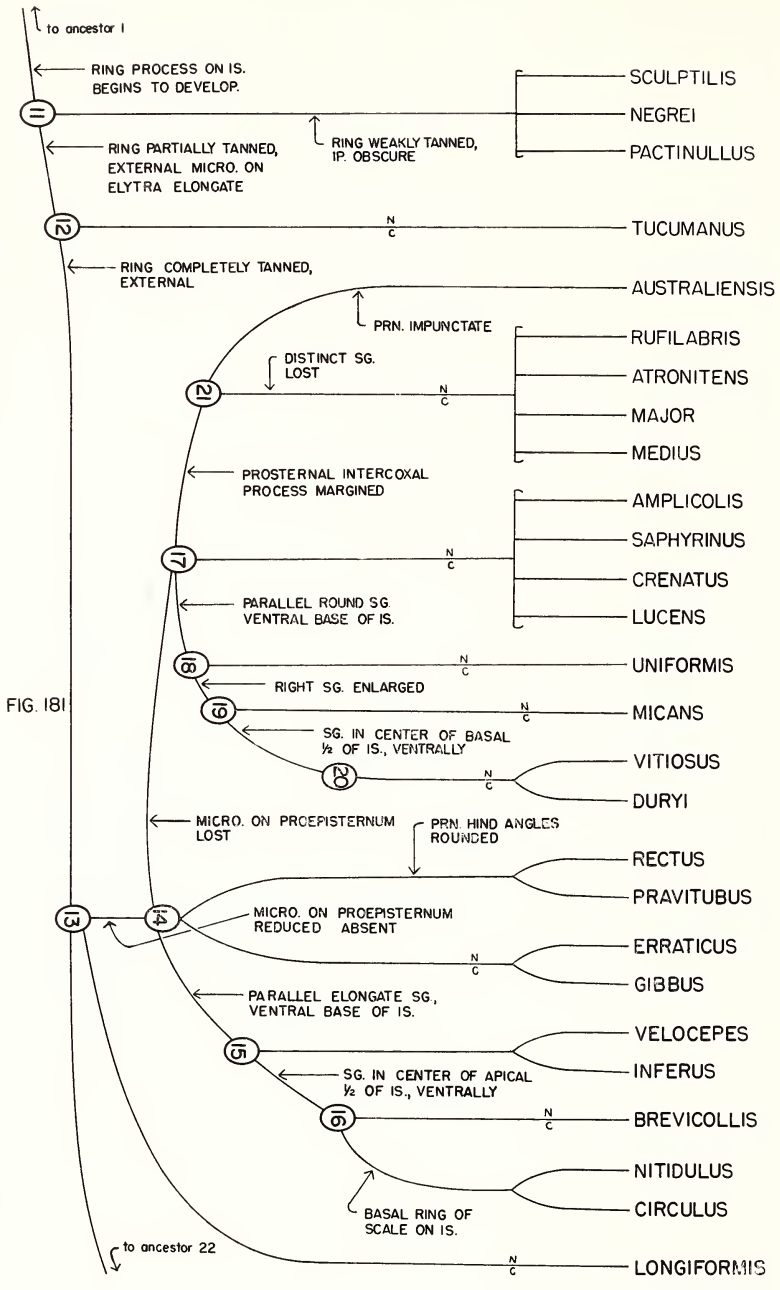
The progenitor of *Loxandrus* is represented by ancestor 1. Three lineages seem to have arisen from ancestor 1. *Loxandrus infimus*, one lineage arising from ancestor 1, appears to have changed little from the ancestor. The second lineage arising from ancestor 1 gave rise to ancestor 2 in which the microsculpture on the elytra became reduced to fine elongate lines or became altogether absent (Figs. 13, 14), a character which has apparently evolved twice in *Loxandrus* as we shall presently see. The third lineage arising from ancestor 1 gave rise to ancestor 11 in which a ring process near the apex of the internal sac of the aedeagus began to develop (Figs. 91 A; 93 A).

Ancestor 2 gave rise to three lineages. *Loxandrus elongatus* appears to have changed little from the ancestor. *Loxandrus dubius* is the end result of a second lineage arising from ancestor 2 in which two sclerites developed on the internal sac of the aedeagus (Figs. 73 B – S1, S2). The third lineage arising from ancestor 2 resulted in ancestor 3 in which the microsculpture on the elytra was entirely absent.

→

FIGS. 180–182. Hypothetical phylogeny of *Loxandrus* species. Three parts.


FRAUS
UNISPINUS
10
SCALE GROUP NR.
APEX OF IS
ELYTRA SPOTS ELONGATE
BALLI
9
ELNAE
METEPISTERNUM IMPUNCTATE
8
WHITEHEADI
TROPICUS
MESEPISTERNUM IMPUNCTATE
LEPIDUS
7
SPINIGRANDIS
DISCOLOR
ELYTRA WITH SPOTS
SETAE ON ABD. SEG. 2
SUBRECTUS
6
LATUS
MICRO ON PRN.
LOST
FIG. 180
SUBIRIDESCENS
5
REMOTUS
MICRO ON VENTRAL
SURFACE REDUCED ABSENT
CUBANUS
4
CELERIS
MENTUM WITH FOVAE
NOCTICOLOR
3
RECTANGULUS
MICRO. ON ELYTRA
ABSENT
DUBIUS
2
ELOGATUS
MICRO. ON ELYTRA
ELONGATE ABSENT
2 SCLERITES ON IS.
1
INFIMUS
to ancestor II


to ancestor 1
RING PROCESS ON IS. BEGINS TO DEVELOP.
11
RING PARTIALLY TANNED, EXTERNAL MICRO. ON ELYTRA ELONGATE
RING WEAKLY TANNED, IP. OBSCURE
SCULPTILIS
NEGREI
PACTINULLUS
12
N
C
TUCUMANUS
RING COMPLETELY TANNED, EXTERNAL
AUSTRALIENSIS
PRN. IMPUNCTATE
21
DISTINCT SG. LOST
N
C
RUFILABRIS
ATRONITENS
MAJOR
MEDIUS
PROSTERNAL INTERCOXAL PROCESS MARGINED
17
N
C
AMPLICOLIS
SAPHYRINUS
CRENATUS
LUCENS
PARALLEL ROUND SG. VENTRAL BASE OF IS.
18
N
C
UNIFORMIS
RIGHT SG. ENLARGED
19
N
C
MICANS
SG. IN CENTER OF BASAL ½ OF IS., VENTRALLY
20
N
C
VITIOSUS
DURYI
FIG. 181
MICRO. ON PROEPISTERNUM LOST
PRN. HIND ANGLES ROUNDED
RECTUS
PRAVITUBUS
13
14
MICRO. ON PROEPISTERNUM REDUCED ABSENT
N
C
ERRATICUS
GIBBUS
PARALLEL ELONGATE SG., VENTRAL BASE OF IS.
15
VELOCEPES
INFERUS
SG. IN CENTER OF APICAL ½ OF IS., VENTRALLY
16
N
C
BREVICOLLIS
NITIDULUS
CIRCULUS
BASAL RING OF SCALE ON IS.
to ancestor 22
N
C
LONGIFORMIS

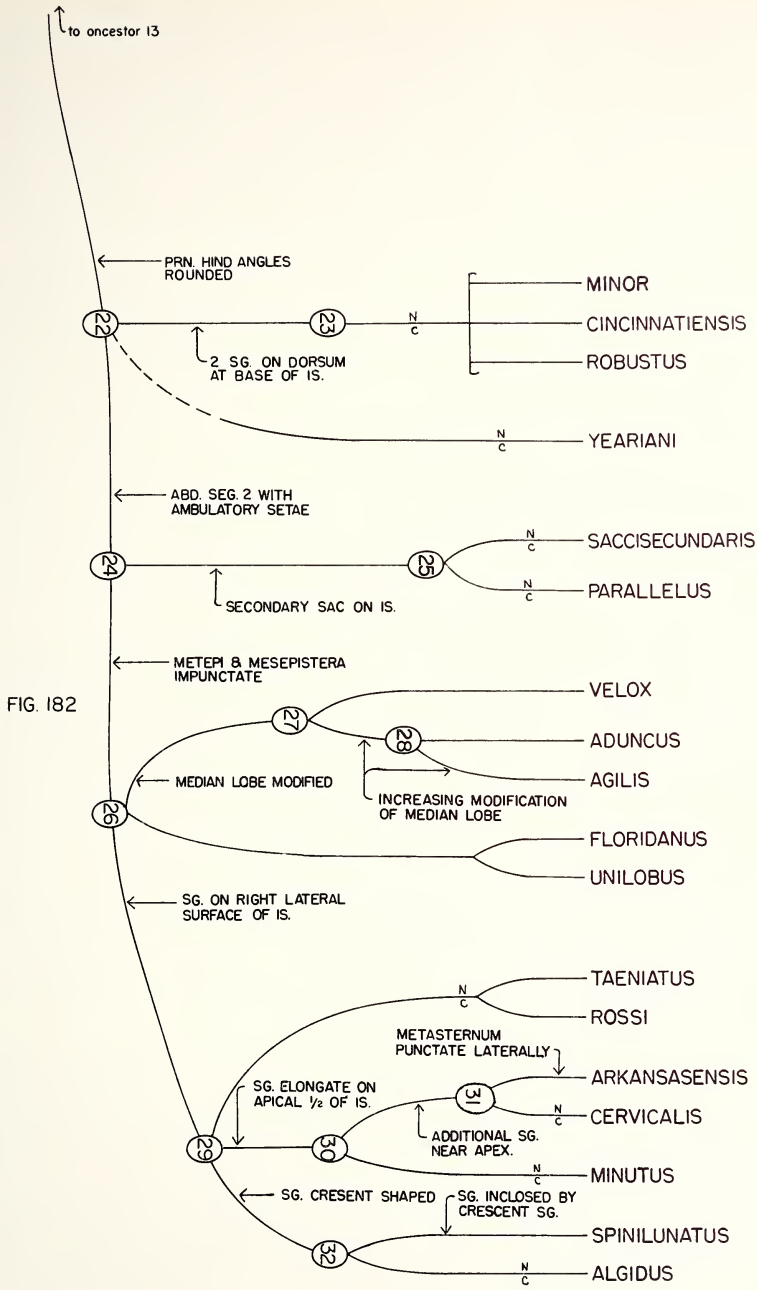

to oncestor 13
PRN. HIND ANGLES ROUNDED
22
23
N C
MINOR
CINCINNATIENSIS
ROBUSTUS
2 SG. ON DORSUM AT BASE OF IS.
N C
YEARIANI
ABD. SEG. 2 WITH AMBULATORY SETAE
24
25
N C
SACCISECUNDARIS
N C
PARALLELUS
SECONDARY SAC ON IS.
METEPI & MESEPISTERA IMPUNCTATE
VELOX
27
28
ADUNCUS
AGILIS
MEDIAN LOBE MODIFIED
INCREASING MODIFICATION OF MEDIAN LOBE
26
FLORIDANUS
UNILOBUS
SG. ON RIGHT LATERAL SURFACE OF IS.
N C
TAENIATUS
ROSSI
METASTERNUM PUNCTATE LATERALLY
ARKANSASENSIS
SG. ELONGATE ON APICAL ½ OF IS.
31
N C
CERVICALIS
29
30
ADDITIONAL SG. NEAR APEX.
N C
MINUTUS
SG. CRESENT SHAPED
SG. INCLOSED BY CRESCENT SG.
SPINILUNATUS
32
N C
ALGIDUS

FIG. 182

Loxandrus nocticolor and *Loxandrus rectangulus* are two existent species which appear to have changed little from ancestor 3. Ancestor 3 also gave rise to a lineage in which fovae on the mentum were developed (Figs. 138, 139, 140). Ancestor 4 is represented in our present day fauna by *Loxandrus celeris* and *Loxandrus cubanus*. These two species appear to have changed little from ancestor 4. Ancestor 4 also gave rise to a lineage in which the microsculpture on the surface of all ventral sclerites became greatly reduced if not absent and which resulted in ancestor 5.

Ancestor 5 is represented in our present day fauna by *Loxandrus subiridescens* and *Loxandrus remotus*. These two species appear to have changed little from ancestor 5. Ancestor 5 also gave rise to a lineage in which the microsculpture on the pronotum was lost and which resulted in ancestor 6.

Ancestor 6 is represented in our present day fauna by *Loxandrus subrectus* and *Loxandrus latus*. These two species appear to have changed little from ancestor 6. Ancestor 6 also gave rise to a lineage which resulted in ancestor 7 in which a unique character among *Loxandrus* appeared. The character was the development of orange or dark yellow spots on each elytron, one near the humeri and one towards the apex (Fig. 2 A).

Ancestor 7 gave rise to at least four and possibly five phylogenetic lineages. *Loxandrus spinigrandis*, *Loxandrus tropicus*, and *Loxandrus lepidus* are the end results of three of these lineages and appear to have changed little from the ancestor. *Loxandrus discolor*, a fourth lineage that may have arisen from ancestor 7, also possesses most of the external characters attributed to ancestor 7, but the internal sac of the male aedeagus (Fig. 82 A) is very similar to *Loxandrus whiteheadi* (Figs. 86 A, B). Occasional specimens of *Loxandrus discolor* also have ambulatory setae present on sternite 2 of the abdomen, a character which apparently arose one other time in a far-distantly related *Loxandrus* group. The phylogenetic position of *Loxandrus discolor* is thus questionable at this time. A fifth lineage arising from ancestor 7 in which the punctures on the mesepisternum were lost resulted in ancestor 8 (Fig. 20 B).

Ancestor 8 seems to have given rise to two evolutionary lines. *Loxandrus whiteheadi* is the end result of one of these lines and appears to have changed little from its ancestor. In the second line arising from ancestor 8 the punctures on the metepisternum (Fig. 20 A) were lost, resulting in ancestor 9.

Ancestor 9 appears to have given rise to 3 phylogenetic lineages. *Loxandrus balli*, one line arising from ancestor 9, is a species that seems to have changed little from the ancestor. *Loxandrus elnae* arose

from ancestor 9 and has one notable external character that is different from its hypothetical ancestor. In *Loxandrus elnae* the spots on each elytron have become elongate, thus forming lines near the lateral margins of the elytra. The internal sac of the aedeagus of *Loxandrus elnae* must also be mentioned (Figs. 90 A, B). It is quite similar to *Loxandrus floridanus* (Figs. 122 A, B), a distantly related species. This similarity is very striking but I feel that at the present time the evidence indicates that the common ancestry of *Loxandrus elnae* and *Loxandrus floridanus* is not very close. In the third line arising from ancestor 9 there developed a small group of scales near the apex of the internal sac that resulted in ancestor 10 (Figs. 87 A; 89).

Ancestor 10 gave rise to two lineages. One lineage resulted in *Loxandrus fraus* and the other lineage resulted in *Loxaudrus unispinus*. These two species appear to have changed little from their ancestor.

Thus far, none of the species discussed have possessed a sclerotized ring near the apex of the internal sac. The third phylogenetic line arising from ancestor 1 resulted in a short series of species that illustrate what I believe to be the gradual development of this sclerotized ring. Hypothetical ancestor 11 and 3 species of our present day stock represent the first step in the development of the sclerotized ring.

Ancestor 11 gave rise to several phylogenetic lineages. In one lineage arising from ancestor 11 the ring on the internal sac of the aedeagus became larger and was weakly sclerotized but was not completely enclosed inside the sac of the aedeagus (Fig. 94 A – R1) and the microsculpture on the elytra became reduced or obscure, fine, parallel lines (Figs. 13, 14, 15). This lineage resulted in ancestor 12. The remaining lines that arose from ancestor 11 resulted in *Loxandrus pactinullus*, *Loxandrus negrei*, and *Loxandrus sculptilis*.

The ring on the internal sac of the aedeagus of males of the above three species is turned inward and covered by the membraneous sac (Figs. 91 A; 93 A – R1). I have been unsuccessful in trying to force the ring to the surface without destroying the sac. The ring is weakly sclerotized if at all. It does have enough rigidity that when compressed with a pair of forceps it will return to its original shape. The median lobe and internal sac of the aedeagii of the males of the three species under discussion show no other distinctive morphological characters. The mentum in these three species is transverse. That is, the tooth is as long as or almost as long as the lobes of the mentum. This is apparently a derived character state. The remainder of the external morphology is rather nondescript. Thus, it is presently impossible to discuss any further the relationship of the species *Loxandrus pactinullus*, *Loxandrus negrei*, and *Loxandrus sculptilis*.

Ancestor 12 gave rise to two lineages. *Loxandrus tucumanus* appears to have changed little from its ancestor. In a second line arising from ancestor 12 that resulted in ancestor 13 the ring on the internal sac of the aedeagus completed its development into a form that is common today in many of our *Loxandrus* species. The ring was fully sclerotized and not enclosed by the internal sac (Fig. 95 A – R1).

Ancestor 13 gave rise to three lineages. *Loxandrus longiformis*, a species representing one lineage arising from ancestor 13, appears to have changed little from its hypothetical ancestor. The aedeagus of this species is unknown to me and its phylogenetic position may change when a male specimen is studied. In a second lineage arising from ancestor 13 the posterior angles of the pronotum became rounded (Figs. 51, 52). This character appears to have evolved several times in *Loxandrus*. This lineage resulted in ancestor 22. In the third lineage arising from ancestor 13 the microsculpture on the proepisternum became reduced or absent resulting in ancestor 14.

Ancestor 14 apparently gave rise to 3 distinct lineages and two species that have changed little from the ancestor. *Loxandrus gibbus* and *Loxandrus erraticus* are the two species that are similar to their ancestor. In another lineage arising from ancestor 14 the microsculpture on the proepisternum was entirely lost and resulted in ancestor 17. In a second distinct lineage arising from ancestor 14 the hind angles of the pronotum became rounded (Figs. 43 A, B; 44 A, B). This evolutionary pathway resulted in *Loxandrus rectus* and *Loxandrus pravitubus*. Both species have a characteristic scale pattern on the internal sac but I am unable to ascertain which of these two patterns represents the ancestral condition. In the third lineage arising from ancestor 14 the scale groups on the surface of the internal sac of the aedeagus became arranged in a characteristic pattern and gave rise to ancestor 15.

Hypothetical ancestor 15 is characterized by the development of two elongate groups of scales present on the ventral, basal portion of the internal sac of aedeagus (Fig. 102 D – SA2). This ancestor, ancestor 15, gave rise to two phylogenetic lineages. In one lineage the resulting species changed little from their ancestor. These species are *Loxandrus velocipes* and *Loxandrus inferus*. In the second lineage arising from ancestor 15 there developed a group of scales on the ventral surface in the center of the apical half of the sac (Fig. 101 C – SA1) which resulted in ancestor 16.

Ancestor 16 gave rise to one species that differs very little from it, *Loxandrus brevicollis*, and one distinct phylogenetic lineage. In the distinct phylogenetic lineage arising from ancestor 16 there developed a wide ring of small scales completely encircling the basal half of the

internal sac and a small group of elongate scales near the sclerotized ring of the internal sac (Figs. 102 A, B). These developments resulted in *Loxandrus nitidulus* and *Loxandrus circulus*.

Ancestor 17, which we have previously noted as arising in a lineage emanating from ancestor 14 through the loss of the microsculpture on the prosternum, gave rise to several phylogenetic lineages. Four species arose from ancestor 17 and appear to have changed very little from it. The four species are *Loxandrus amplicolis, Loxandrus crenatus*, *Loxandrus saphyrinus* and *Loxandrus lucens*. I have not seen a male of *Loxandrus amplicolis* and I place the species here only tentatively. It should also be noted that the sclerotized ring of *Loxandrus crenatus* is very different from the other *Loxandrus* species in this group (Fig. 104 – R1). In another line arising from ancestor 17 the intercoxal process of the prosternum became margined resulting in ancestor 21. In the last lineage arising from ancestor 17 there developed on each side of the ventro-lateral surface in the basal quarter of the internal sac a round or elongate group of scales that resulted in ancestor 18 (Figs. 108 C; 110 B; 109 C, D, E, F – SA1). We have previously noted a similar group of scales arising in a lineage arising from ancestor 14 and resulting in ancestor 15. In this lineage, however, the group was always elongate.

Ancestor 18 gave rise to two lineages. The first lineage resulted in *Loxandrus uniformis*, a species that apparently changed little from its ancestor. In the second lineage arising from ancestor 18 the basal, ventral scale group on the left side of the sac lost its elongate form by becoming larger and more oval in form (Fig. 108 C – SA1) resulting in ancestor 19.

Ancestor 19 also gave rise to two lineages. One lineage, represented in our present day fauna by *Loxandrus micans*, seems to have changed little from its ancestor. In the second lineage arising from ancestor 19 there developed an additional group of scales on the ventral surface in the center of the basal half of the internal sac (Figs. 109 E; 110 C – SA2). This lineage resulted in ancestor 20 which in turn gave rise to *Loxandrus duryi* and *Loxandrus vitiosus*. These species have characteristic scale patterns on the internal sac but I am unable to discern the ancestral state.

Ancestor 21, which arose from a phylogenetic line emanating from ancestor 17 previously discussed, gave rise to several phylogenetic lineages. Four of these lineages resulted in *Loxandrus rufilabris, Loxandrus atronitens*, *Loxandrus major*, and *Loxandrus medius*. In a fifth lineage arising from ancestor 21 the punctures on the pronotum were lost. This resulted in *Loxandrus australiensis*.

The internal sacs of the aedeagii of *Loxandrus major* (Fig. 111 B),

Loxandrus rufilabris (Fig. 112) and *Loxandrus medius* (Figs. 114 B, C), originating from ancestor 21 (a male is unknown for *Loxandrus amplicolis* and therefore questionable) are characteristically devoid of distinct organized scale groups. This apparently represents a lost character after the main evolutionary stream of *Loxandrus* had developed characteristic scale groups on the internal sacs.

Ancestor 22 arose from ancestor 12 through the development of rounded posterior angles of the pronotum as mentioned previously. It should be noted here that this is the second time this adaptation has occurred in *Loxandrus*. Previously it occurred in a lineage arising from ancestor 14 and resulting in *Loxandrus rectus* and *Loxandrus pravitubus*.

Ancestor 22 gave rise to at least two and possibly three lineages. *Loxandrus yeariani* is a species that has apparently changed little from the hypothetical ancestor 22 from which it arose. Its placement here in the phylogeny is tentative because it possesses some characters that would suggest other relationships. A second line arising from ancestor 22 resulted in ancestor 23. In this line there developed two small parallel groups of scales on the dorsal surface of the sac at the base (Figs. 116; 117; 118 A, B – SA1). The third line arising from ancestor 22 resulted in ancestor 24. In this lineage there developed a tendency for ambulatory setae to be present on the second abdominal sternite. This character is expressed in many specimens of the resulting species but not in all.

Ancestor 23 apparently gave rise to three species, *Loxandrus minor*, *Loxandrus cincinnatiensis* and *Loxandrus robustus*, that have changed little from the ancestor.

Ancestor 24 gave rise to two lineages. In one lineage punctures on the metepisternum, and mesepisternum were lost (Figs. 20 A, B). This resulted in ancestor 26. In the second lineage arising from ancestor 24 there developed a secondary sac on the left lateral surface of the primary sac of the males (Figs. 120 A, B; 121 A, C – SS). This resulted in ancestor 25 which in turn gave rise to two species represented in our present day fauna, *Loxandrus saccisecundaris* and *Loxandrus parallelus*. These two species have evidently changed little from hypothetical ancestor 25.

Ancestor 26, which arose from ancestor 22 through the loss of punctures on the mesepisternum and metepisternum, gave rise to several phylogenetic lines. In one line arising from ancestor 26 there developed on the left lateral surface of the internal sac a characteristic group of scales. In some species the group is elongate (Fig. 122 B – SA1) while in others it is more rounded (Fig. 127 A – SA 1). The group does, however, appear to have the same general position in all the

species evolving past this point in the phylogeny. This evolutionary pathway led to ancestor 29. In a second lineage arising from ancestor 26 the median lobe of the aedeagus became modified and resulted in ancestor 27. In addition to these two lineages there arose from ancestor 26 two species that have apparently changed little from their ancestor. These two species are *Loxandrus floridanus* and *Loxandrus unilobus.*

Ancestors 27 and 28 and the three species resulting from them, *Loxandrus velox*, *Loxandrus aduncus* and *Loxandrus agilis*, represent a phylogenetic sequence in which the median lobe of the aedeagus became highly modified. Based on the general appearance of the morphology I have arranged these three species in what appears to be the evolutionary sequence beginning with the simplest, *Loxandrus velox* (Figs. 134, A, B), an intermediate form, *Loxandrus aduncus* (Figs. 124 A, B), and the most complex, *Loxandrus agilis* (Fig. 125). The reader is cautioned that this is the only place in this phylogeny in which this kind of criterion is used. Note also that the ambulatory setae on the second abdominal sternite in *Loxandrus velox* have not been verified.

Ancestor 29 which arose from ancestor 26, as previously discussed, gave rise to two distinct phylogenetic lineages and two additional species. The two species *Loxandrus rossi* and *Loxandrus taeniatus* would appear to have changed little from their ancestor. In another lineage arising from ancestor 29 there developed on the internal sac a crescent-shaped group of scales on the lateral surface of the left side resulting in ancestor 32 (Figs. 132 A; 133 B – SA1). Ancestor 29 also give rise to yet another lineage in which developed one elongate group of scales in the apical ½ of the internal sac near the sclerotized ring, more or less on the ventral surface (Figs. 129 C; 130 C; 131 A – SA1). This resulted in ancestor 30.

Ancestor 30 gave rise to two lineages. One lineage is represented by *Loxandrus minutus*, a species that appears to have changed little from its ancestor. In the second lineage arising from ancestor 30, additional groups of scales developed near the sclerotized ring on the internal sac of the aedeagus and this resulted in ancestor 31 (Figs. 130 A, B, D; 131 A, B – SA2).

Ancestor 31 gave rise to two species *Loxandrus cervicalis* and *Loxandrus extendus*. The former species, *Loxandrus cervicalis*, appears to have changed very little from its ancestor while in the latter species, *Loxandrus extendus*, the lateral margins of the metasternum have become punctate (Fig. 19 C).

Ancestor 32 which arose from ancestor 29 as previously discussed gave rise to two phylogenetic lineages. One lineage resulted in

Loxandrus algidus, a species that seems to have changed little from its ancestor. In the second lineage arising from ancestor 32 there was an addition of a large group of scales that is partially enclosed by the crescent-shaped scale group (Fig. 132 A – SA2). This evolutionary line resulted in *Loxandrus spinilunatus*.

Based on the information I now possess, I believe that the above discussion is the one most plausible concerning the evolutionary history of the species comprising the genus *Loxandrus*.

ZOOGEOGRAPHY

At the present time there appear to be two general schools of thought concerning methods to be employed in the study of the zoogeography of animals. One group of zoogeographers tends to utilize the "working principles" set forth by Darlington (1957). A second group of zoogeographers places more emphasis on first studying the phylogenetic relationships of taxa. Once these phylogenetic relationships are postulated the present day geographical ranges and data from historical geography are utilized to form hypotheses concerning the past dispersals of the organisms. W. H. Henig and H. H. Ross are two leading proponents of the second method. In the following discussion essentially the latter approach has been followed.

Two factors greatly hinder a discussion of the historical zoogeography of *Loxandrus*. These are (1) an inadequate knowledge of the distribution of most species, and (2) the sympatric distribution of many species, especially species pairs.

Loxandrus *in North America.*

Current data concerning phylogenetic relationships and distribution patterns, indicate that there are two basic faunal groups of *Loxandrus* in North America. One fauna is found primarily in the Southeastern United States while the second fauna is found primarily in the Middle American-West Indies region of North America. A few species are common to both areas. A study of phylogeny and distribution patterns as presented in Fig. 183 indicates the following sequence of events in the past dispersal of the genus *Loxandrus*.

Those species that are more closely related to the hypothetical ancestor of the genus *Loxandrus* (ancestor 1) are now found in Middle America and in South America—*L. infimus*, *L. dubius*, *L. elongatus*, *L. sculptilis*, *L. negrei*, *L. pactinullus* and *L. tucumanus*. The fauna now endemic to the Southeastern United States apparently arose from hypothetical ancestor 12 and resulted in ancestor 13. Ancestor 13 gave rise to three lineages that resulted in ancestor 14, ancestor 22, and one existent species (*L. longiformis* known only from Australia).

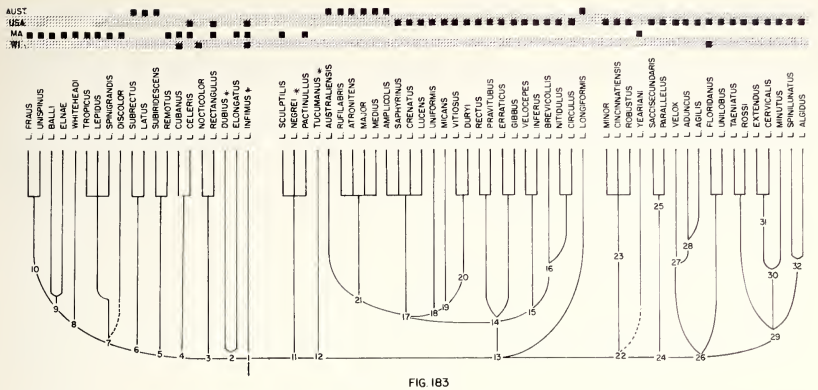


FIG. 183

FIG. 183. Hypothetical phylogeny of *Loxandrus* species and their general geographical ranges. Aust . . . Australia; MA . . . Middle America; USA . . . United States of America; WI . . . West Indies.

Ancestor 14 gave rise to several lineages that eventually resulted in 16 species endemic to the Southeastern United States. Ancestor 14 also gave rise to a lineage, via ancestor 17, that apparently colonized Australia. This lineage evolved into 6 distinct species endemic to the Australian continent.

Ancestor 22, which as previously noted arose from ancestor 14, gave rise to at least two phylogenetic lineages and possibly three. The two evident evolutionary lines arising from ancestor 22 proliferated and eventually resulted in 16 species. Fifteen of these species are found only in the Southeastern United States. One of the 16 species, *L. floridanus*, is also found in the Bahama chain of West Indies; *L. yeariani* also may have arisen from ancestor 22. This latter species is presently known only from Mexico.

The phylogenetic line that resulted in the large majority of our present day Middle America-West Indies fauna also contains taxa endemic to South America and Australia. This lineage, originally emanating from ancestor 1, continues through a moderately long series of hypothetical ancestors, ancestors 2–10, and has resulted in the evolution of 19 species. There are 11 species endemic to Middle America, 3 to Australia, 1 to South America, 1 to the West Indies (Cuba) while 2 occur in both Middle America and the Southeastern United States and 1 is found in Middle America and the West Indies. It should be noted that the majority of the Middle American species, 9 species, evolved from a phylogenetic lineage originally emanating from hypothetical ancestor 6.

The factors that led to the geographical isolation of populations and subsequent evolution of the species that now comprise the genus *Loxandrus* in North America are not at all evident. Freitag and Ball (in Freitag 1969) have suggested that "The analysis of the distribution of pairs of closely related species (sister species) seems to be the most fruitful approach to historical zoogeography at the local level. Their distributions are likely to provide the clearest evidence of location of former barriers and patterns of phylogeny. Of course this is true only if the two sister species are largely allopatric."

Examination of the phylogeny presented in Fig. 183 and the distribution maps, Figs. 144–176, indicates that there are two species pairs in the Southeastern United States and three species pairs in Middle America that are allopatric. They are listed as follows: Southeastern United States—*saccisecundaris-parallelus*; *spinilunatus-algidus*. Central America—*fraus-unispinus*; *nocticolor-rectangulus*; *dubius-elongatus*.

The two species pairs found in the Southeastern United States indicate a barrier or barriers that divided a once single large population into an east and west population that have now evolved into distinct species. In both cases, *saccisecundaris-parallelus*, *spinilunatus-algidus*, the barrier may well have been the Mississippi Embayment on the Mississippi River Basin as it served as an outlet for glacial flood waters. In the case of the *spinilunatus-algidus* pair the barrier could have been the Allegheny Mountain Range although I doubt this since *L. spinilunatus* has not been found east of the Mississippi River.

Evidence for barriers that divide populations into north and south segments is almost absent among *Loxandrus* species. None of the species pair groups indicate this type of division. Only in the case of *L. duryi* is there an indication of distinct north and south populations (Fig. 166). In this species the northern population is found in Indiana, Ohio, and Pennsylvania, while the southern population is found in Western Louisiana and Eastern Texas.

Ross (1967) pointed out "that the inter-American and circum-Caribbean area has been one of the world's most prolific hotbeds of evolution and speciation." This author goes on to say "It is now becoming more and more probable that Central America and the West Indies have been connected at times, and broken up into several isolated land masses at other times, at least since mid-Cretaceous, and possibly with the fracturing reaching its maximum degree during mid-Tertiary." It is also known that the inter-American land masses have been alternately connected and broken with the South American continent during the geological history of this area. This type of history could easily account for the division and isolation of a single

population into two segments that would have led to the evolution of the three species pairs found in Middle America and South America—*fraus-unispinus*, *nocticolor-rectangulus*, *dubius-elongatus*.

The discussion of the past dispersal patterns of the genus *Loxandrus* and the analysis of the sister species pairs are only as strong as the phylogeny. The zoogeographic patterns and the phylogenetic relationships as presented above seem to be compatible in most respects but there are two areas that cause concern at the present time. Both problems have to do with the Australian fauna. Firstly, the evidence presented in this paper indicates that the present day Australian fauna has been derived from three separate phylogenetic lineages. This is in direct conflict with the rule of parsimony. It would be much simpler if it were possible to account for the Australian *Loxandrus* fauna being derived from a single phylogenetic line. Secondly, those species that are more closely related to the hypothetical ancestor of the genus *Loxandrus* are found in Middle America and in South America. This would indicate that the genus *Loxandrus* may have its origin in the New World. This is directly opposite from the views of Darlington (1962) who felt that the genus had originated in Australia and spread to the New World early in geological history. Elucidation of both the South American and Australian faunas should help to solve these problems.

Loxandrus *and the insect fauna of the Eastern United States.*

Van Dyke (1939) postulated that the coleopterous fauna of the Eastern United States had been derived from faunal regions outside this area. In other words he indicated that our present day beetle species migrated into the Eastern United States. Ross (1953) has already pointed out the fallacy of this argument. Numerous other workers have also contributed data showing that not only migration but also the evolution of "new" species from resident populations in the Eastern United States have been a common occurrence for millions of years. In fact much of the entomological literature concerning insect zoogeography in North America has dealt with speciation and the physical factors contributing to speciation, especially the effect of Pleistocene glaciation on our Eastern United States fauna. It is to this phenomenon of Pleistocene glaciation and its effect on the insect fauna of the Eastern United States that I would now like to direct a few comments.

There seems to be no question that Pleistocene events had a profound effect on the evolution of the insect fauna of the Eastern United States. The question is rather "how did the insect fauna react to these Pleistocene events?"

Two opposing theories have been postulated concerning the effect of Pleistocene glaciation and climates on the biota of the Eastern United States. Proponents of the first theory believe that the climate of the Pleistocene had a profound effect, shifting large segments of the fauna and flora of the Eastern United States several hundred miles southward. Opposing this theory is the idea that the biota in front of the glaciers was little disturbed for any great distance. Howden (1969) has summarized much of the entomological literature dealing with the Pleistocene climate and fauna in the Eastern United States. From Howden's review article, from other literature (mostly consulting directly the papers he cites) and from my work with two warm-adapted beetle groups (*Loxandrus* and the carabid tribe Morionini) there seems to be a measure of truth in each of the two above-mentioned theories. The crucial factor in whether or not North American Pleistocene climates had a displacement effect on a particular group of insects revolves around the question of whether the group is primarily adapted to cooler climates and therefore has a more northern range or whether it is adapted to warmer climates and has a more southern range.

The following brief statements summarize the ways in which an insect population may have reacted to the momentous events of the Pleistocene Age. (1) Certain populations were displaced to a more southern range as the glacier itself advanced. As the ice retreated, relict southern populations were left behind as other portions of the population moved northward. These two populations subsequently became separated by ecologically inclement barriers and evolved independently of one another. Ross (1965) has given several examples of this occurring among the caddisflies. (2) Some groups with a more southern range were not displaced but their populations were fragmented by related Pleistocene events. The evolution of these groups was essentially "an *in situ* development" (Howden 1969). (3) Populations could have been entirely destroyed. (4) Populations could have been displaced southward and then retreated northward without leaving relict populations. Fossil evidence would be the only means of detecting type 3 and 4 reactions. (5) Populations could have been displaced southward then retreated northward leaving a relict population, the two populations then becoming geographically isolated but neither evolving into a different species (*Allocapnia pygmaea*, Ross 1965). (6) The population was seemingly unaffected by Pleistocene events (*Moirion monilicornis*, Allen 1968).

Figs. 177 and 178 illustrate the known locality records for all species in the genus *Loxandrus*. Figs. 144 to 176 illustrate the distribution of the individual species of *Loxandrus*. When the distribution patterns of the individual species are examined it is found that of the 34

TABLE IV.

General distribution of *Loxandrus* species occurring in the Eastern United States

Species Endemic to the Coastal Flood Plain	Species Endemic to an Area North of the Coastal Flood Plain	Species Occurring in the Coastal Flood Plain & in Northern Areas
L. parallelus	L. rossi	L. circulus
L. agilis		L. lucens
L. aduncus		L. pravitubus
L. taeniatus		L. rectus
L. crenatus		L. nitidulus
L. cervicalis		L. duryi
L. floridanus[1]		L. erraticus
L. minutus		L. velocipes
L. micans		L. saphyrinus
L. unilobus		L. cincinnatiensis
L. algidus		L. minor
L. rectangulus[1]		L. vitiosus
		L. gibbus
		L. robustus
		L. brevicollis
		L. celeris[1]
		L. uniformis
		L. extendus
		L. velox[2]
		L. spinilunatus[2]
		L. saccisecundaris[2]

[1] Species occurring in the West Indies and/or Mexico.
[2] Species whose range is not definitely known.

species of *Loxandrus* found in the Eastern United States 10 are endemic to the coastal flood plains. Two species are found in the coastal flood plains but also have ranges extending into the West Indies or Mexico. One species is endemic to an area outside the coastal flood plain, 18 species occur both in and outside the coastal flood plain and the exact range of 3 species is unknown. These data as presented here and in Table IV seem to indicate that *Loxandrus* is a taxon in which many of the species are more or less adapted to warmer climates. Effects of Pleistocene events on this genus are elusive. There is no doubt that the paucity of known locality records contributes to this problem. A second factor may be due to *Loxandrus* being a relatively old taxon, the members of which have not experienced a great amount

of speciation for some time. More information concerning this question as well as the many others that have been raised will hopefully be forthcoming as work continues on the insect fauna in North America.

ACKNOWLEDGMENTS

I would like to thank Dr. Herbert H. Ross for his encouragement and guidance during this study. I am grateful to the Bach Fund of the National Academy of Science and to the Society of the Sigma Xi for grants which aided my work. I would like also to thank Dr. George Ball, Dr. Phillip J. Darlington, Jr., and Dr. Milton W. Sanderson for their encouragement and advice. Dr. W. C. Yearian was especially helpful in making the photographs.

The following individuals kindly lent me specimens: Dr. Richard D. Alexander, The University of Michigan; Dr. Ross H. Arnett, Purdue University; Dr. Ross T. Bell, University of Vermont; Dr. W. Wayne Boyle, The Pennsylvania State University; Mr. W. J. Brown, Canadian National Collection of Insects; Dr. Horace R. Burke, Texas A & M University; Dr. George W. Byers, The University of Kansas; Dr. O. L. Cartwright, Smithsonian Institution; Dr. Wilbur R. Enns, University of Missouri; Mr. Terry L. Erwin, University of Alberta; Dr. S. W. Frost, The Pennsylvania State University; Dr. Oswaldo Giannotti, Instituto Biologico; Mr. T. F. Hlavac, Museum of Comparative Zoology; Dr. Karl V. Krombein, Smithsonian Institution; Mr. Hugh B. Leech, California Academy of Sciences; Mr. Jaque Negre, Paris Museum of Natural History; Mr. Gerald R. Noonan, California State College; Dr. Charles Oehler, Cincinnati Museum of Natural History; Dr. L. L. Pechuman, Cornell University; Mr. R. D. Pope, British Museum (Natural History); Dr. Jerome G. Rozen, Jr., The American Museum of Natural History; Dr. Frederick W. Stehr, University of Minnesota; Dr. Charles A. Triplehorn, The Ohio State University; Patricia Vaurie, The American Museum of Natural History; Dr. Rupert L. Wenzel, Chicago Natural History Museum; Mr. D. W. Whitehead, University of Alberta; Dr. Robert Woodruff, Florida Department of Agriculture; Dr. David A. Young, Jr., North Carolina State University.

REFERENCES

ALLEN, R. T.

1968. A synopsis of the tribe Morionini in the Western Hemisphere with descriptions of two new species (Coleoptera: Carabidae). *Carib. J. Sci.*, **8**(3–4): 141–163.

1969. A preliminary study of the phylogenetic relationships among species of the genus *Loxandrus*. Unpublished doctoral dissertation. University of Illinois Library. Urbana.

BALL, G. E.

1962. Carabidae (Latreille, 1810). (*In.* Arnett, Ross H., Jr. The Beetles of the United States. The Catholic University of America Press; Washington, D. C. 55–181).

1966. A revision of the North American species of the subgenus *Cryobius* Chaudoir (*Pterostichus*, Carabidae, Coleoptera). *Opusc. Ent. Supp.*, **28**: 1–166.

BATES, H. W.

1871. Notes on Carabidae, and descriptions of new species. *Ent. Monthly Mag.*, **7**: 194.

1881. Biologia Centrali-Americana, Insecta, Coleoptera, Carabidae, Cicindelidae. **1**(1): 1–152.

1891. Additions to the Carabideous fauna of Mexico, with remarks on some of the species previously recorded. *Trans. Ent. Soc. Lond.*, **39**: 223–278.

BLACKBURN, T.

1890. Notes on Australian Coleoptera, with descriptions of new species. Part XI. *Proc. Linn. Soc. N. S. Wales,* (2) **5**: 707–746.

1892. Notes on Australian Coleoptera, with descriptions of new species. Part XI. *Proc. Linn. Soc. N. S. Wales,* (2) **7**: 65–152.

1907. Further notes on Australian Coleoptera with descriptions of new genera and species, XXXII. *Trans. Roy. Soc. S. Austral.*, **27**: 91–182.

BLATCHLEY, W. S.

1918. Some new or scarce Coleoptera from Western and Southern Florida. *Canad. Entom.*, **50**: 416–423.

CASEY, T. L.

1918. Studies among some of the American Amarinae and Pterostichinae. *Mem. Coleoptera*, **8**: 224–393.

1924. Additions to the known Coleoptera of North America. *Mem. Coleoptera*, **9**: 1–347.

CHAUDOIR, MAXIMILIEN

1843. Carabiques nouveaux. *Bull. Soc. Imp. Nat. Moscow*, **16**: 671–795.

1868. Observations synonymiques sur les carabiques de l'Amerique septentrionale et descriptions d'especes nouvelles de ce pays. *Rev. Mag. Zool.*, Ser. 2, **20**: 161–345.

DARLINGTON, JR., P. J.
1934. New West Indian Carabidae, with a list of the Cuban species. *Psyche*, **41**: 66–131.
1935. West Indian Carabidae II. Itinerary of 1934; Forests of Haiti; new species; and a key to Colpodes. *Psyche*, **42**: 167–215.
1938. *Loxandrus infimus* Bates in Texas. *Psyche*, **45**: 1.
1953. West Indian Carabidae (Coleoptera). The Bahama species. *Amer. Mus. Novitates*, no. 1650: 1–16.
1957. Zoogeography: The geographical distribution of animals. John Wiley and Sons, Inc., New York. 657 p.
1962. The Caribid beetles of New Guinea. Part 1. Cicindelinae, Carabinae, Harpalinae through Pterostichini. *Bull. Mus. Comp. Zool.*, **126**: 319–564.

DEJEAN, P. F. M. A.
1825. Species general des Coleopteres. 1. Paris. pp. I–XXX, 1–563.
1828. Species general des Coleopteres. 3. Paris. pp. I–VII, 1–556.
1831. Species general des Coleopteres. 5. Paris. PP. I–VIII, 1–883.

FREITAG, RICHARD
1969. A revision of the species of the genus *Evarthrus* LeConte. *Quaest. Ent.*, **5**: 89–212.

HENNIG, W.
1966. *Phylogenetic Systematics*. Univ. of Illinois Press, Urbana, Ill. 263 pp.

HOWDEN, H. F.
1963. Speculations on some beetles, barriers and climates during the Pleistocene and pre-Pleistocene periods in non-glaciated portions of North America. *Sept. Zool.*, **12**: 178–201.

ILLIES, J.
1965. Phylogeny and zoogeography of the Plectoptera. *Ann. Rev. Entomol.*, **10**: 117–140.

LECONTE, J. L.
1848. A descriptive catalogue of the Geodephagous Coleoptrea. *Ann. Lyc. Nat. Hist.* (New York), **4**: 173–474.
1852. Synopsis of the species of *Pterostichus* and allied genera, inhabiting temperate North America. *Proc. Acad. Nat. Sci. Phila.*, **5**: 225–256.
1878. Additional descriptions of new species. *In*: E. A. Schwartz, The Coleoptera of Florida. *Proc. Amer. Phil. Soc.* 17. Phila., **5**: 353–472.

LINDROTH, C. H.
1966. The ground-beetles of Canada and Alaska. Part 4. *Opusc. Ent.*, **29**: 409–648.
LINDROTH, C. H. AND FREITAG, R.
1969. North American ground-beetles (Coleoptera, Carabidae, excluding Cicindelidae) described by Thomas Say: Designation of Lectotypes and Neotypes. *Psyche*, **6**(3): 326–361.
MACLEAY, W.
1888. The Insects of Kings Sound and its vicinity I. *Proc. Linn. Soc. N. S. Wales* (2nd series), **3**(2): 443–480.
MOORE, B. P.
1965. Studies on Australian Carabidae (Coleoptera) 4. – The Pterostichinae. *Trans. R. Ent. Soc. Lond.*, **117**(1): 1–32.
MOTSCHULSKY, V.
1865. Enumeration des nouvelles especes de Coleoptera rapportes de ses Voyages 4 e article, suite. *Bull. Soc. Nat. de Moscow*, **38**(2): 227–313.
ROSS, H. H.
1937. A generic classification of the Nearctic sawflies. *Illinois Biol. Monographs*, **15**(2): 1–173.
1953. On the origin and composition of the Nearctic insect fauna. *Evolution*, **7**: 145–158.
1956. *Evolution and classification of the mountain caddis flies.* Univ. Illinois Press, Urbana, Ill., 213 pp.
1959. A survey of the *Empoasca fabae* comples. *Ann. Entomol. Soc. Amer.*, **52**(3): 304–316.
1965. Pleistocene events and insects, pp. 583–596. *In* H. E. Wright, Jr., and D. G. Frey (ed.). The Quaternary of the United States. Princeton University Press, Princeton.
1967. The evolution and past dispersal of the trichoptera. *Ann. Rev. Ent.*, **12**: 169–206.
ROSS, H. H., DECKER, G. C., AND CUNNINGHAM, H. B.
1965. Adaptation and differentiation of temperate phylogenetic lines from tropical ancestors in *Empoasca*. *Evolution*, **18** (4): 639–651.
SAY, T.
1823. Description of insects of the families of Carabeii and Hydrocanthari of Latreille, inhabiting North America. *Trans. Amer. Phil. Soc.* **2**: 1–109.
SLOANE, T. G.
1898. On Carabidae from West Australia sent by Mr. A. M. Lea (with descriptions of new genera and species, synoptic tables, etc.). *Proc. Linn. Soc. N. S. Wales*, **23**: 444–520.

1903. Studies in Australian entomology, No. XII, New Carabidae (Panageini, Bembidiini, Pogonini, Platysmatini, Platynini, Lebini with revisional lists of genera and species, some notes on synonymy, etc.). *Proc. Lin. Soc. N. S. Wales*, **27**: 566–642.

STRANEO, S. L.

1949. Nuovi Pterostichini (Coleoptera, Carabidae, Bull. Inst. Sci. Not. Belg.) **25**(41), 13 pp.

1951. On some Central and South American Pterostichini (Coleoptera, Carabidae) in the Museum of Comparative Zoology. *Psyche*, **58**: 1–18.

1953. Nuovi Pterostichini VII (Coleoptera, Carabidae). Coriana, Genoa, **1**(36), pp. 1–12, 5 figs.

TSCHITSCHERINE, T.

1898. Materiaux pour servir a l'etude de Feroniens. IV. *Horae Soc. Ent. Ross.*, **32**: 1–224.

1900. Note sur le Platysmatini du Museum d'Historie Naturelle de Paris (4). *Ibid.*, **34**: 220–248.

1901. Note sur quelques Platysmatini nouveaux ou peu connus. *Ibid.*, **35**: 49–72.

1903. Nouvelles especes de la tribu de Platysmatini. *Ibid.*, **36**: 38–64.

VAN DYKE, E. C.

1939. The origin and distribution of the coleopterous insect fauna of North America. *Proc. 6th Pacific Sci. Congr. Pacific Sci. Assoc.*, **4**: 255–268.

WRIGHT, J. F.

1939. A new *Loxandrus* (Coleoptera, Carabidae) from Cincinnati, Ohio. *Bull. Brook. Ent. Soc.*, **34**: 257–258.

INSTRUCTIONS TO AUTHORS

1. *Manuscripts* must be typed, double-spaced throughout, on standard bond paper, with margins of 1½ inches on all sides and pages numbered consecutively.

2. A *title page* should be supplied with the title of the paper centered at the top of the page and the author's name (or authors' names) centered below it.

3. *Page one* of the manuscript should include the title, centered at the top of the page, the author's name centered below the title and followed by a superscript footnote number, a brief *table of contents*, a brief *abstract*, and a footnote at the bottom of the page giving the author's present professional titles and affiliations. The text of the paper may begin immediately after the abstract if there is space.

4. A paragraph of *acknowledgments* should appear at the end of the text of the paper.

5. The list of *references* should be in alphabetical order by authors' names. Two or more entries under one author should be in chronological order. The entry should appear, indented, beginning on the line below the auhor's name with the information in the following order: date, title of article (with only the first word and proper nouns capitalized), name of journal (underlined, for italics, with conventional title capitalization, and abbreviated according to the list published by the current *Biological Abstracts* or *Chemical Abstracts* or spelled out in full if not listed), volume number (in arabic numerals, followed by a colon), and page numbers; *OR* date, title of book (with only the first word and proper nouns capitalized), city of publication, publisher, volume number if any (preceded by "vol."), and the number of pages in the book (followed by the abbreviation "pp."). Authors are wholly responsible for accuracy and completeness of references. Examples follow:

   BEAL, R. S., JR.
   1954. A revision of the species included in the genus *Novelsis* (Coleoptera: Dermestidae). *Trans. Amer. Entomol. Soc.*, 80: 73–90.
   ALLEE, W. D., A. E. EMERSON, O. PARK, T. PARK, and K. P. SCHMIDT
   1949. Principles of animal ecology. Philadelphia and London, W. B. Saunders Co., 837 pp.
   KISTNER, D. H.
   1969. The biology of termitophiles. *In* Biology of termites, vol. 1 (ed. K. Krishna and F. M. Weesner). New York and London, Academic Press, Inc., chap. 17, pp. 525–557.

6. *Keys* should be typed on a separate sheet of paper, not run into the text, and provided with a formal title. Each couplet should be numbered, the numbers aligned flush left. The first words of all couplet enries should be aligned, and run-over lines indented and aligned. The number or name which ends each couplet entry should be aligned flush right and the space leading up to it filled in with leaders (periods separated by spaces). Examples:

   4. Transverse fascia on corium always present and straight 5
      Transverse fascia on corium irregular, not straight; or fascia absent 8
   5. Dorsum piceous; all marginal areas of pronotum continuously and widely yellowish orange . . . . . *ashmeadi* Heidemann
      Dorsum reddish brown; at most only the posterior marginal area of the pronotum yellowish 6

7. *Synonymy citations* should begin with a flush left alignment, with run-over lines indented uniformly. Authors' surnames only should be used, separated from the previous citation by a dash (two hyphens) and followed by date and page numbers. In cases where the first name mentioned is not that of the author of a species, it should be preceded by a colon. Example:

   Dermestes megatoma Fabricius, 1798, p. 313.
   Attagenus megatoma: Dahl, 1823, p. 30.—Laporte, 1840, p. 35.—Erichson, 1846, p. 441.—Wollaston, 1854, p. 204.—LeConte, 1854, p. 109.—Chevrolat, 1863, p. 616.—Howe, 1952, p. 40.—Mroczkowski, 1954, p. 7; 1958, p. 4; 1962, p. 6; 1965, p. 668.—Zhantiev, 1963b, p. 421.

8. The dimensions of the printed page (4″ × 6¼″) should be kept in mind in the preparation of *illustrations*, which should be large enough to that details will be clear after reduction. All figures should be numbered consecutively, in the order of their mention in the text, with no distinction between text figures, plates, maps and photographs. All figures should be identified on the reverse side with the author's name and the figure number. The approximate places where figures are to be inserted in the text should be indicated by the author in the margin of the manuscript. *Legends* for figures should be typed, double spaced, on a separate sheet of paper.

9. *Tables* should be typed on separate sheets of paper, double spaced, and the places where they are to be inserted in the text indicated by the author in the margin of the manuscript. A brief title should be typed above each table, and tables should be numbered consecutively (with arabic numerals) in the order of their mention in the text.

10. The metric system should be used for all *measurements*. The *names* of authors of species and geographical names (except in journal titles) should not be abbreviated.

11. Authors will be expected to pay a *page charge* of $15 per printed page toward publication costs. This fee will be waived for authors who do not have funds for publication. *Reprints* are not given gratis. They must be ordered from the printer at the time that proofs are returned. Extensive changes in *proofs*, other than correction of printer's errors, will be charged to authors.

ENTOMOLOGICA AMERICANA

REVIEW OF THE GENUS STERPHUS PHILIPPI (DIPTERA: SYRPHIDAE). PART I.

F. CHRISTIAN THOMPSON

PUBLISHED BY THE
NEW YORK ENTOMOLOGICAL SOCIETY
INCORPORATING THE BROOKLYN ENTOMOLOGICAL SOCIETY

Vol. 46, No. 2 August 8, 1973

The New York Entomological Society (incorporating the Brooklyn Entomological Society) publishes two journals: *Entomologica Americana* (irregularly, according to the availability of acceptable papers) and the *Journal of the New York Entomological Society* (quarterly). Monographs and longer papers (minimum length approximately 70 manuscript pages) are published in *Entomologica Americana.* Shorter papers may be submitted to the *Journal.* Manuscripts should be sent to the Editor, *Entomologica Americana,* Department of Entomology, The American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024.

Entomologica Americana was first published by the Brooklyn Entomological Society in April, 1885. Publication was suspended after six volumes, resumed in 1926, again suspended in 1964 with Volume 44, and resumed in 1969 with Volume 45. Since *Entomologica Americana* is published irregularly, subscription is by volume, not by year and costs $9.00 per volume. Correspondence regarding subscriptions and other non-editorial matters should be addressed to Publication Business Manager, New York Entomological Society, Department of Entomology, The American Museum of Natural History. Back issues may be purchased through Hafner Press, a Division of Macmillan Publishing Company, Incorporated, 866 Third Avenue, New York, New York, 10022.

Mailed August 8, 1973

Entomologica Americana is published for the Society by Allen Press, Inc., 1041 New Hampshire, Lawrence, Kansas 66044.

Vol. 46, No. 1 was published on August 1, 1972

Entomologica Americana
Vol. 46, No. 2, 1973, pp. 185–240

REVIEW OF THE GENUS STERPHUS PHILIPPI (DIPTERA: SYRPHIDAE). PART I.

F. Christian Thompson[1]

Table of Contents

Abstract: The genus *Sterphus* Philippi is reviewed. Twenty-eight species are recognized in this genus and are grouped into three subgenera and eleven species groups. Part I includes descriptions of all subgenera, key to and description of all species except those of the *fascithorax* group. Figures of some of the significant features of these taxa are also provided. One new subgenus and seven new species are described.

INTRODUCTION

During the course of a study of the Neotropical milesine genera (Thompson 1972) a number of new species of *Sterphus*, *Crepidomyia* Shannon and related genera were found. Some of these species display intermediate states of the characteristics traditionally used to separate *Sterphus*, *Crepidomyia*, *Tatuomyia* Shannon, *Senoceria* Hull and *Mutillimyia* Hull; thus, all these genera were synonymized. However, the descriptions of these new species were delayed until a complete review of all the known species could be prepared. No revision or key to the species of *Sterphus* or its subdivisions has ever been published and the species descriptions are widely scattered in the literature.

[1] Research Fellow, Department of Entomology, The American Museum of Natural History, New York, New York 10024.

Genus **Sterphus** Philippi

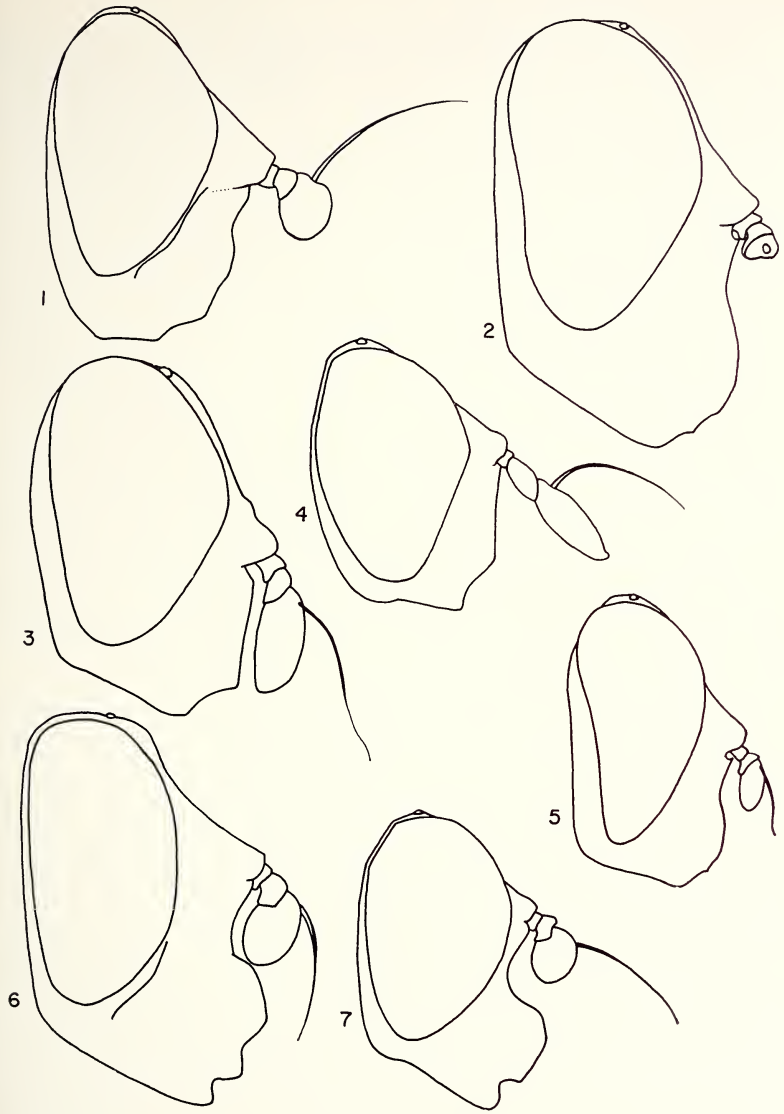
Sterphus Philippi, 1865, p. 737. Type species, *Sterphus autumnalis* Philippi (original indication) =*coeruleus* Rondani. Subsequent references: Kertész, 1910, (cat. citation).—Shannon, 1926, p. 45 (cat. citation).—Shannon & Aubertin, 1933, p. 155 (descrip. note; distr. data).—Hull, 1949, p. 369 (descript.).—Thompson, 1972, p. 153 (descript.).

Stherphus: Fluke, 1957, p. 106 (misspelling).

Head: higher than long; face bare, usually either completely pollinose or pollinose only on sides, mostly shiny only in subgenus *Telus*, usually carinate, with medial and lateral carinae, frequently with carinae very strong and straight, with medial carina slightly concave beneath antennal bases and swollen laterally near the oral margin in subgenus *Sterphus*, rarely tuberculate; cheeks broad, as broad as or broader than long; facial grooves long, extending about two-thirds the way to the antennal bases; facial stripes indistinct; frontal prominence low, above the middle of the head; front of male short, slightly longer than vertical triangle; front of female broad, as broad as or broader at antennal bases than long; vertical triangle of male long, about twice as long as broad; ocellar triangle always distinctly before posterior margin of eyes. Eyes bare, usually narrowly holoptic in male, narrowly dichoptic in males of *fascithorax* group, dichoptic only in males of *telus* and *stimulans*. Antennae usually elongate, slightly shorter than face, sometimes only half as long as face; third segment elongate to orbicular; arista long, longer than antenna.

Thorax: longer than broad, with short sparse pile, without long thick woolly pile, may have pair of medially interrupted transverse golden pollinose bands on anterior part of notum; mesokatepisterna with separate dorsal and ventral pile patches; mesoanepimera with posterior portion bare; meropleurae bare; metasterna usually bare, pilose only in *cybele* and always developed; post-metacoxal bridge usually incomplete, complete only in *fascithorax* group, metathoracic pleurae usually bare, with a few hairs in *plagiatus*; metathoracic spiracle usually enlarged, in some species larger than third antennal segment; plumulae absent to elongate; scutellum usually with ventral pile fringe, without ventral pile fringe only in *fascithorax* group, with or without distinct emarginate apical rim.

Legs: hind trochanters frequently with spurs; hind femora usually slightly swollen, straight ventrally, with two rows of very strong ventral spines; hind tibiae frequently with apical spurs. *Wings*: marginal cell open; apical cell closed and petiolate; anterior crossvein



FIGS. 1–7. Heads of *Sterphus*, lateral view; 1. *coeruleus* (Rondani); 2. *incertus*, n. sp. (holotype); 3. *fulvus*, n. sp. (holotype); 4. *shannoni*, n. sp.; 5. *intermedius*, n. sp. (holotype); 6. *telus*, n. sp. (holotype); 7. *stimulans*, n. sp. (holotype).

at or beyond middle of discal cell, always greatly oblique; anterior margin of wings may be dark.

Abdomen: usually elongate, rarely petiolate; *batesi* group with long petiole; *coarctatus* and *fascithorax* groups with short petiole; constriction always on second segment. *Male genitalia*:[2] cerci long pilose, rectangular, usually rounded on dorsal margin, medium sized, without special modification; surstyli usually of typical *Xylota* form, with elongate curved and tapering dorsal lobe which is densely covered with short appressed pile, with sparsely pilose or bare broad and apically expanded ventral lobe, in *chloropygus* group with both dorsal and ventral lobes greatly expanded, in *stimulans* with ventral lobe expanded, in *tinctus* with ventral lobe greatly reduced; 9th sternum frequently with small membranous opening on dorsolateral surface near base of superior lobe; lingula short or long, absent in *stimulans*; superior lobes broad, broadly and completely fused to sternum, pilose, with large ventral teeth or processes; ejaculatory apodeme umbrella shaped except rod shaped in *stimulans* and *woodorum*; aedeagus consisting of large curved dorsal lobe, paired elongate and tapering lateral lobes and flattened ventral lobe, with posterior margin of dorsal lobe flared into two lateral flaps, with tips of lateral lobes usually between base of these flaps, and with ventral lobe beneath and/or between the lateral lobes, with lateral lobes divided in *chloropygus* group, *batesi* and *genuinus* complex, with lateral lobes absent in *stimulans*.

DISCUSSION: A discussion of the relationships and distinctive characteristics of *Sterphus* has been included in my review of the Neotropical milesine genera (Thompson, 1972, p. 156) and thus is not repeated here.

With nothing known of the immature stages of *Sterphus* and with undoubtedly less than half the probable number of species described, it is premature to discuss the phylogeny of the group in detail. However, to justify my classification (Table I) it is necessary to provide at least a general phylogeny of *Sterphus*. Such a general outline (Diagram 1) can be developed from the study of two morphoclines, cline A—facial color and shape and cline B—abdominal shape and number of hind tibial spurs. In cline A, the facial color darkens, from primitive reddish or orange (A_p & A_o) thru partially black (A_1) to completely black (A_2) and the facial carinae develop, from strongly tuberculate and concave above (A_p), thru slightly tuberculate but still concave above (A_o) and slightly tuberculate and concave above

[2] The male genitalia are described as they appear in lateral view, the same perspective as used for the figures.

TABLE I

Classification of the Genus Sterphus Philippi

Subgenus Telus Thompson

telus Thompson

Subgenus Sterphus Philippi

1. *stimulans* group
   stimulans Thompson
2. *coeruleus* group
   coeruleus (Rondani)
   aurifrons Shannon

Subgenus Ceriogaster Williston

3. *incertus* group
   incertus Thompson
4. *auricaudatus* group
   auricaudatus (Williston)
5. *chloropygus* group
   chloropygus (Schiner)
   intermedius Thompson
   woodorum Thompson
6. *cybele* group
   cybele (Hull)
7. *plagiatus* group
   plagiatus (Wiedemann)
   shannoni Thompson
   genuinus (Williston)
   tricrepis (Shannon)
8. *fascithorax* group
   fascithorax (Williston)
   transversus (Walker)
   transversus (Hine)
   spinosa (Shannon)
   scutellatus (Curran)
   panamensis (Curran)
   arethusa (Hull)
   aureopila (Hull)
   funebris (Hull)
   rudis (Hull)
9. *tinctus* group
   tinctus (Fluke)
10. *coarctatus* group
    coarctatus (Wiedemann)
11. *batesi* group
    batesi (Shannon)
    fulvus Thompson

(A_{1-2}), to straight and carinate (A_3). In cline B the abdomen becomes constricted and petiolate, from parallel-sided (B_0), thru slightly constricted (B_0) and with a short petiole (B_1), to with a long petiole (B_2). Also in cline B the hind tibial spurs develop, from no spurs (B_0) thru one apical spur (B_1) to two apical spurs (B_2). On the basis of this phylogeny, I have recognized three subgenera; *Telus* for the species *telus*; *Sterphus*, s. s., for the *coeruleus* and *stimulans* groups; and *Ceriogaster*, for all the other species groups. *Telus* is considered the plesiomorphic sister-group to *Sterphus* + *Ceriogaster*. Character state A_0, slightly tuberculate and carinate face, demonstrates the monophyly of the combined group, *Sterphus* + *Ceriogaster*. The monophyletic nature of *Ceriogaster* is defined by character state A_1, partially black and slightly tuberculate and concave face. The recognization of *Mutillimyia* (= *auricaudatus* group), *Senoceria* (= *coarctatus* group), *Crepidomyia* (= *plagiatus* group) or *Tatuomyia* (= *batesi* group) is not justified because such an action would leave *Ceriogaster* a paraphyletic and symplesiomorphic group.

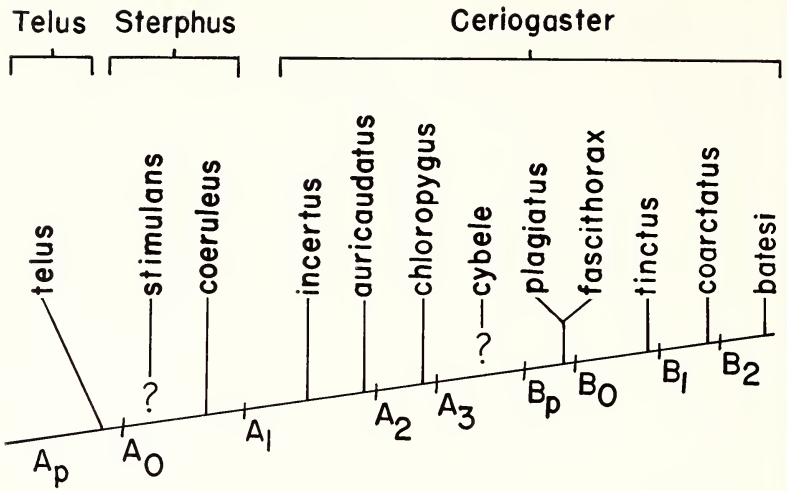


DIAGRAM 1. Phylogeny of the subgenera and species groups of *Sterphus* Philippi. Subgenera listed across the top, species groups listed vertically and apomorphic character states on the bottom. Explanation of characters is in the text.

The only weakness in this arrangement is that no apomorphic character state has been demonstrated for the nominate subgenus, *Sterphus*. Thus there is the strong possibility that *Sterphus*, s.s., is a symplesiomorphic group. This possibility would require that a subgenus be recognized for *stimulans*, if *Ceriogaster* is to be continued to be recognized as a subgenus. In this case, the enlarged metathoracic spiracle would be used as the defining apomorphic character of the *coeruleus* group. However, I consider the completely pollinose faces of both the *stimulans* and *coeruleus* groups to be a synapomorphous condition and define my concept of the nominate subgenus, *Sterphus*, by it (see discussion under the subgenus *Sterphus*).

My recent key to Neotropical milesine genera (Thompson, 1972) should be modified to include the new subgenus *Telus*.

MODIFICATION OF NEOTROPICAL MILESINI GENERA KEY (THOMPSON, 1972, P. 148)

1–14, the same, no change.

15. Face straight, with distinct keels (fig. 4) ..... *Sterphus* (*Ceriogaster*) Williston

Face either concave or tuberculate, never straight 16

16. Hind femora spindle-shaped, greatly enlarged on apical half, slender on basal half and apex (Fig. 11) ..... *Sterphus* (*Telus*) Thompson
Hind femora slender, if enlarged, then uniformly enlarged 17
17. Apical cell petiolate, with petiole as long as or longer than humeral crossvein 18
Apical cell not petiolate, closed at wing margin 19
18. Face bright yellow or orange in ground color ..... *Sterphus* (*Sterphus*) Philippi
Face dark in ground color 20
19. Scutellum with apical emarginate rim; abdomen oval-elongate ..... *Philippimyia* Shannon
Scutellum without apical emarginate rim; abdomen petiolate ..... *Odyneromyia* Shannon and Aubertin
20. Face straight or outwardly sloping above, with epistoma strongly produced below; hind femora greatly enlarged ..... *Crioprora* Osten-Sacken
Face concave or tuberculate, not as above; hind femora slender 21
21. Face usually with tubercle; if without facial tubercle, then either with strongly constricted abdomen or wings bicolored, anterior edge dark and posterior part light ..... *Valdivia* Shannon
Face concave; abdomen not strongly constricted and wings never bicolored 22
22. Anterior crossvein distinctly before middle of discal cell; males with dichoptic eyes ..... *Hemixylota* Shannon & Aubertin
Anterior crossvein at or beyond middle of discal cell; males with holoptic eyes ..... *Xylota* Meigen

KEY TO THE SPECIES OF *STERPHUS* PHILIPPI

A. Postmetacoxal bridge complete; occiput and anterior edge of mesonotum with transverse row of short black spines ..... *fascithorax* (Williston) group
Postmetacoxal bridge incomplete; occiput (except in *plagiatus*) and anterior edge of mesonotum never with a row of such spines 1
1. Abdomen petiolate, minimal width usually less than ⅓ maximal width (figs. 19–21) 2
Abdomen not petiolate, if slightly constricted, then minimal width never less than ¾ maximal (fig. 18) 6
2. Hind tibiae with apical spurs 4
Hind tibiae without apical spurs 3
3. Hind legs orange except brownish coxae and apical two tarsal segments, with black femoral spines; abdominal segments without bands of golden tomentose-like pile; face straight, epistoma not produced ..... *tinctus* (Fluke)
Hind legs bicolored, coxae, trochanters, femora and apical tarsal segments black, tibiae and basal tarsal segment orange, with black femoral spines; abdominal segments without apical bands of

tomentose-like pile; face with tuberculate swelling below (fig. 2) ..... *incertus*, new species

Hind legs dark, with yellow femoral spines; abdominal terga with apical bands of thick tomentose-like golden pile; face with epistoma distinctly produced forward ..... *auricaudatus* (Williston)

4. Hind tibiae with two apical spurs; abdominal petiole long, about three-fourths as long as second segment (fig. 21) 5

Hind tibiae with single apical spur; abdominal petiole short, about quarter as long as second segment (fig. 20) ..... *coarctatus* (Wiedemann)

5. Anal cell bare except apical quarter microtrichose (fig. 17); middle legs orange ..... *fulvus*, new species

Anal cell almost completely microtrichose (fig. 16); middle legs black ..... *batesi* (Shannon)

6. Abdomen red; wings completely dark except for apical light band ..... *telus*, new species

Abdomen dark; wings hyaline or almost completely hyaline 7

7. Face shiny medially, pollinose laterally, mostly black, never completely yellow or orange 11

Face completely pollinose, orange, yellow or black in ground color 8

8. Cheeks and most of frons orange, all of frontal triangle in males and lower third in females orange 10

Cheeks and frons black 9

9. Legs black; mestasterna bare 16

Anterior four legs orange; metasterna pilose ..... *cybele* (Hull)

10. Thoracic pile reddish brown; bases of tibiae light reddish brown ..... *aurifrons* Shannon

Thoracic pile white and black; tibiae completely black ..... *coeruleus* (Rondani)

11. Mesonotum with longitudinal stripes of golden appressed pile on posterior half 12

Mesonotum without longitudinal stripes of golden pile 13

12. Abdomen with bands of golden tomentose-like pile on third thru fourth (males) or fifth (females) terga; wings diffusely yellowish brown ..... *shannoni*, new species

Abdominal terga without apical golden pile bands; wings with distinct diagonal brown stripe (fig. 13) ..... *plagiatus* (Wiedemann)

13. Hind trochanter and tibiae without spurs or processes 3

Hind trochanter and/or tibiae with distinct spurs or processes (figs. 10, 12) 14

14. Transverse suture golden pollinose; hind tibiae without apical spur ..... *genuinus* complex

Transverse suture without golden pollinosity; hind tibiae with long apical spur (fig. 10) 15

15. Mesonotum with front and sides silvery-gold pilose; frontal triangle of male shiny black; hind trochanter of male with simple spur ..... *woodorum*, new species
Mesonotum black and yellow pilose, completely black pilose above wings and on postalar calli; frontal triangle of male golden pollinose; hind trochanter of male with a bilobed spur ..... *intermedius*, new species
16. Face orange, concave, slightly tuberculate (fig. 7); hind tibiae without spurs ..... *stimulans*, new species
Face black, straight (as in fig. 5); hind tibiae with apical spur ..... *chloropygus* (Schiner)

Subgenus **Telus**, new subgenus

Type species: *Sterphus* (*Telus*) telus, new species

Head: face tuberculate; mostly shiny, pollinose only under antennae; antennae short, third segment orbicular, arista about as long as face; eyes of male dichoptic, separated by about length of third antennal segment.

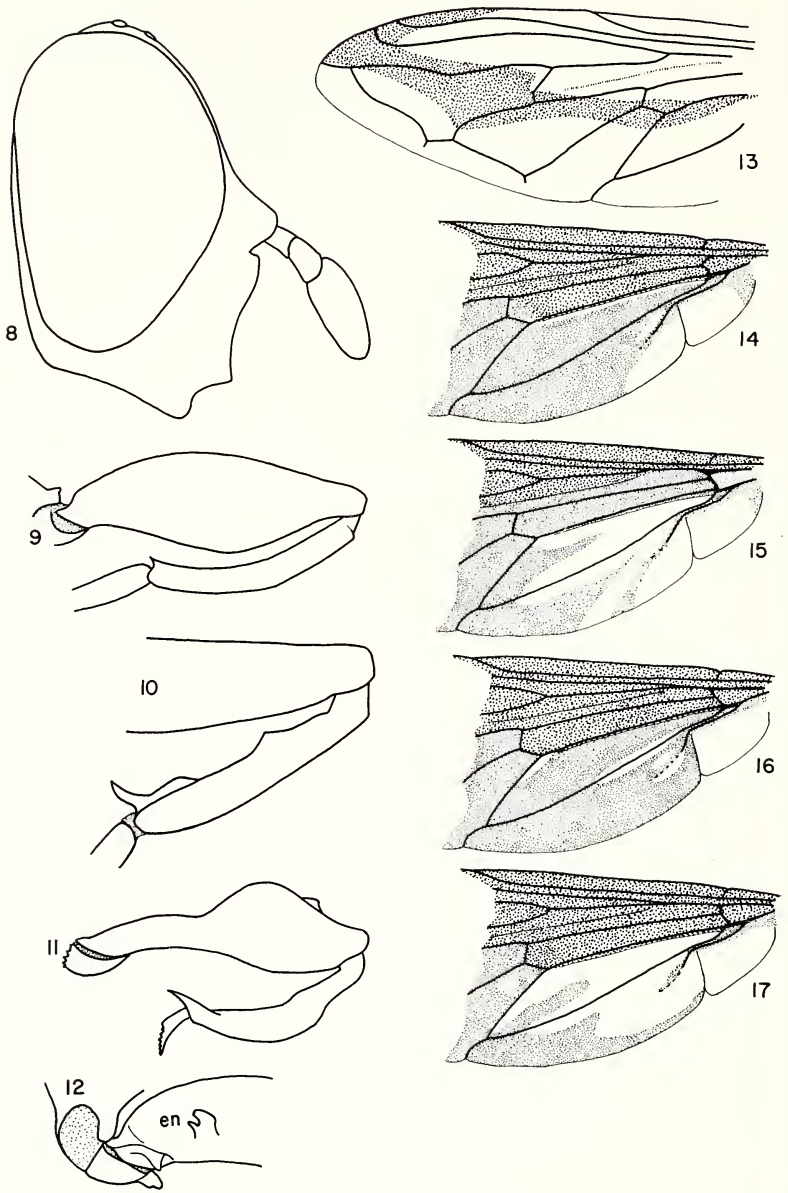
Thorax: metathoracic spiracle slightly larger than third antennal segment; scutellum non-emarginate. *Wings*: dark except for apical orange spot; apical crossvein just beyond middle of discal cell. *Legs*: (fig. 11), hind trochanter without spur; hind femora greatly enlarged on apical half, spindle-shaped, with patch of thick pile on apical half, with small dorsoapical tubercle on inner side; hind tibiae with slight medial swelling, with two apical spurs, with outer spur longer than inner, with medial patch of thick pile. These characteristics of the hind leg may be restricted to the male sex.

Abdomen: elongate, slightly broader apically.

DISCUSSION: The combination of a xylotine body form with a tuberculate face is an unique feature in the Milesini and will distinguish the subgenus *Telus* from other milesine groups. The structure of the hind leg of *Telus* is unique among syrphids. The hind leg of *Cacoceria* Hull is similar but it lacks a dorsoposterior apical tubercle and has only one spur on the tibia. *Cacoceria* with its elongate antennae, bifurcate third antennal segment and pilose metasterna can hardly be confused with *Telus*. *Telus* with its tuberculate face is considered the plesiomorphic sister-group to *Sterphus* (*Sterphus* + *Ceriogaster*).

The name *Telus* is derived from the Greek, *Telos*, meaning end and should be treated as masculine.

Since *Telus* is the plesiomorphic sister-group to *Sterphus* + *Ceriogaster* and is amply distinct, it would be feasible to recognize *Telus* as a genus rather than a subgenus of *Sterphus*. While this action is clearly justified and would perhaps better illustrate the phylogenetic



FIGS. 8–17. fig. 8. Head of *Xylota ventralis* Walker (holotype), lateral view; figs. 9–11. Hind legs, lateral view; 9. *Xylota ventralis* Walker (holotype); 10. *Sterphus intermedius*, n. sp. (paratype);

relationships involved, I have decided against recognition of *Telus* as a genus on utilitarian grounds, i.e., a broader genus is of greater utility and intelligibility to more people than would be two smaller genera. Crowson (1970, pp. 47–56, 298), Darlington (1971, pp. 147, 148) and others have presented a strong case against excessive splitting of genera and for the use of broader, more utilitarian genera, with the use of subgeneric categories by specialists, if necessary.

Sterphus (Telus) telus, new species

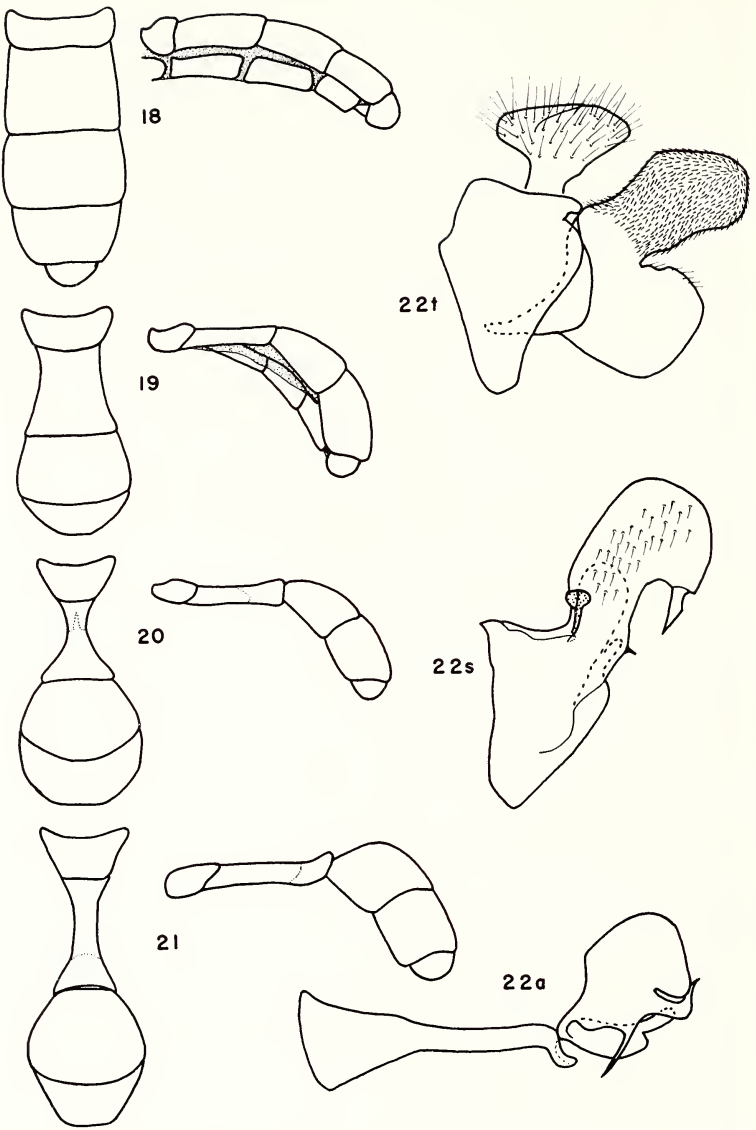
Type locality: Ecuador, Azuay Province, Tarqui, 2800 m. Holotype ♂ CNC.

Head: (fig. 6), face slightly concave below antennae with a strong tubercle above epistoma, dark reddish brown medially, black laterally and beneath antennae, shiny except silvery pollinose band under antennae; cheeks black, shiny, black pilose; front black except dark yellowish red on lower quarter, shiny medially, silvery pollinose laterally and posteriorly, black pilose; frontal lunule yellowish red; vertical triangle black, lightly silvery pollinose, black pilose; occiput black, lightly silvery pollinose, black pilose with a few light brownish gold hairs on upper half. Eyes broadly dichoptic, separated by distance equal that between anterior ocellus and posterior ocelli. Antennae dark brown except lighter at base of third segment; third segment roughly oval, as long as broad, slightly longer below than above; arista dark reddish brown except black at base, about as long as face.

Thorax: dark bluish black except dark reddish on humeri and postalar calli, black pilose except white pilose on proepisterna and on mesokatepisterna between front and middle coxae and light golden brown on anterior part of humeri, dull grayish pollinose except for shiny spots on upper posterior corner of mesoanepisterna and medially to notopleura and dark black and brown pollinose pattern on mesonotum; mesonotal pollinose pattern as figured (fig. 34); scutellum black, grayish pollinose, black pilose except golden subscutellar fringe;

←

11. *telus*, n. sp. (holotype); fig. 12. Enlarged view of base of hind leg of *Sterphus intermedius*, n. sp. (holotype), biased lateral view; figs. 13–17. Wings of *Sterphus*, brown or blackish coloration indicated by large dots, microtrichia indicated by small dots as well as by the large dots; 13. *plagiatus* (Wiedemann), only extent of brownish coloration indicated; 14. *coarctatus* (Wiedemann) (Typic population); 15. *coarctatus* (Wiedemann) (Panama population); 16. *batesi* (Shannon); 17. *fulvus*, n. sp. (holotype). en = trochanteral spur, enlarged view.



FIGS. 18–22. fig. 18–21. Abdomens of *Sterphus* (*Ceriogaster*), dorsal and lateral views; 18. *genuinus* (Williston); 19. *tinctus* (Fluke); 20. *coarctatus* (Wiedemann); 21. *batesi* (Shannon); fig. 22. Male genitalia of *Sterphus batesi* (Shannon), lateral view. t = 9th tergum and associated structures, s = 9th sternum, a = aedeagus and apodeme.

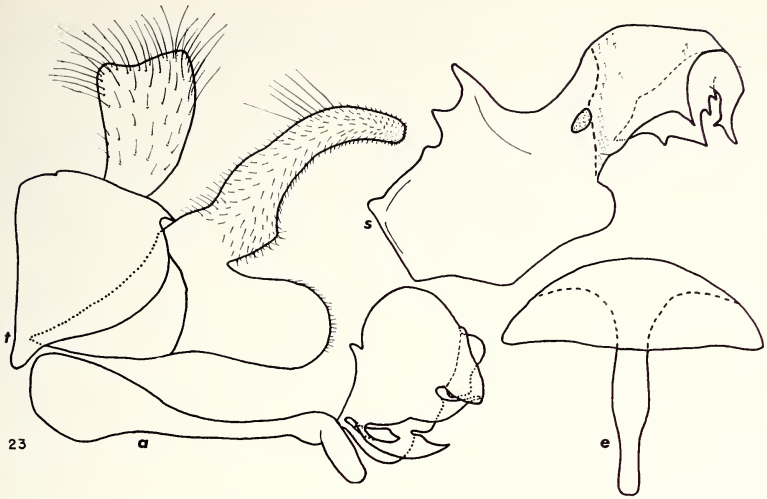
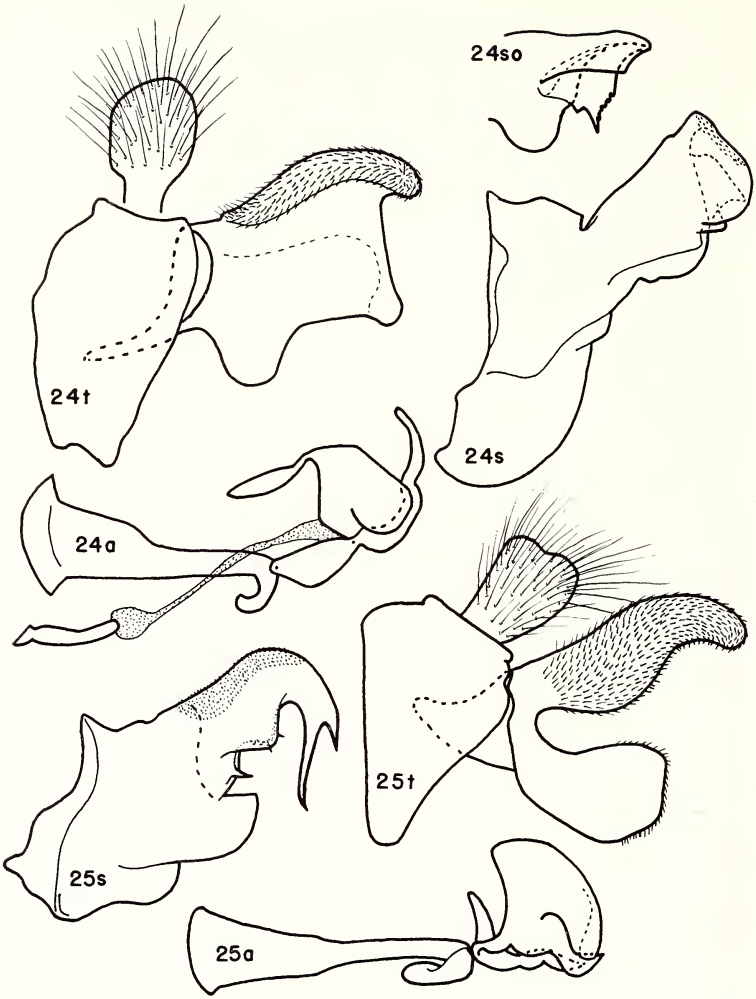


FIG. 23. Male genitalia of *Sterphus coeruleus* (Rondani), lateral view. a = aedeagus and apodeme, e = ejaculatory apodeme, s = 9th sternum, t = 9th tergum and associated structures.

plumulae black; squamae white with black fringe; halters brown with yellow stalk. *Legs*: black except reddish femoral-tibial joints, black pilose except with a few white hairs intermixed on coxae, trochanters and bases of femora. *Wings*: black except for yellowish-orange subapical spot, which extends from wing margin at end of subcosta to just beyond third vein; completely microtrichose.

Abdomen: elongate, slightly broader at apex than base, red except first segment black, black pilose except white pilose on first and basal two-thirds of second segment. *Male genitalia*: (fig. 25), cerci rectangular, rounded dorsally, with slight indentation on dorsal margin. Surstyli: dorsal lobe narrow, elongate, gently arched on dorsal margin, strongly sinuous on ventral margin and slightly turned in medially at apex; ventral lobe elongate, broaden on apical three-fourths and with blunt apical margin. Ninth sternum without dorsolateral opening; lingula short, broad, and tri-lobed medially; superior lobe with dorsoapical margin evenly curved and densely covered with very short pile, with ventroapical portion hook-like and ending in short outer tooth and longer inner tooth, with ventral margin with a number of small teeth and larger single basal tooth, with lateral flap covering all but large basal tooth. Aedeagus with two dorsolateral processes at base; dorsal lobe large, produced posteriorly; lateral lobes elongate, narrow,



FIGS. 24–25. Male genitalia of *Sterphus*, lateral view; 24. *stimulans*, n. sp. (holotype); 25. *telus*, n. sp. (holotype). a = aedeagus and apodeme, s = 9th sternum, so = tip of 9th sternum, ventrolateral view, t = 9th tergum.

broadly tapering to point; ventral lobe flat, long, reaching almost to end of dorsal lobe. Ejaculatory apodeme umbrella shaped.

MATERIAL EXAMINED: ECUADOR, Azuay Prov., Tarqui, 2800 m., 11 Mar. 1965, L. Peña, 1 ♂ (CNC, holotype).

DISCUSSION: *Sterphus telus* is easily distinguished from all other species of *Sterphus* by its bright red abdomen.

Subgenus **Sterphus** Philippi

Head: face bright orange, completely pollinose, slightly to strongly concave above, with either large or small tuberculate swelling below, facial carinae weak; third antennal segment roughly oval, as long as broad; males with holoptic or dichoptic eyes.

Thorax and *abdomen* dark bluish or greenish black, either iridescent or dull; humeri with white pollinose spot on medial margin; scutellum with weakly emarginate rim; metathoracic spiracle either large or small; wings without dark anterior margin, slightly fumose; legs dark, hind legs simple except hind trochanter usually spurred in males, hind femora not enlarged; abdomen elongate oval.

DISCUSSION: *Sterphus* is readily separated from both *Telus* and *Ceriogaster* by its dark coloration and bright orange pollinose face. The facial shape of *Sterphus* with its strong concavity beneath the antennae, is also characteristic.

As suggested above, *Sterphus* may be a symplesiomorphic group. The enlarged metathoracic spiracle of *aurifrons* and *coeruleus*, a synapomorphic character, clearly suggests that these two species form a monophyletic group but *stimulans* does not have an enlarged spiracle. Most of the other character states mentioned in the description must be considered plesiomorphic when compared to those of *Ceriogaster*. However, if the extensively shiny face of *Telus* is accepted as the primitive condition of the face, then the completely pollinose face of *Sterphus* can be used to demonstrate the monophyletic nature of the subgenus. This evaluation of the character states is not unreasonable since most species of *Ceriogaster* have laterally pollinose faces (intermediate condition) and only *batesi* and *chloropygus* have an almost or completely pollinose face. The facial pollinosity of *Ceriogaster* species would support the idea of a trend from the primitive shiny condition to the derived pollinose condition.

coeruleus group

A synapomorphic character state of the *coeruleus* group is the enlarged metathoracic spiracle. The structure of aedeagus is also unique to the group.

Sterphus (Sterphus) coeruleus (Rondani)

Xylota coerulea (Rondani), 1863, p. 8 (also, 1864, p. 8 (1863)). Type locality: Chile. Type ♂ ?

Sterphus coeruleus: Kertész, 1910, p. 308 (cat. citation).—Shannon, 1926, p. 46 (descript. note; distr. recs.).—Porter, 1932, p. 190 (distr. rec.).—Shannon & Aubertin, 1933, p. 156 (distr. recs., fig. head of male, lateral).—Porter, 1937, p. 42 (distr. rec.).—Stuardo, 1946, p. 127 (cat. citation).—Fluke, 1957, p. 107 (cat. citation).—Etcheverry & Shenefelt, 1962, p. 208, figs. 5 (♂ genitalia), 10 (♀ genitalia).—Pino, 1962, p. 51, figs. 12, 13 (heads), 14 (antenna), 15 (mouthparts), 16 (wings), 17 (legs).—Etcheverry, 1963, p. 80 (descript., synonymy, distr. data).—Thompson, 1971, p. 526 (fig., head of male, lateral).

Sterphus autumnalis Philippi, 1865, p. 738, 782. Type locality: Chile, Prov. Valdivia. Types ? MNHN Santiago.

Sterphus antennalis Philippi, 1865, p. 737. Incorrect original spelling of *autumnalis* Philippi (First reviser, Lynch Arribalzaga, 1892, p. 191).

Xylota aurifacies Schiner, 1868, p. 360. Type locality: Chile. Types VMNH. Subsequent references: Kertész, 1910, p. 297 (cat. citation).—Shannon, 1926, p. 50 (questioned generic placement of).—Shannon & Aubertin, 1933, p. 123 (note on status).—Stuardo, 1946, p. 130 (cat. citation).—Fluke, 1957, p. 157 (cat. citation).—Etcheverry, 1963, p. 110 (citation). **New Synonym.**

Head: (fig. 1), face orange, orange pollinose, weakly carinate, slightly concave beneath antennae, slightly swollen below; cheeks orange, shiny, with a few black and white hairs intermixed posteriorly; frontal triangle of male orange, orange pollinose and pilose; front of female shiny orange on lower third, bluish-black and white pollinose on upper two-thirds, black pilose; frontal lunule orange; vertex bluish black, lightly brownish pollinose, black pilose; occiput bluish black, white pollinose, white pilose below becoming intermixed with black pile above. Antennae black, black pilose; third segment roughly oval, as long as broad; arista black, about as long as face.

Thorax: metallic bluish black; pleurae white pollinose, white pilose except black pile intermixed on mesoanepisterna and upper half of mesoanepimera and all black pile on upper posterior corner of mesoanepisterna; mesonotum brown pollinose except for shiny lateral and sublateral stripes and shiny patch in front of scutellum, light brownish yellow and black pilose on anterior half, black pilose posteriorly; scutellum shiny, black pilose except white subscutellar fringe. *Legs*: simple except spur on hind trochanter of male, black, black pilose except white pilose as follows: front and middle coxae, lateral apical patch on hind coxae, about basal half on front and middle femora, basal three-fourths of hind femora, slightly more extensive on posterior than anterior surface of femora, and tips of tibiae. Plumulae brownish, squamae white with black margin and

fringe. Metathoracic spiracle much larger than third antennal segment. Halters black with orange stem. *Wings*: diffusely blackish, completely microtrichose.

Abdomen: metallic bluish, shiny except dull pollinose as follows: basal margin of first tergum, narrowly along basal margin of second tergum medially, apical half of second tergum with narrow medial connecting stripe to basal band, and apical third of third tergum; pile appressed black except long white as follows: on all sterna and first tergum, in lateral triangular patches on basal three-fourth of second tergum with these patches touching medially, and on basal third of lateral margins of third and fourth terga. *Male genitalia*: (fig. 23), cerci rectangular, with shallow indentation on dorsal margin. Surstyli: dorsal lobe narrow, elongate, slightly curved medially at apex, with dorsal margin arched and ventral margin recurved except basal portion straight, with a few long marginal hairs on dorsal edge, elsewhere short pilose; ventral lobe broad, elongate, with rounded apical margin. Ninth sternum with small dorsolateral membranous opening; lingula very short, reduced to small convex lip. Superior lobes with dorsoapical margin angulate, with ventroapical portion hook-like and ending in a long narrow outer tooth and small inner tooth, with two small teeth near base of apical hook-like process, with ventral margin with one small tooth, with large lateral flap extending posteroventrally in form of large tooth. Aedeagus: dorsal lobe large, produced dorsally, with well developed lateral flaps and with medial production between flaps; lateral lobes narrow, tapering into long thin points; ventral lobe with large lateral flaps which extend posteriorly into sharp point. Ejaculatory apodeme umbrella shaped.

MATERIAL EXAMINED: ARGENTINA: Neuquén, San Martin de los Andes, Oct. 1952–Jan. 1953, F. H. Walz, 1 ♀ (FCT). CHILE: 2 ♂ (AMNH); Valparaiso, A. Faz, 1 ♂ (USNM); Valparaiso, E. P. Reed, 1 ♀ (AMNH); Valparaiso, Limache, A. Faz, 1 ♂ (AMNH); Valparaiso, Pichilemis, Jan. 1925, Reed, 1 ♀ (FCT); Arauco, Peral, 1–2 Jan. 1966, Flint & Cekalovic, 1 ♂ (USNM); Malleco, Angol, 4 Feb. 1951, J. Suarlez, 1 ♂ (USNM), 27 Mar. 1930, 1 ♀ (AMNH), 2 Apr. 1951, J. Suarlez, 1 ♂ (USNM), 6 Apr. 1926, 1 ♀ (AMNH), 5 Oct. 1937, Gekwall, 1 ♀ (USNM), 20 Oct. 1946, F. Trina, 1 ♀ (AMNH); Llanquihue, Casa Panque, Dec. 1926, R. & E. Shannon, 1 ♂ (USNM); Chiloe, Castro, 20 Dec. 1926, R. & E. Shannon, 1 ♂, 2 ♀ (USNM); Chiloe, Isla de Chiloe, Ancud, Apr. 1941, P. A. Berry, 1 ♂, 2 ♀ (USNM); Magallanes, Wellington Island, Puerto Eden, 7–15 Dec. 1962, P. J. Darlington, 1 ♀ (MCZ); Magallanes, Magellan Strait, 25 Mar. 1925, 2 ♀ (AMNH). In addition, I briefly

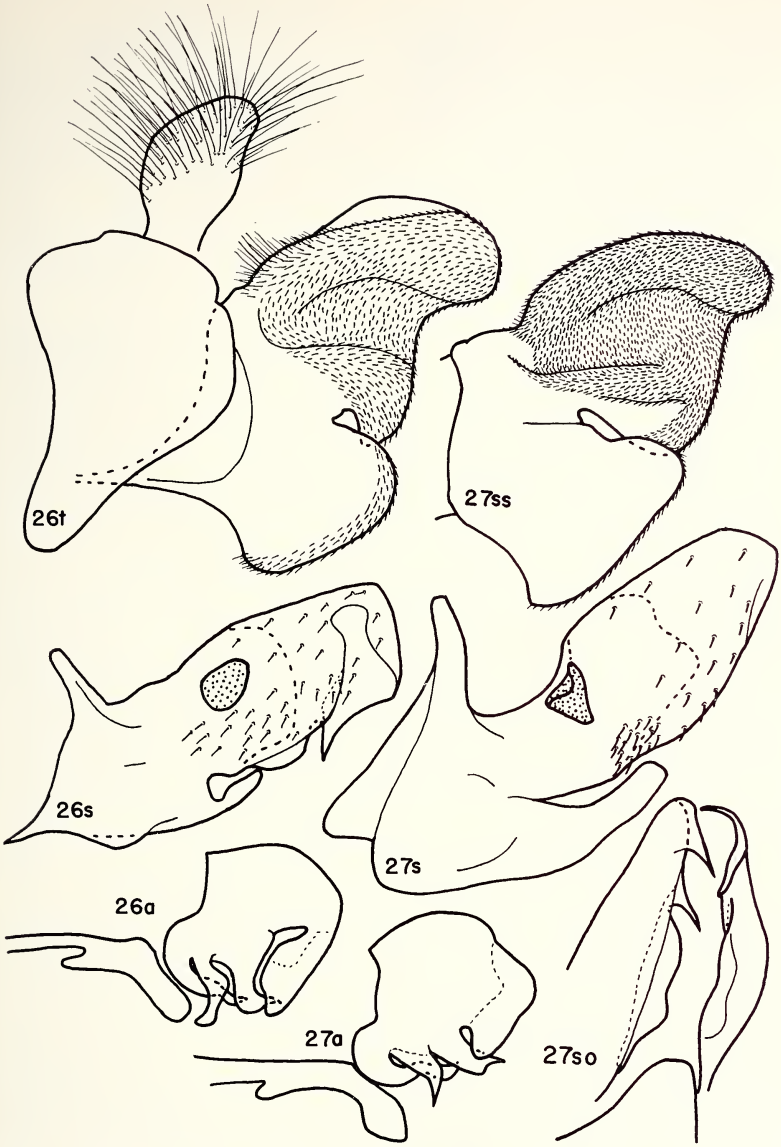
examined 36 ♂ ♀ from Chile, ranging from Santiago to Aysén, in the Canadian National Collection.

DISCUSSION: *S. coeruleus* is readily separated from most syrphids by its shiny metallic blue body color with a bright orange face and front. Both *Philippimyia cyanocephala* and *Stilbosoma rubiceps* are very similar in appearance but can be readily separated by their distinctive generic characters and also, in *S. rubiceps* by the orange vertex, and in *P. cyanocephala* by the metallic blue face. A discussion of the distinguishing characters between *S. coeruleus* and the other species of the subgenus have been included under those species, *aurifrons* and *stimulans*.

The name "*Xylota aurifacies* Bigot" was first published by Schiner in the discussion of the relationships of his new species, *Mallota xylotaeformis* (". . . ich kenne einige exotische Xyloten, wie z. B. *Xylota aurifacies* Big. aus Chile, bei welechen die Cubitalader schon ziemlich stark eingebogen ist, . . ."). This name was never used by Bigot. Since Schiner's citation, the name *aurifacies* has been usually carried in the literature as available, either attributed to Bigot or Schiner but of uncertain applicability (i.e. *nomen dubium*). Vockeroth and I have looked for material of "*Xylota aurifacies*" in the Bigot Collection at both Oxford and the British Museum (Natural History) without finding any. However, among the *S. coeruleus* material in the American Museum of Natural History there is an old specimen labelled "*Xylota aurifacies* Schiner" by Curran.[3] This determined specimen lead me to suspect that there was similarly determined material in the Naturhistorisches Museum Wien where Schiner did his work. Ruth Lichtenberg of that museum informs me that there are two such specimens among the *S. coeruleus* material in their collections, one labelled as "X. aurifacies n. sp. Bigot, Chili, Schiner 1869" and the other as "aurifacies B. Alte Sammlung, Philippi Chili 1870." Schiner's statement was probably based on the first of these two specimens and thus that specimen should be considered as the type of *aurifacies*. Until a careful examination of all the *S. coeruleus* material in the Naturhistorisches Museum Wien is made to ascertain which specimens could have been available to Schiner at that time, I hesitate labelling this specimen as either the type or lectotype. There is no question that the name *aurifacies* must now be synonymized under *coeruleus*.

---

[3] During the 1920's Curran acquired (? through exchange with Hans Zerny?) an extensive collection of syrphid material from the Naturhistorisches Museum Wien. Thus the American Museum has cotypes and other authenticated specimens of many of Wiedemann's and Schiner's species.



FIGS. 26–27. Male genitalia of *Sterphus*, lateral view except so; 26. *woodorum*, n. sp. (holotype); 27. *intermedius*, n. sp. (holotype). a = aedeagus and base of apodeme, s = 9th sternum, so = tip of 9th sternum from ventral view with slight lateral bias, ss = surstyle, t = 9th tergum and associated structures.

Sterphus (Sterphus) aurifrons Shannon

Sterphus aurifrons Shannon, 1926, p. 46. Type locality: Chile, Juan Fernandez Islands (see below). Type ♂ BM(NH), Subsequent References: Shannon & Aubertin, 1933, p. 156 (descript. note, distr. data).—Stuardo, 1946, p. 127 (cat. citation).—Fluke, 1955, p. 42 (descript. ♀, distr. recs.).—Fluke, 1957, p. 107 (cat. citation).—Etcheverry, 1963, p. 79 (descript., synonymy, distr. data).

MATERIAL EXAMINED: CHILE: Juan Fernandez Islands, Masatierra, Plazoleta del Yunque, 12 February 1951, P. J. Kuschel, 1 ♂ (AMNH).

DISCUSSION: *S. aurifrons* is very similar to *coeruleus* in all respects except as follows: 1) the thoracic pile is completely reddish-brown instead of a mixture of black and white; 2) the mesonotum is completely reddish-brown pollinose with pollinosity completely obscuring the ground color instead of lightly brownish pollinose with a pair of submedial and sublateral shiny vittae and pollinosity not obscuring the bluish-black ground color; 3) the abdominal pile is brownish yellow and black instead of white and black; 4) the abdomen has a more greenish metallic lustre instead of steel blue lustre; 5) the dorsal lobe of surstyle (fig. 30ss) is more evenly curved on the ventral margin, not strongly angulate near the base; 6) the ventral lobe of the surstyle (fig. 30ss) has a slight ventroapical notch, not evenly rounded; and 7) the dentation of the superior lobe (fig. 30s) is quite different, the apical hook-like process is much broader with the inner tooth greatly reduced, the two small teeth at the base of the hook-like process are absent and the lateral flap is not as strongly produced.

The type locality of *S. aurifrons* was given by Shannon as "Chile (J. Fernz)," and later in *Diptera of Patagonia and South Chile* (Shannon and Aubertin, 1933) it was stated that "precise locality unrecorded." However, the only known material of the species besides the holotype was collected on Juan Fernandez Islands (Fluke 1955) and this strongly suggests that Shannon confused a contraction of Juan *Fern*andez for a collector's name. Since there is no indication on the locality label of the type that "J. Fernz" is either a location or collector it should be assumed to be a locality and that the type locality of *Sterphus aurifrons* be restricted to the Juan Fernandez Islands, where the species is known to exist.

stimulans group

Some of the apomorphic character states of *stimulans*, the only species in the *stimulans* group, that may be of use in defining the

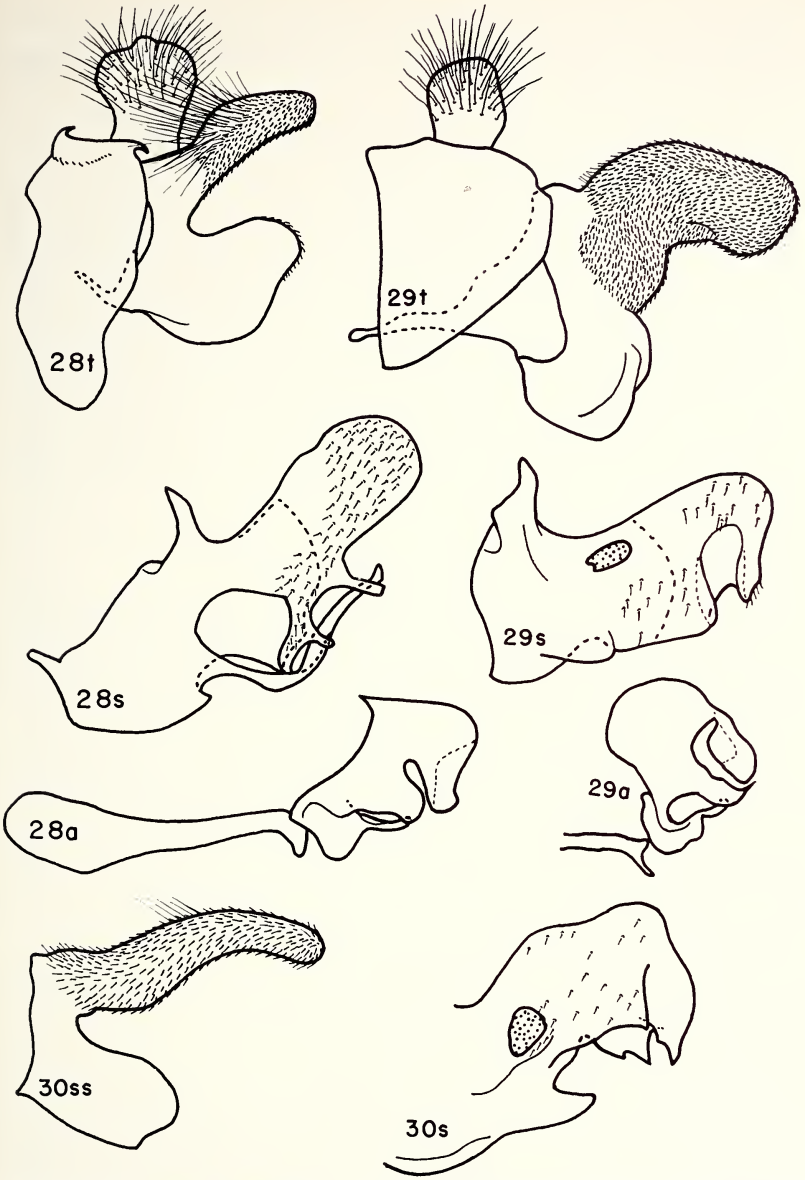


FIG. 28–30. Male genitalia of *Sterphus*, lateral view; 28. *shannoni* Thompson, n. sp. (paratype), 29. *tinctus* (Fluke), 30. *aurifrons* Shannon. a = aedeagus and apodeme, s = 9th sternum, ss = surstyle, t = 9th tergum and associated structures.

group, are: 1) the loss of the ventral lobe of the surstyle; 2) the lack of lateral lobes on the aedeagus; and 3) the elongate and bifid ventral lobe of the aedeagus.

Sterphus (Sterphus) stimulans, new species

Type locality: Bolivia, Chipiriri. Holotype ♂ CNC.

Head: (fig. 7), face orange, golden pollinose, deeply concave beneath antennae, with distinct but low tubercle below; cheeks black, shiny on anterior two-thirds, silvery pollinose on posterior third, white pilose; frontal lunule black; frontal and vertical triangle black, brownish black pollinose, black pilose; occiput black, silvery pollinose and white pilose on lower half, brownish black pollinose and black pilose on upper half. Eyes dichoptic in male, separated by distance equal to that between anterior ocellus and posterior ocelli; antennae black, black pilose; third segment roughly oval, as long as broad; arista black, much longer than face.

Thorax: bluish black, completely dull pollinose, pleurae with pile same as in *coeruleus*; mesonotum black pilose except for a few light hairs on anterior margin and notopleurae; scutellum dull pollinose, black pilose except white subscutellar fringe; halters black; squamae white with black margin and fringe; plumulae light brown. *Legs*: black, simple, without spur on trochanters or tibiae, with pile same as in *coeruleus* except all white pile on hind coxae. *Wings*: diffusely light black, completely microtrichose.

Abdomen: bluish black, dull pollinose except shiny narrowly on lateral margins of terga; mostly yellow pilose, longer on sterna and lateral margins of terga, black pilose on third and fourth terga except broad basal triangular corner patches of yellow pile. *Male genitalia*: (fig. 24), cerci rectangular, with dorsal margin rounded; surstyli broad, about as broad as long, with narrow curved dorsal ridge (= dorsal lobe), with large ventral extension (= ventral lobe) beneath this ridge, with margins of ventral extension straight except for basoventral and posteroventral lobes; ninth sternum without dorsolateral opening; lingula absent; superior lobe with dorsoapical margin angulate, very short pilose narrowly along apical margin, with two lateral flaps, with outer flap with evenly curved margin and inner flap with serrate ventral edge; aedeagus with dorsal lobe produced posteriorly and with long anterior process, with lateral lobes absent, with ventral lobe greatly elongate and bifid; ejaculatory apodeme rod-shaped.

MATERIAL EXAMINED: BOLIVIA: Chipiriri, Sept. 1962, T. Steinbach, 1 ♂ (holotype, CNC).

DISCUSSION: *S. stimulans*, with its orange face, simple legs, and bluish-black coloration, is quite distinct from all other species of *Sterphus* except *coeruleus* and *aurifrons*. *S. stimulans* can be contrasted with *coeruleus* and *aurifrons* as follows: 1) the cheeks and lower front (all of frontal triangle in male) is black, not orange; 2) the face is strongly concave above, not slightly concave (fig. 7); 3) the frontal pile in the male is black, not orange; 4) the frontal lunule is black, not orange; 5) the metathoracic spiracle is much smaller than the third antennal segment, not much larger; 6) the metathoracic spiracle has a black fringe, not a white fringe; 7) the lateral margins of the abdomen has a long golden pile, not an alternatively mainly black and white pile; and 8) the hind coxae are completely white pilose, not mainly black pilose (*coeruleus*) or golden (*aurifrons*).

S. stimulans also differs from *coeruleus* in that the scutellum is dull pollinose, not shiny and the mesonotum is completely dull pollinose, not with shiny longitudinal stripes. It differs from *aurifrons* in that its mesonotum is black pilose not tawny brown pilose.

Subgenus **Ceriogaster** Williston

Ceriogaster Williston, 1888, p. 285. Type species, *fascithorax* Williston (monotypy). Subsequent references: Kertész, 1910, p. 308 (cat. citation).—Shannon, 1926, p. 50 (note on relationship to *Tatuomyia*).—Curran, 1934, p. 405 (notes, synonymy of *Zonemyia*).—Hull, 1949, p. 367 (descript.).— Fluke, 1957, p. 104 (cat. citation). **New status.**

Zonemyia Shannon, 1925, p. 109. Type species, *spinosa* Shannon (original designation). Subsequent references: Shannon, 1927, p. 4 (key ref.).—Shannon, 1928, p. 573 (relationship of *Lepidostola* to genus).—Shannon & Aubertin, 1933, p. 139 (key ref.).

Crepidomyia Shannon, 1926, p. 47. Type species, *tricrepis* Shannon (original designation). Subsequent references: Curran, 1934, p. 404 (note).—Hull, 1949, p. 368 (descript.).—Fluke, 1957, p. 105 (cat. citation).—Thompson, 1971, p. 524 (synonymy).

Tatuomyia Shannon, 1926, p. 48. Type species, *batesi* Shannon (original designation). Subsequent references: Hull, 1949, p. 367 (descript.).—Fluke, 1957, p. 105 (cat. citation, synonymy of *Senoceria*).

Senoceria Hull, 1930, p. 144. Type species, *spinifemorata* Hull (original designation) = *coarctatus* Wiedemann. Subsequent reference: Hull, 1949, p. 367 (descript., as subgenus of *Tatuomyia*).

Mutillimyia Hull, 1943, p. 139. Type species, *Ceriogaster auricaudata* Williston (original designation). Subsequent references: Hull, 1949, p. 372 (descript.).—Fluke, 1957, p. 109 (cat. citation).

Willistonomyia Hull, 1943, p. 140. Incorrect original spelling of *Mutillimyia*.

Head: face usually black, orange in *cybele* and partially orange in *incertus*, usually with strongly developed facial carinae, carinae weak in *incertus* and *chloropygus* group, usually straight and without tubercle, weakly tuberculate only in *incertus* and with epistoma produced only in *auricaudatus*, usually pollinose laterally and shiny medially, completely pollinose only in *cybele* and *chloropygus*; third antennal segment usually elongate, usually 1½ times or more as long as broad, *chloropygus* group (and probably *incertus*) with oval third segments; eyes of male holoptic or narrowly dichoptic in *fascithorax* group.

Thorax: black or brownish black, usually dull pollinose, frequently with yellow pollinose markings, only shiny in *batesi* and *incertus*; metathoracic spiracle either large or small; scutellum with or without apical emarginate rim; wings frequently with dark anterior margins, otherwise hyaline except *plagiatus* with diagonal brown stripe. *Legs*: frequently with hind femora enlarged, with or without trochanteral or tibial spurs.

Abdomen: ranging from parallel sided to strongly petiolate.

DISCUSSION: The subgenus *Ceriogaster* can be divided into two sets of species groups: those groups with weakly carinate faces and oval third antennal segments, and those with strongly carinate faces and elongate third antennal segments. The first division, a symplesiomorphous grouping, includes only the *incertus*, *auricaudatus* and *chloropygus* groups; whereas all the other groups fall into the second division. The groups of the first division can be easily separated by their facial shape, and the groups of the second division by abdominal shape (figs. 18–21). Other differences between these species groups are listed in the following Table.

TABLE II

Character table for the species groups of *Sterphus* (*Ceriogaster*)

	Character states											
Species groups	1	2	3	4a	4b	4c	5	6	7	8	9	10
incertus	–	?	–	–	–	–	?	–	0	?	–	–
auricaudatus	–	–	+	–	–	+	–	–	0	+	–	–
chloropygus	–	–	–	–	–	–	+	+	0	+	–	–
cybele	–	–	–	–	–	–	?	–	2	?	–	+
plagiatus	–	+	–	–	–	–	+	+	0–2	–	+	+
fascithorax	+	+	–	–	–	+	–	+	0	–	+	+
tinctus	+	+	+	–	–	+	–	–	0	–	+	+
coarctatus	+	+	+	–	+	+	+	+	1	–	+	+
batesi	+	+	+	+	+	+	–	?	2	+	–	+

TABLE II (continued)

List of species group characters

1) Cheeks linear, about four times as long as broad (+); about twice as long as broad (–).
2) Third antennal segment elongate, usually two times as long as broad (+); oval, about as long as broad (–).
3) Wing with dark anterior margin (+); without dark anterior margin (–).
4) a) Abdomen strongly petiolate, with long petiole (+); not so (–).
   b) Abdomen strongly petiolate, with long or short petiole (+); not so (–).
   c) Abdomen slightly (or strongly petiolate) (+); not so (–).
5) Males with spurs on hind trochanter (+); unspurred (–).
6) Hind femora enlarged (+); simple (–).
7) Hind tibiae with spurs, one (1), two (2), or none (0).
8) Male frontal triangle shiny (+); or golden pollinose (–).
9) Mesonotum with golden pollinose markings (+); without (–).
10) Face with strong facial carinae (+); not so (–).

incertus group

The *incertus* group can be easily separated from all other species groups by its partially orange and slightly tuberculate face. Other diagnostic characters for the group have been listed in Table II.

Sterphus (Ceriogaster) incertus, new species

Type locality: Venezuela, La Negra, Paramo. Holotype ♀ MZUSP

Head: (fig. 2), face black medially, orange laterally, light yellowish pollinose on orange areas, shiny on black areas, slightly concave beneath antennae, with slight tuberculate swelling above epistoma; cheeks black, shiny, light pollinose posteriorly, yellow pilose posteriorly; frontal lunule yellow; front black, shiny and bare on lower half, brownish pollinose on upper half, golden brown pilose on upper half with a few black hairs intermixed; vertex black, lightly brownish pollinose, black pilose; occiput black, silvery pollinose, yellow pilose below becoming darker above. Antennae with first two segments reddish orange, with black pile; third segment missing.

Thorax: black except reddish brown postalar calli; pleurae silvery pollinose, yellow pilose except black pilose on upper posterior corner of anepisterna; mesonotum shiny except brownish pollinose narrowly on sides and across front edge between humeri and with medial posteriorly directed spur of pollinosity, reddish brown pilose. Scutellum shiny black, with reddish brown pilose with a few longer black hairs intermixed, with subscutellar fringe yellow. Squamae

dirty white, with dark brown fringe; plumulae and halters brownish orange. *Legs*: black except orange tibiae and basal two tarsal segments, yellow pilose except black pilose on apical third of femora and medial third of tibiae and apical four tarsal segments. *Wings*: pale yellowish brown, completely microtrichose.

Abdomen: black, greenish bronze pollinose except shiny lateral margins and fifth segment. Pile long and erect yellow on sterna, lateral margins of all terga, all first tergum, second and third terga except for posterio-medial triangular patch of appressed black pile, and narrowly on anterior margins of fourth and fifth terga; short appressed black pilose on second and third terga in form of posterio-medial triangular patch on posterior half and three-fourths respectively of second and third terga, and all fourth and fifth terga except yellow pilose on lateral and anterior margins.

MATERIAL EXAMINED: VENEZUELA: La Negra, Paramo, August 1948, Lichy, 1 ♀ (holotype, MZUSP).

DISCUSSION: *S. incertus* differs from the typical species of the subgenus *Ceriogaster* in that its: 1) face is orange laterally; 2) face is slightly concave beneath the antennae and has a distinct tuberculate swelling above the epistoma; 3) transverse sutures are shiny; and 4) tibiae and apical two tarsal segments are orange. *S. incertus* is represented by a single female which has the third antennal segments missing and for these reasons I have named this species, *incertus*.

auricaudatus group

The *auricaudatus* group is readily distinguished from all other species groups by its anteriorly produced epistoma. Other diagnostic characters for the group have been listed in Table II.

Sterphus (Ceriogaster) auricaudatus (Williston)

Ceriogaster auricaudata Williston, 1892, p. 73, pl. 2, figs. 10 (habitus), 10a (head). Type locality: Mexico, Guerrero, Omiltemi, 8000 ft. Types ♂ ♀ BM (NH). Subsequent references: Kertész, 1910, p. 308 (cat. citation).—Shannon, 1926, p. 50 (note on placement in Temnostomini).—Curran, 1934, p. 405 (note, key ref.).

Mutillimyia auricaudata: Hull, 1943, pp. 137, 140 (described as mutillid mimic).—Fluke, 1957, p. 109 (cat. citation).

Head: face black except for orange spot on either side of epistoma, shiny medially, yellowish-white pollinose laterally; cheeks shiny black, with some yellow pile posteriorly; front black except for small narrow yellow triangle above antennal bases, shiny about antennal bases, elsewhere yellowish-white pollinose, yellow pilose;

vertex black, yellow pilose; occiput black, white pollinose, yellow pilose. Antennae reddish brown, about three-fourths as long as face; third segment quadrate, slightly longer than wide, about as long as first two segments; arista yellow, slightly longer than antenna.

Thorax: black, light pollinose, silvery pollinose on pleurae, brownish pollinose on mesonotum except velvety black pollinose on transverse suture, short yellow pilose except longer golden pilose in front of postalar calli; scutellum black, lightly brownish pollinose, white pilose. *Legs*: white pilose, coxae and femora blackish except yellowish apically on all femora and also basally on hind femora; tibiae and tarsi dark reddish brown; hind femora with double row of ventroapical short yellow spines. Halters brownish yellow with dark head. Squamae dirty white with brown fringe. Plumulae brownish. *Wings*: brownish anteriorly and hyaline posteriorly, microtrichose except bare anterior quarter of anal cell. Brown extends back to anal and discal cell basad to anterior crossvein, beyond anterior crossvein brown area bordering on spurious vein and extending diagonally from tip of spurious vein to apical corner of first posterior cell (also see Williston's figure for exact extent of brownish anterior margin of wings).

Abdomen: petiolate, minimal width about one-third maximal width; first tergum opaque velvety black except shiny on sides; second tergum opaque velvety black except two large lateral shiny metallic triangles on petiole, with triangles connected medially; remainder of terga black, lightly whitish-yellow pollinose; pile of dorsum short yellow except thick, opaque golden on apical margin of first, second, and third terga, and all fourth and fifth terga. Venter black, with short appressed white pile except black medially on third and fourth and all of fifth sterna.

MATERIAL EXAMINED: MEXICO: Guerrero, Omiltemi, 8000 ft., 1 ♀ 1 ♂ (cotypes, BM(NH)).

DISCUSSION: *S. auricaudatus* is readily separated from all other species of *Sterphus* by its anteriorly produced epistoma. In appearance it is similar to *S. tinctus* (Fluke) but it is easily distinguished by the characters given in the key. The female cotype was figured in color in the original publication. However, a few discrepancies between the female cotype and figure should be noted: 1) the epistoma is produced more in the type; 2) the antennae are longer than shown, reaching almost to the epistoma; 3) too much yellow is shown on front, there is only a small narrow triangle of yellow extending back from the frontal lunule; and 5) the color on the tips of the femora is not reddish but yellowish.

chloropygus group

Sterphus chloropygus, *woodorum* and *intermedius* are very closely related, being separated from all other species of *Sterphus* by the structure of their hind tibiae, scutellum and male genitalia. The hind tibia (fig. 10) of the males, with its subbasal medial keel and apical keel-like spur, is unique among syrphids. In the females these structures are less pronounced, the apical spur does not have the keel-like basal portion and the subbasal medial keel is much lower. All the members of *chloropygus* group have a distinct apical emarginate rim on the scutellum, this rim being absent or very weak and indistinct in all other species of *Sterphus*. The surstylus with its large ventral extension to the dorsal lobe is also distinctive among *Sterphus* species. Thus, the *chloropygus* group is clearly monophyletic.

Sterphus (Ceriogaster) chloropygus (Schiner)

Xylota chloropyga Schiner, 1868, p. 366. Type locality: "Columbien" (= Venezuela). Lectotype ♂ VMNH. Kertész, 1910, p. 298 (cat. citation).—Shannon, 1926, p. 50 (questioned generic placement).—Fluke, 1957, p. 157 (cat. citation).

Male.—*Head*: black; face straight, slightly convex about epistoma, completely silvery gold pollinose; cheeks shiny, with a few yellow hairs posteriorly; frontal triangle silvery gold pollinose, with some black hairs at junction of eyes; frontal lunule reddish brown; vertical triangle dull black, black pilose; occiput light silvery pollinose, thickly yellow pilose below and sparsely black pilose on upper quarter. Antennae black, short, about three-fourths as long as face; third segment trapezoidal, ventral margin slightly longer than dorsal; arista black, about 1½ times as long as face.

Thorax: black, dull brownish pollinose (there appears to be a trace of a pair of faint, medial, light brownish, pollinose vittae as in *intermedius*), black pilose except yellow pilose on propleurae; metathoracic spiracle distinctly larger than third antennal segment, with white fringe; scutellum with emarginate rim, shiny bluish black, black pilose including subscutellar fringe; squamae brownish with brown margin and fringe; plumulae yellow. *Wings*: brownish, completely microtrichose. *Legs*: black except reddish brown basal two tarsal segments of anterior legs and only first tarsal segment of hind leg, black pilose; hind trochanter with long flatten spur; hind femora only slightly enlarged; hind tibiae with ventral keel on basal third and long apical keel-like spur.

Abdomen: orange, except brownish black first tergum and medially on second, third and basal half of fourth terga, long yellow

pilose except shorter black pilose on dark areas of first thru third terga, shiny except dull on first thru third terga.

Female.—Quite similar to male except for normal sexual dimorphism and front shiny except for silvery pollinose spot on eye margin half way between antennae and vertex, black pilose on upper half; mesonotum with a few scattered golden hairs intermixed with black pile; tarsi much darker and hind tarsi all black; abdomen much darker, sterna dark reddish brown, terga mostly dull black, shiny bronze on lateral margin of second, third and all of fourth terga, with yellow pile on sterna and lateral margins of second, third, and all of fourth terga, rest black pilose.

MATERIAL EXAMINED: VENEZUELA: 1864, Lindig, 1 ♂ 1 ♀ (cotypes of *chloropygus*, VMNH).

DISCUSSION: *S. chloropygus* is readily distinguished from both *woodorum* and *intermedius* by its completely pollinose face, black pilose legs and mesothorax. I have examined the types of *chloropygus* Schiner, both of which are labelled "Lindig, 1864, Venezuela," "*chloropygus*, Alte Sammlung." The male is hereby designated lectoype and has been so labelled. The type locality is thereby restricted to Venezuela. Schiner in his part of "*Reise der österreichischen Fregatte Novara*" described a number of species as "*aus Columbien*" and types of all the syrphids so described have been found to be Lindig material from Venezuela as are the *chloropygus* cotypes. Thus, it is apparent that Schiner's "*Columbien*" included Venezuela.

Sterphus (Ceriogaster) woodorum, new species

Type locality: Venezuela, Distrito Federal, Parque Nacional Avila, 2000 m. Holotype ♂ CNC.

Head: black; face straight, shiny medially, silvery-white pollinose laterally, bare; cheeks shiny, white pilose; frontal triangle of male shiny except very narrowly silvery white pollinose along eye margins, with a few black hairs at junction of eyes; frontal lunule brownish black; front of female shiny on lower half, silvery-white pollinose and black pilose on upper half; vertex sparsely silvery pollinose anteriorly and bronze pollinose posteriorly, black pilose; occiput white pollinose and pilose below becoming bronze pollinose and black pilose on upper third. Antennae short, about two-thirds as long as face, black pilose; third segment trapezoidal, dorsal edge about half as long as ventral; arista yellow, about twice as long as antenna.

Thorax: black, mainly bronze pollinose, predominately yellowish silver pilose with some black pile intermixed on all sclerites except on

mesokatepisterna, with disc of mesonotum completely short black pilose in female; mesonotum with distinct pair of light brownish pollinose, medial vittae and a pair of indistinct, grayish pollinose, sublateral vittae behind suture; pile on margins of mesonotum and scutellum thicker, opaque and brighter in color; scutellum with distinct apical emarginate rim, with thick white ventral fringe, without apical spines, with intermixed black pile much longer than light colored pile; mesonotum without black spine-like pile above wing bases; metathoracic spiracle distinctly larger than third antennal segment; halters orange; plumulae orange; squamae light orange with upper margin dark brown and lower margin orange, with fringe orange. *Wings*: light brownish, completely microtrichose. *Legs*: black and dull pollinose except hind femora shiny bronze to bluish black, reddish brown femoral-tibial joints and basal segment of middle and hind tarsi; white pilose except black pilose in male as follows: apical posterior third and ventral margin of front femora, apical posterior tip and ventral margin of middle femora, apical half of hind femora, intermixed on middle and hind coxae, medial posterior third of front tibiae, ventral and posterior surface of middle tibiae, all of hind tibiae, apical four tarsal segments of all legs; legs more extensively white pilose in female; hind trochanter with short sharp papilla in male, papilla reduced in female; hind femora greatly swollen, with large tuberculate swelling on basal third of inner side of male; hind tibiae with ventral keel on basal third and long apical keel-like spur in males, these structures reduced in female but still quite distinct.

Abdomen: shiny bronze except dull pollinose medially on second and third terga in males and first thru third in females, long bronze-yellow pile on shiny areas and appressed black on dull areas. *Male genitalia*: (Fig. 26), cerci elongate, produced posterodorsally. Surstyli: dorsal lobe very broad, broader than long, with curved dorsal and ventral ridges, with slight mediodorsal projection, with a few longer hairs on anterodorsal edge, with ventroapical edge angulate and extending slightly beneath ventral lobe; cleft between dorsal and ventral lobes short and broad; ventral lobe short, broad, broader than long, with fairly extensive marginal pile, with broadly rounded apical margin. Ninth sternum with dorsolateral membranous opening; lingula short, broadly triangular, with apex blunt; superior lobe sparsely pilose, with dorsoapical margin angulate, with large lateral excavation extending dorsally from ventral margin, with single large tooth on ventral margin. Aedeagus: dorsal lobe produced posteriorly, with large lateral flaps; large, long cleft between dorsal and lateral lobes; lateral lobes divided into basal and medial processes, with basal

process directed ventrally and with blunt apex, with medial process curved posteriorly and with pointed apex. Ejaculatory apodeme rod-shaped, with anterior end slightly expanded.

MATERIAL EXAMINED: VENEZUELA: D. F., Parque Nac. Avila, 2000 m, 28 Feb. 1971, G & M Wood, 1 ♂ (holotype), 1 ♀ (allotype) (CNC).

DISCUSSION: The species is named after its collectors, Dr. Monty Wood, of the Canada Department of Agriculture, and his wife. *S. woodorum* differs from the other species of the *chloropygus* group in that: 1) the arista is yellowish orange, not black; 2) the frontal triangle of the male is shiny, not golden pollinose; and 3) the lateral margins of the mesonotum are silvery golden pilose.

Sterphus (Ceriogaster) intermedius, new species

Type locality: Bolivia, Cochabamba, Chapare, Limbo, 2200 m. Holotype ♂ MZUSP

Head: (fig. 5), black; face straight beneath antennae, slightly convex above epistoma, shiny except broadly silvery pollinose on sides; cheeks shiny, with a few light yellowish hairs posteriorly; frontal triangle light golden pollinose with two black hairs on each side near eye contiguity; frontal lunule orange; vertical triangle light pollinose, black pilose; occiput silvery pollinose, light yellow pilose except with black pile intermixed on upper part. Antennae black, short, slightly more than half as long as face; third segment trapezoidal, ventral margin about twice as long as dorsal; arista black, about as long as face.

Thorax: black, brownish pollinose except for faint pair of medial light brownish pollinose vitta on mesonotum; pile yellow and black intermixed, except all black pilose on dorsal posterior corner of mesoanepisterna, above wings and on postalar calli; metathoracic spiracle slightly larger than third antennal segment, with white fringe; scutellum with emarginate rim, black with metallic luster, black and yellow pilose, with yellow ventral fringe; halters orange; squamae light brownish orange, with dark brown margin and fringe; plumulae orange. *Legs*: black, yellow pilose except black pilose as follows: apical posterior tip of front femora, apical third of middle femora, apical half of hind femora, both middle and hind tibiae, apical four of front and middle tarsal segments and all hind tarsal segments; hind femora only slightly enlarged; hind trochanter (fig. 12) with short curved bilobed spur; hind tibiae (fig. 10) with large apical spur and ventral keel on basal third. *Wings*: light brownish, completely microtrichose.

Abdomen: elongate, parallel-sided, metallic bluish black, shiny

except for dark brown pollinose bands on apical half of second and third terga, with pollinose bands not reaching lateral margins and bands of second terga with narrow medial projection reaching to anterior margin; pile long, erect yellow except appressed black on pollinose areas. *Male genitalia*: (fig. 27), quite similar to *woodorum* except as follows: 1) dorsal lobe of surstyli without mediodorsal projection; 2) cleft between the dorsal and ventral lobes much longer; 3) posteroventral edge of dorsal lobe of surstyli rounded, not angulate; 4) ventral lobe of surstyli larger and produced more into a posterodorsal lobe; 5) dorsolateral membranous opening on ninth sternum triangularly shaped, not round; 6) lingula longer and with apex rounded; 7) superior lobe without lateral excavation; 8) superior lobe with two large ventral teeth which are hidden in lateral view; 9) dorsoapical margin of superior lobes more rounded, not angulate; 10) superior lobe with pile sparse except for dense patch near basoventral corner; 11) basolateral process of aedeagus ending in sharp point, not blunt point; 12) cleft between lateral and dorsal lobes of aedeagus very short; and 13) ejaculatory apodeme umbrella-shaped.

MATERIAL EXAMINED: BOLIVIA: Cochabamba, Chapare, Limbo, 2200 m, November 1953, Martínez, 1 ♂ (Holotype, MZUSP); Cochabamba, October 1965, Steinbach, 1 ♂ (paratype, CNC).

DISCUSSION: The name *intermedius*, is an adjective from latin, alluding to the position of the species and its group in the phylogeny of *Sterphus*.

S. intermedius is distinguished from the other species of the *chloropygus* group in that: 1) it lacks the abundant semiopaque golden pile on the tip of the abdomen; 2) the tarsi are all black; and 3) the male hind trochanter has a bilobed process. Also, the second tergum has two large shiny spots and the third tergum has a broad basal shiny band whereas both *woodorum* and *chloropygus* have only the lateral margins of these terga shiny.

cybele group

The *cybele* group can be easily separated from all other species groups by its pilose metasterna. Other diagnostic characters for the group have been listed in Table II.

Sterphus (Ceriogaster) cybele (Hull)

Crepidomyia cybele Hull, 1951, p. 184. Type locality: Peru, Chanchamayo. Type ♀ Hull. Subsequent reference: Fluke, 1957, p. 106 (cat. citation).

Head: face bright yellowish orange, yellow pilose, golden pollinose, without medial shiny stripe; cheeks black, shiny, yellow pilose; front black, shiny except brownish golden pollinose across middle, yellow pilose; vertex shiny black, black pilose; occiput black, yellowish pollinose, brassy yellow pilose throughout. Antennae brownish black, third segment roughly oval, about as long as broad, about as large as metathoracic spiracle.

Thorax: black, mesonotum with broad, medial, posteriorly furcate, faint, reddish pollinose vitta and still more faint similar ones sublaterally; lateral margins of mesonotum and medial vitta on anterior half with appressed, opaque, brassy yellow pilose; pleural and scutellar pile brassy yellow; remainder of mesonotum with short black pile, without short black bristle-like hair above wings; scutellum with distinct apical emarginate rim, subscutellar fringe thick, brassy yellow; metasterna with long distinct pile; squamae and halters pale orange. *Legs*: Anterior legs orange except brownish orange coxae and trochanters, with similarly colored pile; hind coxae black; hind trochanter reddish brown; hind femora yellowish brown basally, becoming reddish through middle, still darker at apices, golden pilose except black pilose on apical quarter, with nine black ventral spines; hind tibiae nearly blackish, but actually dark reddish sepia, with black pile except for short streak of golden hair basolaterally and medioapically, with two stout, short spinous apical processes; hind tarsi yellowish brown. *Wings*: almost uniformly pale yellowish brown with costal cells and first basal cell light yellow with pterostigma deep yellow except apically; microtrichose except very narrowly bare behind Ax.

Abdomen: dorsum black except slightly reddish on medial sides of second and third terga, dull medially on second thru fourth terga, shiny with brassy yellow to purplish iridescence on all first tergum and laterally on second thru fourth terga, with shiny laterally areas in form of medially pointed triangles; with appressed short black pile on dull areas and long erect golden pile on shiny areas; venter white pilose, with first sternum reddish brown, with second and basal three-fourths of third sterna orange, with apical quarter of third and all of fourth and fifth sterna black.

MATERIAL EXAMINED: PERU: Chanchamayo, 20 Jan. 1949, J. Schunke, 1 ♀ (holotype, Hull). COLOMBIA: Cundinamarca, Monterredondo, 19 Jan. 1957, 1 ♀ (Cornell University).

DISCUSSION: *S. cybele* appears to be a typical member of the subgenus *Ceriogaster* except that the metasterna are pilose and the face is yellowish orange in ground color. The first character state is

unique in *Sterphus* (usually considered as a primitive state in other syrphids) but the second character state is found in the two primitive subgenera, *Telus* and *Sterphus*. The question of whether *cybele* represents a case of the retention of some primitive traits in a otherwise highly derived fly or convergence in those derived character states, cannot be decided without the study of additional characters, such as those of the male genitalia. Until this question is answered, I have taken the most parsimonious alternative and have tentatively included *cybele* in *Sterphus* (*Ceriogaster*).

plagiatus and *fascithorax* groups

The transverse pollinose markings on the mesonotum of these groups are unique among the taxa of the *Xylota* group of genera as well as of the tribe Milesini (see Thompson, 1972). The similar pollinose markings in *Temnostoma* (*Temnostoma* group) are quite different and many other characters strongly support my groupings and thereby the contention that this is a convergent character state in *Temnostoma*. Thus the possession of transverse pollinose mesonotal markings in both the *fascithorax* and *plagiatus* groups is synapomorphy and demonstrates the monophyly of this combined grouping.

The character states previously used to separate the *fascithorax* group as a genus are only specialized states easily derived from those of a *plagiatus*-type ancestor: 1) the medial facial keel becomes convex below; 2) the frontal and vertical triangles are elongate and the eyes separate slightly; 3) the occiput and mesonotum acquire a row of short spines (a few spines are already present on occiput of *plagiatus*); 4) the metathoracic epimera extends to complete the post-metacoxal bridge; 5) the scutellum loses its ventral pile fringe; and 6) the abdomen becomes slightly constricted.

Since the unique character states of the *fascithorax* group could have been derived from a *plagiatus*-type ancestor and the group does share synapomorphic character states (facial keels and color, antennal shape, pollinose markings, etc.) with other *Sterphus* species, the *fascithorax* group is included in *Sterphus* and placed as the sister group to the *plagiatus* group.

To maintain the *fascithorax* group as a separate genus in its traditional sense, would require one of two courses of action: 1) one would have to accept the hypothesis that the *fascithorax* group arose independently of *Sterphus*, but that the two are sister groups and that the apparent similarities in various character states are convergences due to homoiology (Griffiths, 1972:24); or 2) if one accepts my phylogenetic analysis of the group, then one would be required

to elevate almost all of the other species groups here recognized to generic rank to avoid either paraphyletic or polyphyletic genera. I have rejected both these alternatives, the first on the basis of the rule of parsimony and the second on utilitarian grounds (see discussion under *Telus*)—my arrangement does not involve any convergences in character states and utilizes only one medium size genus instead of ten very small genera.

plagiatus group

The *plagiatus* group roughly corresponds to the original limits of Shannon's genus *Crepidomyia*, but three species groups, which would have been undoubtedly included by Shannon in his genus, have been left out of the *plagiatus* group. The *chloropygus*, *tinctus*, and *incertus* groups all lack the pollinose bands on the mesonotum and further differ by: the short antennae in the *chloropygus* and probably *incertus* groups; the slightly petiolate abdomen in the *tinctus* group; and the slightly concave and tuberculate face in the *incertus* group.

Sterphus (Ceriogaster) plagiatus (Wiedemann)

Xylota plagiata Wiedemann, 1830, p. 98. Type locality: Brazil. Type ♀ VMNH. Subsequent reference: Kertész, 1910, p. 304 (cat. citation).

Crepidomyia plagiata: Shannon, 1926, p. 48 (descript. note, distr. rec.—Brazil).—Curran, 1934, p. 404 (note on type, distr. rec.—Guyana).—Doesburg, 1963, p. 19 (distr. rec.—Surinam); 1966, p. 98 (distr. rec.—Surinam).—Fluke, 1957, p. 106 (cat. citation).

Zelima plagiata: Sack, 1941, p. 116 (also, 1951, p. 112) (distr. rec.—Peru).

Head: black; face shiny medially, silvery pollinose laterally; cheeks shiny anteriorly, white pilose, silvery pollinose posteriorly; front bare and sparsely white pollinose on lower half, yellow pilose and thickly white pollinose below becoming browner near vertex on upper half; frontal lunule dark reddish brown; vertex brownish pollinose, yellow pilose; occiput white pollinose, white pilose below becoming yellower above, with row of short thick spine-like hairs above; antennae elongate, slightly longer than face, brownish black, yellow pilose with a few longer black bristle-like hairs on ventral and dorsal margins of basal two segments; third segment about twice as long as broad, narrowed apically into blunt tip; arista yellowish on basal half, brown apically; distinctly longer than antennae.

Thorax: black; pleurae sparsely silvery pollinose, short white pilose, with patch of long hairs behind metathoracic spiracle; mesono-

tum mainly blackish pollinose and short, appressed, black pilose except as follows: long white pilose on notopleurae, shorter white pilose on humeri, two lateral golden pilose vittae stretching from basal corners of scutellum and posterior corners of postalar calli to level of wing bases, with patch of short thick spine-like black pile above wing bases, silvery pollinose on mesial sides of humeri and on transverse sutures, dark brown pollinose on medial ends of transverse suture, with faint medial and sublateral grayish pollinose vittae; scutellum with appressed black pile except thickly golden pilose on margin. Halters white; squamae white with brown margin and fringe. *Legs*: front legs dark brownish black, white pilose except black pile on anterior tip of femora, ventral half of tibiae, and all tarsi; middle legs similar to front legs except tawny basal three tarsal segments with white pile; hind legs brownish black except tawny femora, femora short black pilose except white pilose laterally on basal half and dorsal fourth, tibiae sparsely white pilose; tarsi black pilose; hind tibiae with strong apical spur. *Wings*: (fig. 13), hyaline except for diagonal brown stripe along posterior edge of second basal cell, across base of third posterior and discal cell, through basal two-thirds of apical cell to wing margin; microtrichose except bare behind spurious vein in first basal cell and basad to branching of Rs.

Abdomen: black; venter sparsely silvery pollinose; first three sterna white pilose and fourth and fifth sterna black pilose; first tergum silvery pollinose, long white pilose; second tergum brownish black pollinose except shiny reddish laterally on basal seven-eights, shiny portion with long white pile, rest with appressed black pile; third tergum shiny grayish silvery pollinose basally and dull brownish-black pollinose apically shiny area reaching from basal third medially to apical quarter laterally, dull area with short appressed black pile and shiny areas with short white pile; fourth and fifth terga shiny grayish silvery pollinose, short appressed black pilose.

MATERIAL EXAMINED: MEXICO: 1 ♀ (USNM). PANAMA: Canal Zone, Barro Colorado, 1 Aug 1924, N. Banks, 1 ♀ (MCZ). BRITISH GUIANA: Kamakusa, 1922, H. Lang, 2 ♀ (AMNH & HULL). ECUADOR: Napo, Napo River, Coca, 250m, May 1965, L. Peña, 3 ♀ (CNC); Napo, Pano River, 12 Feb 1923, F. X. Williams, 1 ♀ (USNM); Pastaza, Napo River, Pompeya, 14–22 May 1965, L. Peña, 1 ♀ (CNC). PERU: Madre de Dios, Avispas, 400 m, 1–15 Oct 1962, L. Peña. 1 ♀ (CNC); Middle Río Ucayali, 18 Nov 1923, H. Bassler, 1 ♀ (AMNH). BRAZIL: Amazonas, Rio Caiary-Uaupes, 1906, H. Schmidt, 1 ♀ (AMNH); Amazonas, Rio Cauburi, Boca do Tucano, Nov 1965, E. Dente, 1 ♀ (MZUSP); Amapá, Rio Felias,

28 July 1959, J. Lane, 1 ♀ (MZUSP); Amapá, Rio Amapari, 9–10 July 1957, J. Lane, 3 ♀ (FCT & MZUSP).

DISCUSSION: *S. plagiatus* differs from all other *Sterphus* species by the presences of a few long hairs behind the metathoracic spiracle and by a diagonal dark stripe on an otherwise hyaline wing (fig. 13). *S. plagiatus* is very closely related to *shannoni* but it can be contrasted as follows: 1) the scutellum has a marginal band of thick, opaque golden pile and lacks spines, not a fine white subscutellar fringe and strong short black spines; 2) the hind femora are tawny, with an appressed black pile on the apical half, not orange with an orange pile; 3) the abdomen has a short appressed black pile, not bands of thick, golden, tomentose pile on the tip of the abdomen; 4) the abdomen has shiny metallic bands on the third tergum, rather than being completely dull black; 5) the first basal cell is bare behind the spurious vein, not microtrichose. Character states 1 and 4 can also be used to distinguish *plagiatus* from the *genuinus* complex. Also, *S. plagiatus* is unique in the *plagiatus* group because of its short row of black spines on the upper fourth of the occiput.

Sterphus (Ceriogaster) shannoni, new species

Type locality: Brazil, Santa Catarina, Nova Teutonia. Holotype ♂ FCT.

Head: (fig. 4), black; face shiny medially, golden pollinose laterally; cheeks shiny anteriorly, silvery white pollinose posteriorly, white pilose; frontal lunule reddish brown; frontal triangle of male golden pollinose; front of female mainly shiny on lower half, with medial vitta of golden pollinosity and narrowly whitish pollinose laterally on lower half, light brownish pollinose and yellow pilose on upper half; vertex brown pollinose with some light yellowish pollinosity around anterior part of ocellar triangle, yellow pilose; occiput silvery white pollinose, yellow pilose. Antennae elongate, slightly longer than face, yellow pilose, light to dark brown on basal two segments, lighter orange brown on apical segment; third segment elongate, about twice as long as broad, with blunt tip but with dorsal margin slightly but distinctly concave before tip; arista yellow, only about as long as antenna.

Thorax: black; pleurae sparse silvery pollinose, short yellow pilose except for a few long golden hairs on apical posterior edge of mesoanepisterna; mesonotum mainly dark brownish pollinose and short appressed black pilose, except as follows: long yellow pilose on notopleurae, shorter yellow pilose on humeri and between them, two lateral golden pilose vittae stretching from posterior corner of

postalar calli to level of wing bases, with patch of short thick spine-like black pile above wings, golden pollinose on mesial sides of humeri and transverse suture, dark brown velvety pollinose behind golden pollinose, with faint medial and two sublateral grayish pollinose vittae. Scutellum short appressed black pilose, with sparse white ventral fringe, with indistinct apical emarginate rim, with a few very short apical spines. Squamae white with brown margin and fringe; plumulae brown; halters orange. *Wings*: light yellowish orange on anterior basal half, elsewhere light brownish; completely microtrichose. *Legs*: yellow pilose; front legs dark brownish black; middle legs slightly more reddish brown; hind coxae and trochanter dark reddish brown; hind femora and tibiae tawny, light reddish brown; hind tarsi darker; hind trochanter of male with long spur; hind tibiae of both sexes with apical lateral spur and with subapical medial spur in male.

Abdomen: black; dorsum dull brownish pollinose except shiny on sides of first and second terga, long white pilose laterally on first and second terga, short yellow appressed pilose elsewhere and with thicker opaque golden pile in form of transverse bands on apex of third tergum and basal margin and apical half of fourth tergum. Venter shiny on first and second sterna, light pollinose on rest of sterna, yellow pilose. *Male genitalia*: (fig. 28), cerci broad, rounded dorsally, with small medial tuberculate swelling. Surstyli: dorsal lobe elongate, narrow, with dorsal margin angulate and ventral margin evenly curved, with apex blunt, with many long hairs medially on dorsal edge; ventral lobe broad, broader than long, with rounded apical margin. Ninth sternum without dorsolateral opening, with large lateral membranous area above base of lingula; lingula very long and narrow, ending in small upturned point. Superior lobe with dorsoapical margin rounded, without apical hook-like process, extensively pilose, with two subbasolateral and one basolateral processes, with all these blunt-tipped and extending toward lingula. Aedeagus with dorsal lobe produced posteriorly, with lateral lobes broad and short, with lateral lobes not extending between lateral flaps of dorsal lobe, with ventral lobe produced on basal section and with apical section flatten. Ejaculatory apodeme umbrella-shaped.

MATERIAL EXAMINED: BRAZIL: Paraná, Caviuna, Sept. 1947, A. Maller 1 ♂ (AMNH) São Paulo, Campinas, Mar. 1924, F. X. Williams, 1 ♂ (USNM); São Paulo, Villa Americana, Feb. 1924, F. X. Williams, 1 ♀ (USNM); São Paulo, Rio Claro, Adutora, Sept. 1940, 1 ♂ (USNM) São Paulo, S. Sebastião, A. A. Barbiellini, 1 ♀ (USNM); São Paulo, Sto. Amaro, 8 May 1944, Oct. 1950, Feb.

1950, J. Lane, 2 ♂ 1 ♀ (MZUSP); Santa Catarina, Nova Teutonia, Sept.–May, 191 ♂♀ (AMNH, CNC, FCT, MCZ, MZUSP, Hull, BM(NH); holotype male, allotype female, both Nov. 1971, in FCT; other paratypes). ARGENTINA: Córdoba, Dept. San Javier, La Paz, 15–31 Dec. 1928, C. Bruch, 1 ♂ (USNM).

DISCUSSION: *S. shannoni* is quite easily separated from all other species of *Sterphus* by its golden tomentose pile bands on the tip of the abdomen. For discussion of the other differences between *shannoni*, *plagiatus* and the *genuinus* complex, see the discussion under those species.

S. shannoni is named for Raymond Corbet Shannon, who needs no introduction to syrphids workers.

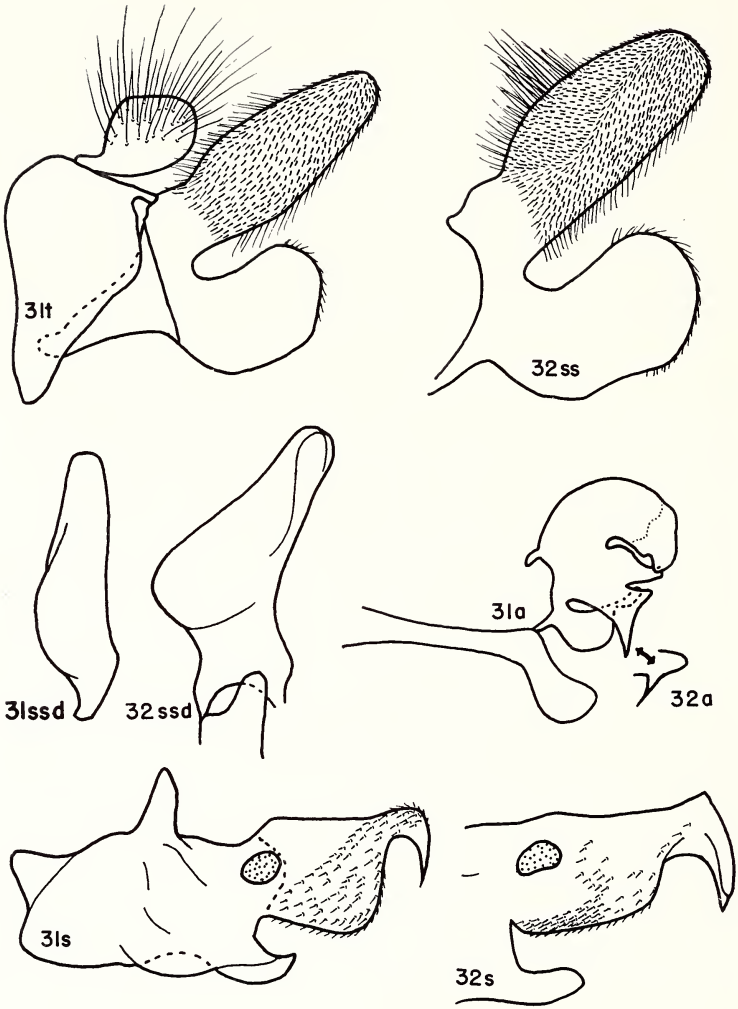
genuinus complex

S. genuinus (Williston) and *tricrepis* (Shannon) are very closely related and apparently only distinguishable by a few characteristics of the male genitalia. These genitalic differences are as follows: 1) the apical hook of the superior lobe is rounded dorsally and is sharp and simple apically in *genuinus* (fig. 31s) but in *tricrepis* it is angulate dorsally and is blunter and notched apically (fig. 32s); 2) the distribution of setae on the superior lobe is more uniform in *genuinus* (fig. 31s) but in *tricrepis* it is reduced (fig. 32s); 3) the ventral portion of medial lobe of aedeagus is broad and perpendicular in *genuinus* (fig. 31a) but in *tricrepis* it is thin and recurved (fig. 32a); 4) the lower lobe of the surstyle is short and somewhat angulate posteriorly in *genuinus* (fig. 31t) but in *tricrepis* it is longer and more curved posteriorly (fig. 32ss); and 5) the left surstyle is only produced slightly on the lateral side (fig. 31ssd), but in *tricrepis* it is greatly produced laterally (fig. 32ssd).

The following description and discussion applies to both species.

Head: black; face shiny medially, white to silvery yellow pollinose laterally in female, golden pollinose laterally in male; cheeks shiny anteriorly, silvery white pollinose posteriorly, white pilose; frontal lunule orange; front of female shiny on lower half, white pollinose and yellow pilose on upper half; frontal triangle of male golden pollinose; occiput silvery white pollinose, white pilose below becoming yellower above with some black hairs intermixed on upper third. Antennae shorter than face, brownish black except yellow arista, black pilose; third segment obtusely pointed, about 1½ times as long as broad; arista about twice as long as antenna.

Thorax: black; pleurae sparse silvery pollinose, short white pilose except for a few long black hairs on apical posterior tip of mesoan-



FIGS. 31–32. Male genitalia of *Sterphus*, lateral view except ssd dorsal view; 31. *genuinus* (Williston), 32. *tricrepis* (Shannon). a = aedeagus and base of apodeme (32a is only ventral prolongation of lateral lobe). s = 9th sternum, ss = surstyle, ssd = surstyle dorsal view, t = 9th tergum.

episterna; mesonotum mainly brownish pollinose with faint medial and two sublateral grayish pollinose vittae, with transverse sutures and mesial sides on humeri golden pollinose, appressed black pilose except for long white pilose on notopleurae, with black spine-like hairs above wings; scutellum brownish pollinose, short appressed black pilose, with very indistinct apical emarginate rim, with long white ventral fringe, with six to eight short strong marginal spines. Squamae white with brown margin and fringe; plumulae brown; halters yellow. *Wings*: very light brownish black, microtrichose except bare in front of Rs and behind spurious vein on basal half of first basal cell. *Legs*: black; mainly black pilose, white pilose as follows: on coxae, on basal two-thirds of anterior and all posterior side of front and middle femora, on basal half of both anterior and posterior sides of hind femora, dorsal half of front and middle tibiae; hind trochanter with short apical spur in female and longer one in male.

Abdomen: (fig. 18), black, mainly dull grayish black pollinose, shiny on sides of first thru third terga and medially on first and third sterna and on all of second sterum; second tergum frequently with pair of small lateral orange spots in male; long white pilose on shiny areas including all of first and third sterna, short yellow subappressed pilose on apical half of fourth tergum, appressed black pilose elsewhere on dorsum and long black pilose on fourth sterna; male genitalia with yellow pile. *Male genitalia*: (figs. 31–32), cerci quadrate with basal portion flattened, with dorsal margin evenly rounded. Surstyli: dorsal lobe elongate, broad, straight, not curved ventrally or medially, with blunt apex, on left side slightly to greatly produced basolaterally, with some long marginal pile on dorsal edge; ventral lobe broad, short, either with angulate or rounded apex. Ninth sternum with small dorsolateral membranous opening; lingula short, broadly triangular, with apex rounded; superior lobe with dorsoapical margin either angulate or rounded, densely or sparsely pilose, with apical portion hook-like, with either single sharp point or bifid point. Aedeagus: dorsal lobe large, arched produced dorsally; lateral lobes divided into short posteriorly directed process and large ventrally directed process, with posteriorly directed process with blunt tip and ventrally directed process extending into sharp point; ventral lobe produced ventrally on basal portion. Ejaculatory apodome umbrella-shaped.

DISCUSSION: *S. genuinus* and *tricrepis* are very similar to *shannoni* and *plagiatus* but can be separated from both species by their 1) lack of longitudinal stripes of appressed golden pile on the posterior mesonotum; 2) shorter and blunt tipped third antennal

segment; 3) black pile on the upper posterior corner of the mesopleurae; 4) spurs on the hind trochanter in the female, and 5) lack of well developed spurs on the hind tibiae. The *S. genuinus* complex further differs from *shannoni* in its 1) lack of golden tomentose pile on the abdomen, 2) black hind femora, and 3) hyaline wings. Other differences between *genuinus* and *plagiatus* are listed in the discussion of the latter species.

Sterphus (Ceriogaster) tricrepis (Shannon)

Crepidomyia tricrepis Shannon, 1926, p. 47. Type locality: Peru, Río Charape. Type ♂ USNM. Subsequent references: Fluke, 1950, p. 453 (synonymy under *genuinus* Williston).

Crepidomyia darlingtoni Hull, 1944, p. 40. Type locality: Cuba, Eastern Oriente, Mounts north of Imias, 3–4000 ft. Type ♂ MCZ. Subsequent reference: Fluke, 1957, p. 106 (cat. citation). **New synonymy.**

?*Crepidomyia dion* Hull, 1951, p. 183. Type locality: Peru, Chanchamayo. Type ♀ Hull. Subsequent reference: Fluke, 1957, p. 106 (cat. citation).

DISCUSSION: When Hull described *darlingtoni* he stated that it was "related to *tricrepis* Shannon but very distinct in the smoky wing apex." I have examined the holotype of *darlingtoni* including the male genitalia and can find no other differences between it and *tricrepis*. Thus, I feel the slight difference in the intensity of the color of the wing apex, *tricrepis* having light brownish black wings, is only of trivial importance. I have also examined the type of *dion* Hull and can find no differences between it and the females of the *genuinus* complex. Since the females of the *genuinus* are indistinguishable, I have tentatively synonymized *dion* under *tricrepis* on the basis of geographical distribution, that is, all the males of the *genuinus* complex examined from Peru, the type locality of *dion*, have been *tricrepis*.

MATERIAL EXAMINED: CUBA: Pico Turquino, Cumbre, 22 July 1922, S. C. Bruner & C. H. Ballou, 1 ♀ (AMNH); Eastern Oriente, Mounts north of Imias, 3–4000 ft., 25–28 July 1936, P. J. Darlington, 1 ♂ (holotype of *darlingtoni*, MCZ). DOMINICA: Pont Casse, April 1965, 12 Oct.–30 Nov. 1964, P. J. Spangler & R. Davis, 8 ♀ (USNM), 27–30 Nov. 1964, P. J. Spangler, 1 ♂ (USNM). PERU: Río Charape, 14 Sept. C. H. T. Townsend, 1 ♂ (holotype of *tricrepis,* USNM); Piches & Perene Valleys, 2000–3000 ft., 1 ♂ 2 ♀ (paratypes of *tricrepis*, USNM). BOLIVIA: Cochabamba, Oct. 1965, Steinbach, 1 ♂ (CNC); El Limbo, 65°36′W 17°07′S, 2200 m, Nov. 1963, F. Steinbach, 1 ♂ (CNC).

Sterphus (Ceriogaster) genuinus (Williston)

Xylota genuina Williston, 1888, p. 284. Type locality: Brazil, Rio de Janeiro. Type ♀ AMNH. Subsequent references: Kertész, 1910, p. 301 (cat. citation).—Shannon, 1926, p. 50 (suggested placement in *Crepidomyia*).

Zelima genuina: Sack, 1941, p. 116 (also, 1951, p. 112) (distr. rec.—Peru [= *tricrepis*?]).

Crepidomyia genuina: Fluke, 1950, p. 453, fig. 19 (male genitalia) (synonymy of *tricrepis*; distr. recs.—Brazil, Argentina); 1957, p. 106 (cat. citation).

MATERIAL EXAMINED: COSTA RICA: Cartago, Turrialba, La Suiza, 1 Oct., 13 Nov., P. Schild, 2 ♂ (USNM). VENEZUELA: Mt. Duida, 28 Dec. 1928, 16 Jan. 1929, Tate, 2 ♀ (AMNH). BRAZIL: Minas Gerais, Passa Quatro, 30 March 1916, 1 ♂ (USNM); Rio de Janeiro, Itatiaya, 1200 m, Feb. 1941, R. C. Shannon, 7 ♂ 5 ♀ (USNM); Rio de Janeiro, Itatiaya, Maromba, 23 Dec. 1935, 11 April 1940, J. F. Zikan, 2 ♂ (MZUSP & FCT); Rio de Janeiro, Dist. Federal, Jan. 1938, 1 ♂ (USNM); São Paulo, C. Jordão, Jan. 1954, J. Lane, 1 ♂ (MZUSP); Santa Catarina, Nova Teutonia, March 1966, Sept. 1966, 1 ♂ 1 ♀ (CNC). ARGENTINA: Tucumán, Villa Nougués, 13 Jan. 1929, Jan. 1929, R. A. Jaynes, 3 (USNM).

fascithorax group

Face with medial carina slightly concave below antennal pits and slightly convex below that concavity; cheeks narrow; frontal triangle of male about two-thirds as long as vertical triangle; vertical triangle of male long, more than twice as long as broad at occiput; occiput with transverse row of short strong spines on upper half; eyes with an oblique transverse impressed groove at level of antennal pits, narrowly dichoptic in male; third antennal segment always elongate, two or more times as long as broad; anterior edge of mesonotum with transverse row of short strong spines; postmetacoxal bridge complete; metathoracic spiracle small; scutellum without ventral pile fringe; abdomen slightly petiolate.

DISCUSSION: The species of this group will be reviewed in a separate paper. The group as a whole is quite distinctive, with its 1) complete postmetacoxal bridge, 2) lack of a scutellar fringe, 3) row of spines on the occiput and the mesonotum, and 4) modified medial facial keel. It is hardly likely that the species of the *fascithorax* group will be confused with any other *Sterphus* species.

tinctus group

The *tinctus* group is readily distinguished by its abdominal shape (fig. 19) and the lack of hind tibial spurs. Other diagnostic characters for the group have been listed in Table II.

Sterphus (Ceriogaster) tinctus (Fluke)

Crepidomyia tincta Fluke, 1950, p. 453, fig. 20 (head), 21 (wing). Type locality: Brazil, Santa Catarina, Nova Teutonia. Type ♀ AMNH. Subsequent reference: Fluke, 1957, p. 106 (cat. citation).

Head: black; face shiny medially and broadly golden pollinose laterally in male, almost completely shiny in female, with only very narrow stripe of pollinosity on border of cheek in female; cheek shiny, linear, white pilose; frontal lunule orange; frontal triangle of male golden pollinose; front of female with lower half shiny, with upper half dark brownish pollinose, with pollinosity lighter at junction of shiny area, yellow pilose; vertex brownish pollinose, yellow pilose; occiput sparsely yellowish brown pollinose, white pilose below becoming yellower above. Antennae brownish orange, black pilose, longer than face in female, about as long as face in male; third segment about 1½ times as long as broad in female, slightly longer than broad in male; arista orange, more than twice as long as antenna.

Thorax: brownish black; mesonotum mostly dull brownish pollinose, with transverse sutures black velvety pollinose, with faint grayish medial pollinose vitta, grayish pollinose on mesial sides of humeri, short appressed brownish yellow pilose except black pilose medially on posterior half; without black spine-like pile above wings; pleurae brownish yellow pollinose, short yellow pilose; scutellum appressed yellow pilose, with indistinct apical emarginate rim, with yellow ventral fringe, without spines; squamae and halters orange; plumulae reddish brown. *Wings*: light yellowish brown, dark brown on anterior half; microtrichose except bare anterior third of anal cell. *Legs*: mainly orange, slightly darker on anterior legs of male, yellowish to orange pilose, front coxae brownish black on basal four-fifths; middle and hind coxae brownish basally, front tarsi with apical four segments brownish black, middle and hind tarsi with apical two segments dark; tarsi with dark pile on dark segments, hind trochanter with very short stubbly papilla.

Abdomen: elongate, slightly constricted on second segment, minimal width about two-thirds of maximal width (two-thirds in female; three-fifths in male); dark brownish black, dull brownish black pollinose, mainly short yellow to golden pilose, slightly longer

pile basolaterally. *Male Genitalia*: (fig. 29) cerci quadrate, with dorsal margin slightly rounded; dorsal lobe of surstyli elongate, broad, angulate, with broad apex, apparently without long marginal pile; ventral lobe of surstyli greatly reduced, completely bare; ninth sternum with small dorsolateral membranous opening; lingula short, very broad, with apex broadly truncate; superior lobe with dorso-apical margin rounded, sparsely pilose, without apical hook-like process, with large lateral excavation extending up from ventral margin; aedeagus with dorsal lobe produced posterodorsally, and arched, with long and wide cleft between dorsal and lateral lobes, with lateral lobes broad and tapering to long sharp apex, with ventral lobe flattened; ejaculatory apodeme umbrella-shaped.

MATERIAL EXAMINED: BRAZIL: Santa Catarina, Nova Teutonia, August–January, F. Plaumann, 21 ♂ ♀, (FCT, BM(NH), & AMNH (including holotype)).

DISCUSSION: *S. tinctus* is quite similar to *S. auricaudatus* in overall appearance, both species have slightly petiolate abdomens, general brownish black color, brown anterior edge of the wing, and simple legs. However, *S. tinctus* can be easily separated by its straight black face and lack of golden tomentose-like pile on the abdomen. Also, the possession of the apomorphic black and straight face character states clearly demonstrates that the similarities between *S. auricaudatus* and *tinctus* are due to convergence.

coarctatus group

The *coarctatus* group can be easily separated from all other species groups by its abdominal shape (fig. 20) and single hind tibial spur. Other diagnostic characters for the group have been listed in Table II.

Sterphus (Ceriogaster) coarctatus (Wiedemann)

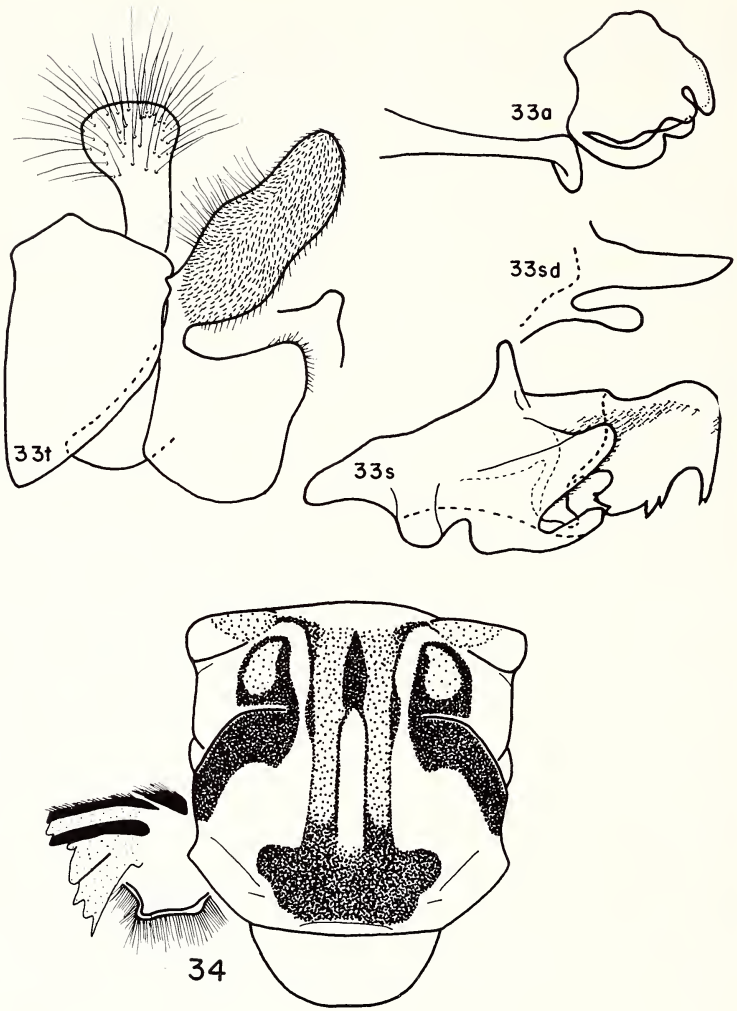
Xylota coarctata Wiedemann, 1830, p. 100. Type locality: Brazil. Type ♀ SMF. Subsequent reference: Kertész, 1910, p. 298 (cat. citation).

Tatuomyia coarctata: Shannon, 1926, p. 49 (differential diagnosis from *batesi*).—Fluke, 1957, p. 105 (cat. citation).

Zelima coarctata: Sack, 1941, p. 116 (also, 1951, p. 112) (distr. rec.—Peru).

Senoceria spinifemoratas Hull, 1930, p. 145. Type locality: Brazil. Type ♂ ANSP.

Head: face black, shiny medially, golden pollinose laterally; cheeks black, shiny, white pilose; frontal lunule orange; frontal triangle of male golden pollinose, with a few marginal yellow hairs;



FIGS. 33–34. Fig. 33. Male genitalia of *Sterphus coarctatus* (Wiedemann), lateral view except sd dorsal view; 34. Mesonotal pollinose pattern of *Sterphus telus* Thompson. a = aedeagus, s = 9th sternum, t = 9th tergum and associated structures (with outline of tip of lower lobe of left surstyle).

front of female shiny on lower half, silvery pollinose and white pilose on upper half; vertex black, silvery pollinose in front of ocellar triangle, brown pollinose on ocellar triangle, yellow pilose; occiput black, white pollinose, white pilose below becoming yellower above; antennae tawny, except dark third segment, with white pile on medial surface and black pile on lateral surface, slightly longer than face; third segment elongate, with blunt tip, twice as long as broad; arista orange, about three-fourths longer than face.

Thorax: black; pleurae lightly silvery pollinose, short yellow pilose; mesonotum dark grayish pollinose except as follows: golden pollinose on transverse sutures and mesial sides of humeri, dark brown pollinose behind the areas of golden pollinosity, sparsely light golden pollinose in form of medial longitudinal stripe with splits into two stripes behind the transverse suture and two broad submedial longitudinal stripes starting behind transverse sutures; mesonotal pile short appressed golden in front of transverse sutures, short appressed golden in form of anteriorly pointed triangular patch on postalar and adjacent mesonotum; scutellum black, dark grayish pollinose, appressed yellow pilose, subscutellar fringe golden yellow; squamae white, with brown margin and fringe; halters dark reddish brown with yellow stalk; plumulae light brownish yellow. *Legs*: dark reddish brown, white pilose except black pilose on dorsal edge on apical quarter of hind femora; hind tibiae with single short spur; hind trochanter of male with short spur. *Wings*: (fig. 14), with anterior portion metallic purplish black, hyaline behind; with dark color extending back to spurious vein, second basal cell light yellowish brown; microtrichose except bare narrowly along anterior edge of anal cell, apical three-fourths of alula, behind and in small spot in front of Ax.

Abdomen: (fig. 20), black, except red petiole, dark grayish pollinose except shiny first segment and petiole; pile long white on first segment and lateral margin of second tergum, long black on third and fourth sterna, short appressed black with a few scattered yellow hairs on second and third terga, short appressed yellow with a few scattered black hairs on fourth tergum; fifth tergum of female with short appressed black pile. *Male genitalia*: (fig. 33), cerci slightly expanded dorsally, with dorsal margin rounded. Surstyli: dorsal lobe elongate, straight except dorsal and ventral margins slightly sinuous, with some long marginal pile on dorsal edge, with apex broadly rounded; ventral lobe broad, almost square, with posteroapical corner of left ventral lobe slightly produced; ninth sternum without dorsolateral opening, with large lateral lobe, with

medial side of this lobe short pilose; lingula short, broadly triangular, with apex rounded; superior lobe with dorsoapical margin rounded, with apical hook-shaped process, with four large teeth on ventral margin; aedeagus with dorsal lobe produced posterodorsally, with lateral lobes small and broadly rounded apically, with ventral lobe long; ejaculatory apodeme umbrella-shaped.

MATERIAL EXAMINED: PANAMA: Chorrera, 6 June 1948, 1 ♂ 1 ♀ (MCZ). GUYANA: Essequibo River, Moraballi Creek, 8 Sept. 1929, Oxford University Expedition, 1 ♀ (BM(NH)). BRAZIL: Amazonas, Rio Tucano, Serra da Neblina, 230 m, 4 Dec. 1965, E. Dente, 2 ♀ (MZUSP); 24 July 1936, Lange de Morretes, 1 ♀ (MZUSP); "Freireiss" [=G. W. Freyreiss], 1 ♀ (holotype of *coarctatus*, SMF); H. B. Merill, 1 ♂ (holotype of *spinifemorata*, ANSP).

DISCUSSION: *S. coarctatus* is easily separated from all other described *Sterphus* by its abdominal shape and other species group characters as discussed above. I have examined a pair of *coarctatus* from Panama which differs from all the other material studied in that 1) the wings are bordered with dark brown, not metallic purplish black and 2) the anal cell is extensively bare (fig. 15). Since I can find no other differences (including genitalic differences) between these panamanian specimens and the others I am attributing the above mentioned differences to geographic variation.

batesi group

The synapomorphic character states of the *batesi* group are the long abdominal petiole and the presence of two apical spurs on the hind tibiae.

Sterphus (Ceriogaster) batesi (Shannon)

Tatuomyia batesi Shannon, 1926, p. 48. Type locality: Brazil, Ega. Type ♂ BM(NH). Subsequent reference: Fluke, 1957, p. 105 (cat. citation).

Head: black; face silvery pollinose except for small medial triangular spot on facial carina under antennal base; cheeks shiny, white pilose; frontal triangle shiny, bare; frontal lunule dark brownish orange; vertical triangle silvery pollinose below ocellar triangle, shiny above ocellar triangle, with a few short yellowish hairs on ocellar triangle; occiput silvery pollinose, white pilose below becoming yellower above, with a few black hairs intermixed on upper third. Antennae dark brown, as long as face, black pilose; third

segment about three times as long as broad, with tip blunt; arista yellowish, almost twice as long as antennae.

Thorax: black; dorsum shiny except silvery pollinose on mesial side of humeri and dark brownish pollinose between humeri, black pilose except white pilose on notopleurae, with pile greatly reduced and appressed; pleurae silvery pollinose, white pilose; metathoracic spiracle about half as large as third antennal segment is long; halters white with brown head; squamae white with brown margin and fringe; scutellum shiny, black pilose except yellowish subscutellar fringe. *Legs*: mainly black, except yellowish brown on apical third of hind femora and basal three middle tarsal segments. *Wings*: (fig. 16), bicolored, brownish black anteriorly, hyaline posteriorly; black area extending to anal cell, to discal cell before anterior crossvein and to diagonal line from anterior crossvein to apex of apical cell; almost completely microtrichose, except bare narrowly on both sides of basal half of anal vein, on apical corner of anal cell, and on spot in front of and behind vein and on alula.

Abdomen: (fig. 21), black except reddish brown petiole; shiny except brownish black pollinose on apical third of second segment, black pilose except white pilose on first segment and petiole of second segment, with dorsal pile greatly reduced and appressed. *Male genitalia*: (fig. 22), cerci broadly expanded and flattened dorsally, with narrow basal neck; dorsal lobe of surstyli elongate, broad, with dorsal margin angulate, apical margin truncate; ventral lobe of surstyli broad, broader than long, with rounded apical margin; ninth sternum with large dorsolateral membranous opening; lingula short, blunt apically; superior lobe with dorsoapical margin rounded, with anteroventrally directed process on posteroventral margin, with small basoventral lateral tooth; aedeagus with dorsal lobe posterodorsally produced and arched, with lateral lobes divided into long thin and ventrally produced basolateral process and broader curved anteriorly directed process, with ventral lobe long and produced on basal half; ejaculatory apodeme umbrella-shaped.

MATERIAL EXAMINED: BRAZIL: Amazons, Saunders Collection, 1 ♂ (OXF).

DISCUSSION: The specimen on which the above description was based agrees with Shannon's original description of *batesi* in all particulars except that the basal three segments of the middle tarsi are dark orangish brown, not black. However, Dr. Hippa has compared the above specimen with the holotype of *batesi* and states that the two are conspecific. For a discussion of the differences between *batesi* and *fulvus* check under the latter.

Sterphus (Ceriogaster) fulvus, new species

Type locality: Brazil, São Paulo, Salesopolis, Boracea. Holotype ♀ MZUSP.

Head: (fig. 3), face black medially, reddish brown laterally, shiny medially, white pollinose laterally; cheeks dark reddish brown, with a few white hairs posteriorly; frontal lunule orange; front dark reddish brown, shiny and bare on lower half, brownish black pollinose and yellow pilose on upper half except white pollinose along eye margins; vertex dark reddish brown, dark brownish black pollinose, yellow pilose; occiput black, white pollinose, white pilose below becoming yellow above. Antennae elongate, almost as long as face, dark orange, orange pilose except for a few black bristle-like hairs on dorsal and ventral margins of first two segments; third segment rectangular, twice as long as broad; arista orange on basal third, dark apically slightly longer than antennae.

Thorax: dark brown, except slightly reddish on humeri and postalar calli, uniformly brownish pollinose except white pollinose on mesial side of humeri and indistinct light brownish pollinose medial and two submedial vittae, short yellow pilose, without short black spine-like pile above wings. *Legs*: coxae dark brown except orange on ventral portion of hind coxae, yellow pilose; trochanters dark reddish brown, yellow pilose; femora tawny, yellow pilose; anterior tibiae and tarsi dark brownish black, black pilose except with yellow pile intermixed on dorsal surface; middle tibiae tawny except with brown, broad, apical band, yellow pilose; middle tarsi tawny except dark brownish apical two segments, yellow pilose; hind tibiae and tarsi tawny except dark brownish apical two segments, yellow pilose. Halters tawny, head not dark; squamae brownish. *Wings*: (fig. 17), brownish anteriorly, hyaline posteriorly, with extent of brown area same as in *batesi,* microtrichose except mostly of anal cell and behind anal cell bare and alula bare.

Abdomen: dark brown except tawny petiole, yellow pilose except black pilose on fifth segment and intermixed black pile on sterna.

MATERIAL EXAMINED: BRAZIL: São Paulo, Salesopolis, Boracea, 24–30 January 1953, Collectors—Carrera, Vanzolini, Oiticica, Pearson; 1 ♀ (holotype, MZUSP).

DISCUSSION: *S. fulvus* is very similar to *batesi* Shannon but as its name implies it is a dull brownish fly whereas *batesi* is a shiny black fly. The principal differences between *fulvus* and *batesi* are as follows: 1) the antennae are dark orange, not black; 2) the mesonotum is pollinose and brownish, not shiny black; 3) the postalar calli are golden pilose, not black; 4) the pile above wings

is orange and long, not black and bristle-like; 5) the scutellum is golden pilose, not mainly black; 6) the head of the halters are orange, not brownish black; and 7) abdominal terga 3 and 4 are pollinose, brownish and with golden pile, not shiny black with black pile. *S. fulvus* can also be separated from *batesi* by its more extensively bare anal cell (fig. 17) and less swollen hind femora.

"Xylota" ventralis Walker

Xylota ventralis Walker, 1858, p. 96. Type locality: Aru Islands. Type ♀ BM(NH). Subsequent references: Kertész, 1910, p. 307 (cat. citation).—Shannon, 1926, p. 50 ("apparently belongs to . . . *Crepidomyia*").

Head: (fig. 8), black; face bare, carinate, with slight concavity, black with metallic bluish lustre, white pollinose except shiny V-shaped medial area; cheeks shiny; front shiny except with broad pollinose band across medial half, light yellow pilose; vertex shiny, light yellow pilose; ocellar triangle slightly anterior to posterior margin of eyes; occiput completely white pollinose, yellow pilose. Antennae black; third segment elongate, twice as long as second.

Thorax: black, with metallic bluish luster except orange postalar calli and scutellum; pleurae lightly white pollinose and short yellow pilose, anterior mesoanepisterna bare; posterior mesoanepimera bare; barrette and hypopleurae bare; metathoracic pleurae bare; metasterna pilose and developed; postmetacoxal bridge incomplete; scutellum with distinct emarginate rim, with ventral pile fringe (single row); mesonotum without pollinose markings except white pollinose along anterior margin, short appressed black pilose except yellow pilose as follows: on notopleurae, humeri, along transverse suture, on and in front of postalar calli and scutellum, and in medial area in front of and between transverse sutures; squamae white with black border and fringe; plumula brownish. *Wings*: with slight brownish tinge; stigma brown; marginal cell open; apical cell petiolate, with petiole longer than humeral crossvein; anterior crossvein slightly before middle of discal cell, slanted; anal cell petiole straight, slightly longer than petiole of apical cell; marginal crossveins disjunctive, not continuous, with external spurs at their bases; microtrichose except bare as follows: basal quarter of costal cell, area between Rs and R1, anterior half and basal quarters of second basal cell, narrowly along anterior edge of anal cell, along posterior edge of anal cell and in front Ax. *Legs*: anterior four legs light orange except darker reddish orange on trochanters and apical tarsal segments, yellowish pilose, with coxae thickly white pollinose; hind coxae dark reddish brown with

metallic bluish luster, sparsely white pollinose, white pilose; hind trochanters dark reddish brown; hind femora (fig. 9) evenly swollen, orange on basal and apical quarter, darker reddish orange medially, yellow pilose; hind tibiae orange on basal half darker reddish orange apically, yellow pilose; hind tarsi brownish orange, black pilose above, orange below.

Abdomen: metallic bluish black, appressed white pilose laterally on first three terga (color of pile on medial area cannot be seen because wings are folded on the area), fourth tergum appressed white pilose on basal half and black pilose apically; fifth tergum all black pilose.

MATERIAL EXAMINED: Aru Island, A. R. Wallace, 1 ♀ (holotype, BM(NH)).

DISCUSSION: When Shannon described his genus *Crepidomyia* he referred "*Xylota*" *ventralis* Walker to it. I have examined the type of *ventralis* and find that it definitely does not belong to *Sterphus*. "*Xylota*" *ventralis* probably deserves separate generic status. However, without a study of the characters of the male genitalia of *ventralis*, it is difficult to properly place *ventralis* within the present classification of the *Xylota* group. "*Xylota*" *ventralis* appears similar to *Hardimyia* Ferguson. It differs from *elongata* (Hardy), the unique species of *Hardimyia*, as follows: 1) the second antennal segment is not elongate, but about half as long as the third segment, not longer than the third segment; 2) the face has a shiny V-shaped area, not completely pollinose; 3) the scutellum is orange, not black; and 4) the hind femora are completely reddish, not black apically. This species will key to *Neplas* in my key (Thompson, 1971) to syrphid genera with carinate faces. *Xylota ventralis* differs from *Neplas* as follows: 1) the face is nearly straight, not concave; 2) the pleurotergum is not carinate; 3) the abdominal sterna are normal, not greatly narrowed; and 4) the hind femora are not as strongly swollen as in *Neplas* nor are the hind tibiae strongly arcuate.

ABBREVIATIONS

Museums and Private Collections

AMNH —American Museum of Natural History, New York
ANSP —Academy of Natural Sciences, Philadelphia
BM(NH) —British Museum (Natural History), London
CNC —Canadian National Collection, Ottawa

FCT	—F. Christian Thompson Collection
Hull	—Frank M. Hull Collection, Oxford, Mississippi
MCZ	—Museum of Comparative Zoology, Cambridge
MNHN	—Museo Nacional de Historia Natural, Santiago
MZUSP	—Museu de Zoologia, Universidade de São Paulo
SMF	—Senckenbergisches Museum, Frankfurt am Main
USNM	—United States National Museum, Washington
VMNH	—Naturhistorisches Museum, Vienna

Used in synonymy

cat. citation	—catalog citation
descrip. note	—descriptive note
descript.	—description (full)
distr. data	—distribution data
distr. rec. (s)	—distribution record(s)
key ref.	—placement in a key

ACKNOWLEDGEMENTS

I would like to thank the following: Dr. H. Hippa for comparing my *S. coarctatus* material with the type; Dr. F. M. Hull for the loan of the *Sterphus* types in his personal collection; Dr. L. V. Knutson, USDA, ARS, Systematic Entomology Laboratory, Washington, for the loan of material and permission to study and dissect the type of *S. tricrepis* Shannon; Dr. R. Lichtenberg, Naturhistorisches Museum, Vienna, for the loan of the types of *S. chloropygus* Schiner and information on types of *S. aurifacies* (Schiner); Dr. J. F. Lawrence, Museum of Comparative Zoology, Cambridge, for the loan of material and permission to study and dissect the type of *S. darlingtoni* (Hull); Dr. W. W. Morris, Academy of Natural Sciences, Philadelphia, for the loan of the type of *S. spinifemoratus* (Hull); Dr. N. Papavero, Museu de Zoologia, Universidade de São Paulo, for the loan of material; Mr. K. G. V. Smith, British Museum (Natural History), London, for his notes on the types in his custody; Dr. W. Tobias, Senckenbergisches Museum, Frankfurt am Main, for the loan of the type of *S. coarctatus* (Wiedemann); Dr. J. R. Vockeroth, Canada Department of Agriculture, Entomology Research Institute, for the loan of material; and Dr. P. Wygodzinsky for his critical comments on this paper and other things too numerous to mention.

REFERENCES

CROWSON, R. A.
1970. Classification and Biology. New York, Atherton Press, ix+ 350 pp.

CURRAN, C. H.
1934. Diptera of Kartabo, Bartica District, British Guiana. *Bull. Amer. Mus. nat. Hist.* 66: 287–532.

DARLINGTON, P. J., JR.
1971. The carabid beetles of New Guinea. Part IV. General Considerations; Analysis and History of Fauna; Taxonomic Supplement. *Bull. Mus. comp. Zool.* 142(2): 129–337.

DOESBURG, P. H. VAN.
1963. Preliminary list of Syrphidae known from Suriname and British and French Guiana. *Stud. Fauna Suriname* [=*Natuurwet. Stud. Suriname*] **5**(28): 1–33.
1966. Syrphidae from Suriname. Additional records and descriptions. *Stud. Fauna Suriname* [=*Natuurwet. Stud. Suriname*] 9(35): 61–107.

ETCHEVERRY, M.
1963. Descripciones originales, sinonimia y distribución geográfica de las especies de al familia Syrphidae (Diptera) en Chile. *Publ. Centro Estud. Ent.* 5: 1–141.

ETCHEVERRY, M. & R. D. SHENEFELT.
1962. A preliminary study of the genitalia of Chilean Syrphidae. *Verhandl. XI Internatn. Kongr. Ent.* 1960 1: 207–214.

FLUKE, C. L.
1950. Some new tropical syrphid flies with notes on others. *Acta Zool. Lilloana* 9: 439–454.
1955. Los Insectos de las Islas Juan Fernandez. 18. Syrphidae (Diptera). *Revta Chilena Ent.* 4: 39–43.
1956–57. Catalogue of the family Syrphidae in the Neotropical region (Diptera). *Revta Brasil. Ent.* 6: 193–268, 7: 1–181.

HULL, F. M.
1930. Some new species of Syrphidae from North and South America. *Trans. Amer. ent. Soc.* 56: 139–148.
1943. The genus Ceriogaster Williston (Syrphidae). *Revta Soc. Ent. Argentina* 12: 137–140.
1949. The morphology and inter-relationship of the genera of syrphid flies, recent and fossil. *Trans. zool. Soc. London* 26: 257–408, 25 figs.
1951. Some New World Xylotinae (Diptera: Syrphidae). *Pan-Pacific Ent.* 27: 183–186.

KERTÉSZ, K.
1910. Catalogus dipterorum hucusque descriptorum. Vol. 7, Lipsiae, Budapestini [=Leipzig, Budapest], 470 pp.

LYNCH ARRIBALZAGA, F.
1892. Dipterologia Argentina (Syrphidae). *An. Soc. Cien. Argentina* 33: 189–199.
PHILIPPI, R. A.
1865. Aufzählung der chilenischen Dipteren. *Verhandl. K. -k. Zool. -Bot. Gesell. Wien* 15 (*Abhandl.*): 595–782.
PINO, G.
1962. Estudios de algunos caracteres morfologicos de nueve especies de Syrphidae Chilenos de diferentes generos (Diptera). *Publ. Centro Estud. Ent.* 4: 45–58.
PORTER, C. E.
1932. Acerca de algunos Insectos Chilenos. *Revta Chil. Hist. nat.* 36: 190–193.
1937. Acerca de la distribucion geografica de algunos Insectos Chilenos. *Revta Chil. Hist. nat.* 41: 41–42.
RONDANI, C.
1863. *Diptera exotica revisa et annotata.* Modena, 99 pp., 1 pl., (also published as "Dipterorum species et genera aliqua exotica" 1864, *Arch. Zool. anat. Fis., Modena* (1863) 3(1): 1–99, pl. 5.).
SACK, P.
1941. Syrphidae, pp. 97–120. In Titschack, E., *Beitrage zur Fauna Perus.* Band I, 344 pp. [Most copies of this publication were destroyed during World War II. It was reissued as Sack, 1951. see *Zool. Rec.* 1951, 88(13): 132 (#2537)].
1951. Syrphidae, pp. 93–116. In Titschack, E., *Beitrage zur Fauna Perus.* Band II, 344 pp.
SCHINER, I. R.
1868. Diptera. In *Reise der österreichischen Fregatte Novara. Zool.*, Vol. 2, Abt. 1, B., Wien, 388 pp.
SHANNON, R. C.
1925. Some American Syrphidae (Diptera). *Proc. ent. Soc. Wash.* 27(5): 107–112.
1926. Review of the American xylotine syrphid-flies. *Proc. U. S. natn. Mus.* 69(9): 1–52.
1927. A review of South American two-winged flies of the family Syrphidae. *Proc. U. S. natn. Mus.* 70(9): 1–34.
1928. Two new and remarkable Syrphidae in the Museo Nacional de Historia de Buenos Aires. *An. Mus. nac. Hist. nat., Buenos Aires,* 34: 573–576.
SHANNON, R. C. AND D. AUBERTIN.
1933. Syrphidae. pp. 120–170. *IN* British Museum (Natural History), *Diptera of Patagonia and South Chile.* Pt. 7, fasc. 3, pp. 117–175.
STUARDO, C.
1946. Catalogo de los Dipteros de Chile. Santiago, Chile, Min. Agric., 251 pp.

THOMPSON, F. C.
1971. The genus Nepenthosyrphus with a key to world genera of Tropidiini. *J. Kansas ent. Soc.* 44: 523–534.
1972. A contribution to a generic revision of the Neotropical Milesinae (Diptera: Syrphidae). *Arq. Zool.* 23(2): 73–215.

WALKER, F.
1858. Catalogue of the Dipterous insects collected in the Aru Islands by Mr. A. R. Wallace, with descriptions of new species. *J. Linn. Soc. London (Zool.)* 3: 77–110.

WILLISTON, S. W.
1891–2. Fam. Syrphidae. In Godman, F. D. and Salvin, O., eds., *Biologia Centrali–Americana. Zoologia-Insecta-Diptera*, Vol. 3, 127 (pp. 1–56, 1891; 57–79, 1892).

INSTRUCTIONS TO AUTHORS

1. *Manuscripts* must be typed, double-spaced throughout, on standard bond paper, with margins of 1½ inches on all sides and pages numbered consecutively.

2. A *title page* should be supplied with the title of the paper centered at the top of the page and the author's name (or authors' names) centered below it.

3. *Page one* of the manuscript should include the title, centered at the top of the page, the author's name centered below the title and followed by a superscript footnote number, a brief *table of contents*, a brief *abstract*, and a footnote at the bottom of the page giving the author's present professional titles and affiliations. The text of the paper may begin immediately after the abstract if there is space.

4. A paragraph of *acknowledgments* should appear at the end of the text of the paper.

5. The list of *references* should be in alphabetical order by authors' names. Two or more entries under one author should be in chronological order. The entry should appear, indented, beginning on the line below the auhor's name with the information in the following order: date, title of article (with only the first word and proper nouns capitalized), name of journal (underlined, for italics, with conventional title capitalization, and abbreviated according to the list published by the current *Biological Abstracts* or *Chemical Abstracts* or spelled out in full if not listed), volume number (in arabic numerals, followed by a colon), and page numbers; *OR* date, title of book (with only the first word and proper nouns capitalized), city of publication, publisher, volume number if any (preceded by "vol."), and the number of pages in the book (followed by the abbreviation "pp."). Authors are wholly responsible for accuracy and completeness of references. Examples follow:

   Beal, R. S., Jr.
   1954. A revision of the species included in the genus *Novelsis* (Coleoptera: Dermestidae). *Trans. Amer. Entomol. Soc.*, 80: 73–90.
   Allee, W. D., A. E. Emerson, O. Park, T. Park, and K. P. Schmidt
   1949. Principles of animal ecology. Philadelphia and London, W. B. Saunders Co., 837 pp.
   Kistner, D. H.
   1969. The biology of termitophiles. *In* Biology of termites, vol. 1 (ed. K. Krishna and F. M. Weesner). New York and London, Academic Press, Inc., chap. 17, pp. 525–557.

6. *Keys* should be typed on a separate sheet of paper, not run into the text, and provided with a formal title. Each couplet should be numbered, the numbers aligned flush left. The first words of all couplet enries should be aligned, and run-over lines indented and aligned. The number or name which ends each couplet entry should be aligned flush right and the space leading up to it filled in with leaders (periods separated by spaces). Examples:

   4. Transverse fascia on corium always present and straight 5
      Transverse fascia on corium irregular, not straight; or fascia absent 8
   5. Dorsum piceous; all marginal areas of pronotum continuously and widely yellowish orange . . . . . *ashmeadi* Heidemann
      Dorsum reddish brown; at most only the posterior marginal area of the pronotum yellowish 6

7. *Synonymy citations* should begin with a flush left alignment, with run-over lines indented uniformly. Authors' surnames only should be used, separated from the previous citation by a dash (two hyphens) and followed by date and page numbers. In cases where the first name mentioned is not that of the author of a species, it should be preceded by a colon. Example:

   Dermestes megatoma Fabricius, 1798, p. 313.
   Attagenus megatoma: Dahl, 1823, p. 30.—Laporte, 1840, p. 35.—Erichson, 1846, p. 441.—Wollaston, 1854, p. 204.—LeConte, 1854, p. 109.—Chevrolat, 1863, p. 616.—Howe, 1952, p. 40.—Mroczkowski, 1954, p. 7; 1958, p. 4; 1962, p. 6; 1965, p. 668.—Zhantiev, 1963b, p. 421.

8. The dimensions of the printed page (4″ × 6¼″) should be kept in mind in the preparation of *illustrations*, which should be large enough to that details will be clear after reduction. All figures should be numbered consecutively, in the order of their mention in the text, with no distinction between text figures, plates, maps and photographs. All figures should be identified on the reverse side with the author's name and the figure number. The approximate places where figures are to be inserted in the text should be indicated by the author in the margin of the manuscript. *Legends* for figures should be typed, double spaced, on a separate sheet of paper.

9. *Tables* should be typed on separate sheets of paper, double spaced, and the places where they are to be inserted in the text indicated by the author in the margin of the manuscript. A brief title should be typed above each table, and tables should be numbered consecutively (with arabic numerals) in the order of their mention in the text.

10. The metric system should be used for all *measurements*. The *names* of authors of species and geographical names (except in journal titles) should not be abbreviated.

11. A page charge of $15.00 per printed page is assessed but may be reduced in the case of a member of the society who cannot obtain institutional or grant funds for publication. *Reprints* are not given gratis. They must be ordered from the printer at the time that proofs are returned. Extensive changes in *proofs*, other than correction of printer's errors, will be charged to authors.

ENTOMOLOGICA AMERICANA

THE ORTHOTYLINAE AND PHYLINAE (HEMIPTERA: MIRIDAE) OF SOUTH AFRICA WITH A PHYLOGENETIC ANALYSIS OF THE ANT-MIMETIC TRIBES OF THE TWO SUBFAMILIES FOR THE WORLD

RANDALL TOBIAS SCHUH

PUBLISHED BY THE
NEW YORK ENTOMOLOGICAL SOCIETY
INCORPORATING THE BROOKLYN ENTOMOLOGICAL SOCIETY

Vol. 47 February 27, 1974

The New York Entomological Society (incorporating the Brooklyn Entomological Society) publishes two journals: *Entomologica Americana* (irregularly, according to the availability of acceptable papers) and the *Journal of the New York Entomological Society* (quarterly). Monographs and longer papers (minimum length approximately 70 manuscript pages) are published in *Entomologica Americana.* Shorter papers may be submitted to the *Journal.* Manuscripts should be sent to the Editor, *Entomologica Americana,* Department of Entomology, The American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024.

Entomologica Americana was first published by the Brooklyn Entomological Society in April, 1885. Publication was suspended after six volumes, resumed in 1926, again suspended in 1964 with Volume 44, and resumed in 1969 with Volume 45. Since *Entomologica Americana* is published irregularly, subscription is by volume, not by year and costs $9.00 per volume. Correspondence regarding subscriptions and other non-editorial matters should be addressed to Publication Business Manager, New York Entomological Society, Department of Entomology, The American Museum of Natural History. Back issues may be purchased through Hafner Press, a Division of Macmillan Publishing Company, Incorporated, 866 Third Avenue, New York, New York, 10022.

Mailed February 27, 1974

Entomologica Americana is published for the Society by Allen Press, Inc., 1041 New Hampshire, Lawrence, Kansas 66044.

Vol. 46. No. 2 was published on August 8, 1973

Entomologica Americana
Vol. 47, 1973, pp. 1–332

THE ORTHOTYLINAE AND PHYLINAE (HEMIPTERA: MIRIDAE) OF SOUTH AFRICA WITH A PHYLOGENETIC ANALYSIS OF THE ANT-MIMETIC TRIBES OF THE TWO SUBFAMILIES FOR THE WORLD[1]

Randall T. Schuh[2]

Table of Contents

[1] Modified from a doctoral dissertation completed in the Biological Sciences Group, University of Connecticut, with support from grants from the National Science Foundation and the University of Connecticut Research Foundation.

[2] Current address: P. O. Box 518, Ferndale, California 95536.

ABSTRACT: This study is divided into two parts: 1) a faunal study of the Orthotylinae and Phylinae of South Africa; and 2) a phylogenetic analysis of the tribal classification of the two subfamilies for the world. Much new information on the relationships of these taxa is derived from the South African fauna.

In South Africa the Orthotylinae and Phylinae are represented by 54 genera, 20 of which are described as new, and 103 species, 81 of which are described as new. Of the genera occurring in South Africa, 15 percent of the Orthotylinae and 34 percent of the Phylinae are ant mimetic. Generic keys are presented for the Orthotylinae and Phylinae of Africa south of the Sahara; keys to the species are given for those genera occurring in South Africa.

A zoogeographic analysis reveals that the fauna of South Africa is composed of endemic, tropical African, Paleotropical, pantropical, and cosmopolitan elements. The endemic element is the largest and is concentrated in the Southwest Cape and along the Drakensberg Escarpment.

Three tribes are recognized in the Orthotylinae—the Halticini, the Nichomachini, new tribe, and the Orthotylini. The Pilophorini, which have been placed in the Orthotylinae by all previous authors, are moved to the Phylinae, in which four tribes are recognized—the Hallodapini, the Leucophoropterini, new tribe, the Phylini, and the Pilophorini. The classification of the Miridae is discussed briefly. A morphological description and discussion of the phylogenetic and zoogeographic relationships are presented for each tribe. A discussion of each included genus is given for the primarily ant mimetic tribes Nichomachini, Hallodapini, Leucophoropterini, and Pilophorini. In the remaining tribes only those genera which must be moved relative to their placement in the Carvalho System of Classification are discussed in detail.

INTRODUCTION

This study had its origin in 1967–1968 when I had the opportunity to spend nearly a year in the field in South Africa collecting and observing the Miridae of the area. It soon became evident that the South African fauna was not only large and varied, but very poorly known, and that it contained a number of elements, knowledge of which was fundamental to a more mature understanding of the phylogeny and zoogeography of the Miridae as a whole.

My decision to approach the work in the format presented here has been based on the following premises: 1) that the current bases for placing genera in the Phylinae and Orthotylinae were unsatisfactory; and 2) that the many ant-mimetic genera in the two subfamilies appeared to have been placed in the taxonomic hierarchy on the basis of shared mimetic characters of a superficial nature rather than on features of a more fundamental phylogenetic significance. Therefore, this paper is divided into two sections: a faunal and biological study of the Orthotylinae and Phylinae of South Africa with an analysis of the taxonomic relationships and distributions of the genera and species of the region; and an analysis of the phylogeny, taxonomy, and zoogeography of the ant-mimetic tribes and genera of the two subfamilies, not only for South Africa, but for the entire world.

The Orthotylinae and Phylinae are especially intriguing phylogenetically because 1) a relationship between the two subfamilies has been observed by most students of the Miridae (Reuter, 1905a; Slater, 1950; Wagner, 1955; Kelton, 1959b; Leston, 1961), but has never been carefully documented; 2) the subfamily Orthotylinae has for some time been known to contain a number of possibly unrelated elements (Slater, 1950; Kelton, 1959b), but these have never been comprehensively reviewed; and 3) large numbers of ant-mimetic genera occur in both subfamilies but the phylogenetic relationships among these genera and their relationships to non-mimetic genera are very poorly understood.

In South Africa two genera (15 percent) in the Orthotylinae and 14 genera (34 percent) in the Phylinae are ant mimetic. On a world basis approximately 20 (17 percent) of the orthotyline genera and 53 (24 percent) of the phyline genera are ant mimetic. This high proportion of mimetic genera in South Africa, particularly in the Phylinae, identifies the area as one of active ant-mimic evolution and one suitable for studies involving the phenomenon. In addition, the extremely diverse nature of the South African flora,

in light of the strong host plant specificity of the Miridae, enhances the area's attractiveness as one in which to develop a greater systematic knowledge of the Orthotylinae and Phylinae and to begin phylogenetic studies.

METHODS AND MATERIALS

Throughout this study I have employed standard taxonomic procedures. All measurements were taken with an ocular micrometer and are in millimeters. The line drawings were made with the aid of a squared grid at 150× using a Leitz binocular dissecting microscope and all are reproduced to the same scale. The phallus is illustrated in a lateral view with the phallobase to the left, unless otherwise indicated. Consistency of orientation was attained by viewing the phallobase laterally and superimposing the two sides of the bilaterally symmetrical structure. In almost all cases this presents the most useful view of the vesica for comparative purposes. In a few cases other views of the vesica are given where the conventional orientation does not show the most useful structural details. The left clasper and phallotheca in the Phylinae are all illustrated in a lateral perspective. The right clasper is always drawn in such a view as to expose the greatest surface area. Consistency of orientation is more difficult with the claspers of the Orthotylinae but the view is usually obvious or explained in the figure captions. The posterior wall and sclerotized rings of the females are drawn showing their orientation relative to the ovipositor valves. Where genitalic structures are similar for all species of a given genus the structures under consideration are illustrated for only one or a limited number of species. All photographic illustrations were made with a Wild M-4 photomicrographic apparatus at 12.5× on Kodak Panatomic-X 35 mm. film and reproduced to the same scale.

I have relied heavily on the Carvalho Catalogue of the Miridae of the World (Carvalho 1952a; 1958a, b; 1960). This invaluable work brings together taxonomic references on the Miridae up to 1955.

A list of taxa treated in the South African faunal study is given below. These names are often cited in abbreviated form elsewhere in the text to conserve space. For each of these taxa I have included a complete citation for the original description. For genera treated in detail in the tribal analysis, a complete citation is included only for those not included in the Carvalho Catalogue. No references

are given between the date of original description (if before 1955) and 1955 unless they pertain to new synonymy or were omitted from the Carvalho Catalogue. All South African locality data are listed in a somewhat abbreviated form, except in the case of new species where the holotype data are transcribed from the specimen labels as accurately as possible, with the exception of abbreviated words. Collectors are listed by surname in parentheses at the end of the locality data. If no collectors are listed and the dates are 1967–1968 the specimens were collected by J. A. Slater, M. H. Sweet, S. T. Slater, R. T. Schuh, and in some cases J. Munting. Abbreviations of collections where specimens are deposited are listed in parentheses at the end of the locality data.

All keys are strictly utilitarian and I have made no attempt to show phylogenetic relationships in them. Where possible, if a couplet breaks out a higher category, this is indicated. In many cases genera are keyed out more than once. I have tried to avoid the use of sexual characters or those that require dissections, but in some cases this has not been possible.

The graphs used to depict distributional patterns follow Wygodzinsky (1966). As in Wygodzinsky's work, the hatched boxes represent endemic genera and the numbered boxes indicate more widespread genera and show the number of faunal regions in which a genus occurs. Papua is included in the Oriental Region, because the very limited number of taxa known from that area appear to have their strongest affinities with the mainland Oriental fauna. The Ethiopian Region includes Africa south of the Sahara and Madagascar.

At the end of each tribal analysis is included a section entitled "Discussion of individual genera". For the Orthotylini, Halticini, and Phylini I have included only ant-mimetic genera or genera that must be moved from their position in the Carvalho classification; the latter are marked with an asterisk. A complete generic listing is given for the primarily ant-mimetic tribes Nichomachini, Hallodapini, Leucophoropterini, and Pilophorini. A terminal listing of genera *incertae sedis* and "misplaced genera" is also included for the Orthotylinae and Phylinae as defined in the Carvalho Catalogue.

The geographic area included in the South African faunal study encompasses the Republic of South Africa, Swaziland, Lesotho, and South West Africa. Some taxa from outside this area are discussed where they are either closely related to genera or species from South Africa or where it is probable that they may eventually be found there. They are placed at the end of the appropriate genus or tribe.

Data for this research were gathered from several sources. A large number of specimens were collected by J. A. Slater, M. H. Sweet, and myself from October 1967 to May 1968. During this time we worked intensively in most areas of South Africa except the arid western regions and South West Africa. The major additional sources of information for South Africa were the South African National Collection of Insects, Pretoria, the South African Museum, Cape Town, the Transvaal Museum, Pretoria, the Lund University Zoological Institute, Lund, Sweden, and the British Museum (Natural History), London.

Many Reuter and Poppius types important to this study are in the Helsinki Museum and I have relied heavily on this extremely valuable collection. Poppius (1914a; 1921) indicated that some of his type specimens were deposited in collections other than Helsinki. Most important were the Paris Museum and the Berlin-Humboldt Museum. I have determined, with the generous assistance of all curators concerned, that in fact most of the specimens which Poppius studied were never placed in the museums indicated. This was apparently a result of the outbreak of World War I. The specimens in question are all deposited in Helsinki and for the most part are in excellent condition. Where appropriate I have corrected Poppius' original statements and given the present location of the types. In many cases where original series of two, three, or four specimens were indicated, now only a single specimen can be found. The whereabouts of the remaining specimens are unknown, for I could not locate them after much searching. In all cases where I have been able to find only a single specimen of what was originally a co-type series of two or more specimens, I have designated the specimen as a lectotype.

Institutional and private collections from which I have borrowed material are listed below with the abbreviations used in the locality records in the text.

AMNH	American Museum of Natural History, New York
BM (NH)	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco, California
HM	Helsinki Zoological Museum, Helsinki, Finland
JAS	J. A. Slater Collection, University of Connecticut, Storrs, Connecticut

LU	Lund University Zoological Institute, Lund University, Lund, Sweden
PM	Museum National D'Histoire Naturelle, Paris, France
RTS	R. T. Schuh Collection
SAM	South African Museum, Cape Town, South Africa
SANC	South African National Collection of Insects, Pretoria, South Africa
TM	Transvaal Museum, Pretoria, South Africa
USNM	United States National Museum, Washington, D. C.

TERMINOLOGY

Cobben (1968) discussed pretarsal nomenclature in the Hemiptera and concluded on morphological grounds that the structures arising between the tarsal claws in the Miridae are not true arolia and proposed the use of the term *parempodia*. For pseudarolia Cobben used the term *pulvilli*. Goel and Schaefer (1970) came to the same conclusions as Cobben, apparently independently, for they did not cite him.

Although there is justification for the argument that use of the terms parempodia and pulvilli in the Miridae is unnecessary substitution for the long-standing terms arolia and pseudarolia (Knight, 1918), the arguments for the change seem stronger. Cobben (1968) noted that true arolia do exist in the Hemiptera, notably in the Amphibicorisae. If the term arolia is used in non-Amphibicorisan families, a new term will have to be coined for the true arolia. The term pseudarolia is used only in the Miridae to apply to apparently homologous structures called pulvilli in most groups. Little confusion should arise in the Miridae because the change involves only a simple substitution of terms and not a reevaluation of the morphology of the structures (see also discussion under *Paramixia*, below).

I have adopted the terminology of Kelton (1959b) for the male genitalia and that of Slater (1950) and Davis (1955) for the female genitalia. Other terminology is more or less standard in the modern hemipterological literature.

NOMENCLATURE

Although the Carvalho Catalogue of the Genera of Miridae of the World (Carvalho, 1952a) was issued long before the most recent International Code of Zoological Nomenclature (1964), the

subfamily and tribal names applied by Carvalho in the Orthotylinae and Phylinae are correct. Many of these names were changed before 1961 to agree with the oldest included genus. All have received general acceptance subsequently and therefore are valid under Article 40A of the Code.

I am considering publication of names in the Carvalho Catalogue (1958a, b) to represent introduction into the primary zoological literature. If this was not done many of the names published by Poppius (1914a) would have to be considered as forgotten under Article 23b of the Code or they would have to be referred to the International Commission. Most previously described taxa in this paper illustrate the general inapplicability of Article 23b, particularly in entomology, and I have therefore not strictly followed the Code on this point.

PART 1. THE ORTHOTYLINAE AND PHYLINAE OF SOUTH AFRICA

HISTORICAL REVIEW

The only monographic treatment of the Miridae of the Ethiopian Region is Poppius' "Die Miriden der Äthiopischen Region" (1912; 1914a). In this work Poppius detailed the knowledge of the Miridae of Africa, Madagascar, and the adjacent islands of the Atlantic and Indian Oceans. Previous to this only a handful of small papers had treated the African Miridae.

Poppius (1914a) recorded 41 genera, 19 of which were described as new, for the Orthotylinae and Phylinae south of the Sahara. From 1914 to 1955 only five new genera and 13 new species of Orthotylinae and Phylinae were described from Africa, and very little additional information was added to the literature regarding previously recorded species. With the inception of the work of T. R. Odhiambo in 1958, the status of the African Miridae began to change rapidly. From 1955 to 1971, nine new genera and 50 new species of Orthotylinae and Phylinae were described from Africa south of the Sahara. The total number of genera in these two subfamilies now recorded from Ethiopian Africa, including those described below, stands at 68.

The publication of the South African Animal Life Series beginning in 1955 has greatly increased our knowledge of many groups of animals in South Africa, and it is certainly the most significant contribution to South Africa entomology in recent years. Unfortunately the mirid chapter (Carvalho, et al., 1960) was based solely on the original Brinck and Rudebeck collections and is therefore

incomplete. The neglected nature of the South African fauna is revealed in the fact that previous to 1960 and the publication of the Miridae section of the South African Animal Life Series, only nine genera and nine species of Orthotylinae and Phylinae were recorded from the region. Carvalho, et al. (1960) recorded 11 genera, none of which were described as new, and 12 speices, one of which was described as new.

In the following treatment, of the 54 genera I record from South Africa, 20 (37%) are described as new and only 17 were previously recorded from the area. Of the 103 species, 81 (79%) are described as new and 14 were previously recorded from the region (species of *Orthotylus*, *Psallus*, and *Campylomma-Sthenarus* are not included in these figures). In addition, there are several apparently undescribed genera available in collections, but in all cases the material is either inadequate or its relationships too obscure to allow for description at the present time.

CHECKLIST OF GENERA AND SPECIES

Subfamily Orthotylinae
- Tribe Halticini
  - *Namaquacapsus*, new genus
    - *melanostethoides*, new species
  - *Nanniella* Reuter
  - *Halticus* Hahn
- Nichomachini, new tribe
  - *Nichomachus* Distant
    - *minutus*, new species
    - *rufescens*, new species
    - *sloggetti* Distant
    - *sweeti*, new species
  - *Pseudonichomachus*, new genus
    - *capeneri*, new species
    - *mimeticus*, new species
- Tribe Orthotylini
  - *Cyrtorhinus* Fieber
    - *melanops* Reuter
  - *Felisacodes* Bergroth
    - *bryocorina* (Poppius)
  - *Orthotylus*-complex
  - *Pseudambonea*, new genus
    - *capeneri*, new species
  - *Pseudoloxops* Kirkaldy
    - *transvaalensis*, new species

Pangania Poppius
fasciatipennis Poppius
chnous (Odhiambo), new combination, extralimital
Skukuza, new genus
slateri, new species
zeugma (Odhiambo), new combination, extralimital
Systellonotopsis Poppius
bifasciatus Poppius
Systellonotus Fieber
brincki, new species
Trichophorella Reuter
australis, new species
Trichophthalmocapsus Poppius
australis, new species
hessei, new species
pilosus Poppius, extralimital
pumilis (Odhiambo), new combination, extralimital
Aeolocoris Reuter, extralimital
alboconspersus Reuter
Boopidella Reuter, extralimital
fasciata Reuter
Diocoris Kirkaldy, extralimital
agalestus Kirkaldy
Leucophoropterini, new tribe
Karoocapsus, new genus
bifasciatus, new species
brunneus, new species
flavomaculatus, new species
middelburgensis, new species
obscurus, new species
occidentalis, new species
pulchrus, new species
trifasciatus, new species
Tytthus Fieber
parviceps (Reuter)
Tribe Phylini
Austropsallus, new genus
albonotum, new species
drakensbergensis, new species
helichrysi, new species
middelburgensis, new species
saniensis, new species
senecionus, new species
Brachycranella Reuter
viridipunctata (Stål)

Capecapsus, new genus
tradouwensis, new species
Coatonocapsus, new genus
johannsmeieri, new species
pallidus, new species
sweeti, new species
transvaalensis, new species
Denticulophallus, new genus
adenandrae, new species
Ellenia Reuter
obscuricornis (Poppius)
Eminoculus, new genus
drosanthemi, new species
hirsutus, new species
Lamprosthenarus Poppius
near *sjostedti* Poppius
Lasiolabopella, new genus
capeneri, new species
Lepidocapsus Poppius
rubrum, new species
Leptoxanthus Reuter
flavomaculatus Reuter
Macrotylus Fieber
hemizygiae, new species
niger, new species
Natalophylus, new genus
heteromorphae, new species
Odhiamboella, new genus
solani (Odhiambo), new combination
Parapseudosthenarus, new genus
buchenroederae, new species
Parasciodema Poppius
albocoxa, new species
nigrofemur, new species
nitens, Poppius
Plagiognathidea Poppius
Psallus Fieber
Pseudosthenarus Poppius
ater Poppius
grossus, new species
namaquaensis, new species
rozeni, new species
Sthenarus-Campylomma
nigricornis (Poppius) (*Sthenarus*), extralimital
Stoebea, new genus
barbertonensis, new species

elginensis, new species
plettenbergensis, new species
Widdringtoniola, new genus
kirstenboschiana, new species
Tribe Pilophorini
Aloea Linnavuori, (in press)
australis, new species
samueli, new species
Ambonea Odhiambo
munroi, new species
rustenbergensis, new species
Neoambonea, new genus
cynanchi, new species
slateri, new species
Parambonea, new genus
transvaalensis, new species
Paramixia Reuter
australis, new species
suturalis Reuter
Pilophorus Hahn
pilosus Odhiambo

KEY TO THE SUBFAMILIES OF MIRIDAE[1]

1. Ocelli present ..... Isometopinae
   Ocelli absent 2
2. Parempodia fleshy, convergent or divergent apically 3
   Parempodia hair like, parallel 4
3. Parempodia distinctly divergent apically; pronotal collar usually present, generally rounded and separated from the remainder of the pronotum by a furrow (see however Stenodemini) ..... Mirinae
   Parempodia convergent apically, usually recurved (lyre shaped); pronotal collar seldom present ..... Orthotylinae and Phylinae (in part)
4. Pulvilli present, sometimes large, but often small and difficult to see, either free except at base or less commonly adnate to claw over entire length 5
   Pulvilli absent; claws long and slender or strongly toothed basally; if claws strongly toothed, pronotal collar always present and rounded; if claws long and slender, pronotal collar either present or absent 7
5. Pulvilli arising from ventral surface of claws, usually small; tarsi linear; membrane with two cells ..... Phylinae (in part)
   Pulvilli arising from inner surface of claws, usually enlarged, flat-

[1] Modified from Carvalho (1955a). The Palauocorinae are not included. For figures of parempodia types see Carvalho (1955a), Knight (1923; 1941; 1968) and Wagner (1961).

tened, adnate to claw only at base; tarsi and membrane variable 6

6. Membrane with one cell; tarsi thickened distally ..... Bryocorinae
Membrane with two cells; tarsi linear ..... Dicyphinae

7. Claws strongly toothed basally; dorsum usually heavily punctate ..... Deraeocorinae
Claws not toothed basally, usually long and slender; dorsum punctate or impunctate ..... Cylapinae

KEYS TO THE GENERA OF ORTHOTYLINAE AND PHYLINAE OF AFRICA SOUTH OF THE SAHARA

The following keys are divided into three basic sections. The first deals with genera that have fleshy, apically convergent, recurved parempodia, and also genera with weakly fleshy parempodia that are slightly convergent apically; this includes the Orthotylinae, Pilophorini, and certain genera in the Phylini. The second section deals with those genera that have hair-like parallel parempodia and also genera with weakly fleshy convergent parempodia that are also included in the first section of the key; this includes only the Hallodapini, Leucophoropterini, and Phylini. The third section deals with brachypterous forms in the Orthotylinae and Phylinae. Those genera of the Orthotylinae and Phylinae known to occur in Africa south of the Sahara that are not included in the keys are *Atractotomus* Fieber, *Bibundiella* Poppius, *Brachycranella* Reuter, *Chaetocapsus* Poppius, *Dimorphocoris* Reuter, and *Leptoxanthus* Reuter; *Marmorodapus* Schmitz keys to *Trichophorella* Reuter. Genera that are followed by the name of the author are not generally treated in detail elsewhere in the paper.

Genera with convergent parempodia

1. Ant mimetic, brown or black, with light maculae or transverse fasciae on hemelytra, at least at base of cuneus; lateral corial margins always sinuate 2
Non-mimetic (see however *Pilophorus*), color variable, without distinct light maculae or fasciae; lateral corial margins only rarely sinuate 3

2. Pronotum strongly constricted just anterior to middle, posterior lobe tumid, anterior lobe narrow, neck-like (Fig. 7); scutellum without long erect hairs ..... *Pseudonichomachus*
Pronotum not strongly constricted near middle, posterior lobe tumid, anterior lobe short, not distinctly neck-like (Fig. 5); scutellum with a few long erect hairs ..... *Nichomachus*

3. Pronotum very heavily punctured; dorsum entirely black 4
Pronotum not heavily punctured; coloration of dorsum variable 5

4. Antennal segment 2 enlarged, spindle shaped, greater in diameter than segment one, densely covered with semierect stout hairs ..... *Millerimiris* Carvalho

   Antennal segment 2 cylindrical, not enlarged, diameter slightly less than that of segment one, with fine reclining pubescence ..... *Nanniella*

5. Entire body and all appendages with long erect black hairs; pronotum swollen posteriorly; cuneal incisure deep; red and black ..... *Namaquacapsus*

   Pubescence not as above; pronotum and color variable 6

6. Head short, wide, flattened anteroposteriorly, concave behind; posterior margin of vertex finely carinate, head tending to obscure anterior margin of pronotum 7

   Head not particularly short, flattened, or concave behind, posterior margin of vertex not finely carinate, head not obscuring anterior margin of pronotum 14

7. Lateral corial margins distinctly sinuate; hemelytra with a few transverse patches of sericeous appressed, scale-like hairs ..... *Pilophorus*

   Lateral corial margins never sinuate, either straight or convex; hemelytra never with transverse patches of scale-like hairs, although often with decumbent, sericeous, wooly hairs 8

8. Dorsum with single type of pubescence, without flattened or wooly hairs 9

   Dorsum with reclining setiform hairs and decumbent, sericeous, wooly hairs 10

9. Entirely black, including all appendages; antennal segment 2 about four-fifths width of head across eyes ..... *Parambonea*

   Not entirely black; antennal segment 2 subequal to width head across eyes ..... *Pseudambonea*

10. Antennal segment 2 distinctly laminate, broadest medially ..... *Druthmarus* Distant

    Antennal segment 2 cylindrical, not flattened 11

11. Relatively small species about 3.5 mm. long; basically cream colored; pronotum, apex of corium, and sometimes cuneus, red ..... *Aloea*

    Size variable; coloration never light with distinct red markings 12

12. Entirely black, excluding appendages ..... *Neoambonea*

    Body not entirely black 13

13. Abdominal venter with decumbent, wooly, sericeous hairs; vesica in male U-shaped, gonopore subapical (Fig. 318) ..... *Ambonea*

    Abdominal venter with only reclining setiform hairs, without wooly sericeous hairs; vesica forming nearly complete coil, gonopore apical (Figs. 332, 335) ..... *Paramixia*

14. Head convexly rounded behind eyes, eyes removed from anterior margin of pronotum by distance about equal to or greater than diameter of antennal segment 2 (Fig. 14); body elongate, flattened; hemelytra often hyaline or subhyaline 15

Head not convexly rounded behind eyes, posterior margin of eyes contiguous with anterior margin of pronotum or nearly so; body not particularly elongate or flattened; hemelytra seldom hyaline 19

15. Clavus usually with distinct row of punctures more or less parallel to claval suture (see however *Zanchiella sweeti* and *Z. ericae*) 16

Clavus without row of punctures as above 17

16. Antennal segment 1 about as long as width of head across eyes; all appendages very long ..... *Felisacodes*

Antennal segment 1 about as long as interocular space ..... *Zanchiella*

17. Antennal segment 1 longer than width of head across eyes, considerably enlarged, about three times diameter of segment 2, densely covered with stout hairs ..... *Uleana* Carvalho

Antennal segment 1 shorter than width of head across eyes, not greatly enlarged or more than one and a half times diameter of segment 2, without conspicuous stout hairs 18

18. Eyes set forward on head, removed from anterior pronotal margin by about half (or nearly so) diameter of eye (Fig. 19) ..... *Zanchius*

Eyes removed from anterior margin of pronotum by about diameter of antennal segment 2 (Fig. 9) ..... *Cyrtorhinus*

19. Antennal segment 1 about as long as width of interocular space plus one eye, distinctly enlarged, rather densely covered with erect or semierect often dark hairs about as long as diameter of segment; coloration usually red and white or almost entirely red ..... *Pseudoloxops*

Antennal segment 1 usually about as long as width of interocular space, only moderately enlarged, pubescence short, inconspicuous, reclining or decumbent; coloration variable 20

20. Clypeus, juga, and lora brown or black, highly polished, shining, strongly contrasting in texture and usually in coloration with remainder of head 21

Clypeus, juga, and lora not strongly contrasting with remainder of head in texture and coloration, although sometimes black and shining 22

21. Males elongate, lateral corial margins nearly straight; females ovate, brachypterous, hemelytra just covering abdomen; male genital capsule without ventral keel ..... *Capecapsus*

Ovate; lateral corial margins distinctly convex; both sexes macropterous; male genital capsule with keel ventrally ..... *Ellenia*

22. Small, length 3.0 mm. or less; body black; metafemora conspicuously enlarged; height of head below eyes greater than height of eye ..... *Halticus*

    Size and color variable, body never totally black; metafemora not conspicuously enlarged; height of head below eyes about two-thirds height of eye or less 23

23. Parempodia recurved (Orthotylinae); usually elongate, green, although sometimes red or brown; antennal segment 3 about two-thirds length of segment 2; usually over 3.5 mm. long ..... *Orthotylus* and *Pseudorthotylus* Poppius

    Parempodia not recurved (Phylinae); usaully ovate or under 3.5 mm. long; antennal segment 3 less than two-thirds length of segment 2 24

24. Dorsum with only reclining, black, setiform hairs; frons strongly convex ..... *Widdringtoniola*

    Dorsum with reclining setiform hairs and clumps of wooly sericeous hairs ..... *Stibaromma* Odhiambo

Genera with hair-like parallel parempodia

1. Pronotum often strongly narrowed anteriorly, often with a distinct flattened collar at least as wide as diameter of antennal segment 2 (see *Karoocapsus*); hemelytra usually dark with one or more light maculae or fasciae contrasting with basic coloration; often strongly ant mimetic; pulvilli always minute (Hallodapini, Leucophoropterini in part) 2

    Pronotum sometimes narrowed anteriorly and with flattened collar; if pronotal collar present, eyes substylate or stylate; hemelytra never with contrasting maculae or fasciae; seldom appearing ant mimetic; pulvilli usually minute, sometimes long and free apically or long and fused with claw (Phylini, Leucophoropterini) 24

2. Anterior pronotal margin finely carinate, upturned, not in the form of flattened collar; head, pronotum, and scutellum with reclining, dark, setiform hairs and appressed, flattened, sericeous, scale-like hairs (the latter are very easily rubbed off); usually with two or three yellow maculae strongly contrasting with dark hemelytra (Figs. 42–49) ..... *Karoocapsus*

    Anterior pronotal margin always in the form of flattened collar, at least as wide as diameter of antennal segment 2; vestiture of dorsum variable, never with appressed, scale-like, sericeous hairs; coloration variable, maculae or fasciae usually white if present 3

3. Vertex produced into spine above clypeus (Figs. 23, 24) ..... *Acrorrhinium*

    Vertex not produced into spine 4

4. Eyes set far forward on head, removed from anterior margin of pronotum by distance equal to at least diameter of eye (Figs. 36, 37, and 38) 5
   Eyes contiguous with anterior margin of pronotum or nearly so, not removed by more than distance equal to diameter of antennal segment one (Figs. 26, 30, and 39) 7
5. Scutellum produced into sharp spine about as high as pronotum ..... *Myombea*
   Scutellum flat or rounded, not produced into spine 6
6. Antennae inserted at about midpoint of anterior margin of eyes, fossae nearly contiguous with eyes ..... *Formicopsella*
   Antennae inserted below ventral margin of eyes, fossae removed from eyes by distance equal to diameter of antennal segment 1 ..... *Skukuza*
7. Hemelytra with at least one light macula or fascia contrasting with dark background; basic coloration never solid black 8
   Hemelytra without contrasiing maculae or fasciae or if with fascia then basic coloration solid black 20
8. Head concave behind; posterior margin of vertex carinate, produced posteriorly over pronotal collar; scutellum strongly protuberant (Fig. 25) 9
   Head either weakly convex behind forming short neck, or neck obsolete and posterior margins of eyes contiguous with anterior margin of pronotum; posterior margin of vertex not carinate (although sometimes with low rounded transverse ridge between eyes); scutellum sometimes protuberant 10
9. Gula with distinct longitudinal carina; gula at least as long as diameter of antennal segment one; southern Africa ..... *Carinogulus* (in part)
   Gula without carina; length of gula less than diameter of antennal segment one, buccal cavity sometimes contiguous with prosternum; northern Africa ..... *Glaphyrocoris* Reuter and *Hypomimus* Lindberg
10. Gula with distinct longitudinal carina; gula at least one and a half times length of diameter of antennal segment one; scutellum strongly protuberant; eyes removed from anterior margin of pronotum by distance about equal to diameter of antennal segment one; dorsum with some long, erect hairs ..... *Carinogulus* (in part)
    Gula without distinct carina, length variable; scutellum occasionally protuberant or spiniform; eyes either contiguous with or slightly removed from anterior margin of pronotum; dorsal vestiture variable 11
11. Head greatly elongated dorsoventrally; gula almost vertical, nearly as long as height of eye; hemelytral fascia broad laterally, narrowed mesially, forming transverse hourglass-shaped marking

on corium; metatibiae slightly to strongly flattened ..... *Diocoris* and *Gampsodema* Odhiambo

Head only moderately elongated dorsoventrally, length of gula less than one-half height of eye, or head not at all elongated and gula very short 12

12. Length of gula about one-half height of eye, gula nearly vertical ..... *Systellonotus*

Gula never longer than diameter of antennal segment one, often obsolete and buccal cavity contiguous with prosternum 13

13. Dorsum with long, erect hairs nearly as long or longer than diameter of antennal segment one, and with or without shorter decumbent hairs 14

Dorsum never with long, erect hairs although occasionally with short, erect hairs, and always with short, decumbent hairs 18

14. Species always with wing-edge stridulatory mechanism; lateral corial margin always lacking projecting hairs and possessing fine serrations (sometimes not visible even under high magnification); inner surface of metafemora pebbled or otherwise modified into stridulatory plectrum, always glabrous; at least metatibiae with very long spines 15

Species without wing-edge stridulatory mechanism; lateral corial margins usually with projecting hairs, always lacking serrations; inner surface of metafemora may be finely granulose, never distinctly pebbled or otherwise modified into stridulatory plectrum, usually with distinct pubescence; metatibiae without extremely long spines 17

15. Eyes of males very large (Figs. 33, 34), much larger than those of females, occupying nearly entire sides of head and reaching almost to bucculae; lateral corial margin distinctly sinuate; corium with single transverse fascia medially; metatibiae usually broadened medially, spindle-shaped ..... *Trichophthalmocapsus*

Eyes in males not extremely large, only slightly larger than those of females, genal area exposed; lateral corial margin and hemelytral markings variable; metatibia usually cylindrical 16

16. Scutellum in males usually spiniform; females brachypterous, pronotum strongly swollen, scutellum swollen, not spiniform as in males ..... *Laemocoris*

Scutellum in males more or less flat; females usually brachypterous, pronotum and scutellum not highly modified, similar in structure to males ..... *Hallodapus* (in part)

17. Small species, always less than 4.5 mm. long; posterior margins of eyes contiguous with anterior margin of pronotum ..... *Hallodapus* (in part)

Larger species, about 4.5 mm. long; posterior margins of eyes slightly removed from anterior margin of pronotum ..... *Systellonotopsis*

18. Eyes in males very large, occupying nearly entire sides of head and reaching almost to bucculae ..... *Boopidella*
    Eyes in males not extremely large, genal area exposed (eyes of females only slightly smaller that those of males) 19
19. Small species, always less than 4.5 mm. long ..... *Hallodapus* (in part)
    Larger species, at least 5.0 mm. long ..... *Pangania*
20. Basic coloration velvety black, sometimes with broad white hemelytral fascia ..... *Syngonus* Bergroth
    Basic coloration not black, usually light brown, often mottled 21
21. Slender bodied, ratio of total length to greatest width at least 3:1 ..... *Trichophorella*
    More heavy bodied than above, ratio of total length to width 2.75:1 or less 22
22. Antennal segment 3 longer than segment 2 ..... *Kapoetius* Schmitz
    Antennal segment 2 longer than segment 3 23
23. Metalegs, antennae, and most of dorsum marmorate ..... *Aeolocoris*
    Legs, antennae, and dorsum more or less solid color, hemelytra sometimes with a few light markings ..... *Azizus*
24. Eyes stylate, width of head across eyes nearly equal to or greater than width of posterior margin of pronotum; pronotum anteriorly with wide flat collar; black ..... *Eminoculus*
    Eyes not distinctly stylate, sometimes substylate; head rarely as wide as posterior margin of pronotum; pronotum never with flattened collar; color variable, but if eyes substylate never solid black 25
25. Dorsum heavily punctate; black 26
    Dorsum never heavily punctate; if black seldom highly polished; head rarely very short 27
26. Antennal segment 2 enlarged, greater in diameter than segment 1 ..... *Millerimiris* Carvalho
    Antennal segment 2 linear, of smaller diameter than segment 1 ..... *Lamprosthenarus*
27. Antennal segment 2 conspicuously enlarged distally, diameter about equal to or greater than diameter of segment 1 and of much greater diameter than that of segments 3 and 4 28
    Antennal segment 2 not conspicuously enlarged, seldom more than two-thirds diameter of segment 1, not more than 2 times diameter of segments 3 and 4 29
28. Antennal segment 2 thickened distally to about two times proximal diameter; black ..... *Rakula* Odhiambo
    Antennal segment 2 nearly uniformly thickened over entire length; reddish ..... *Lepidocapsus*
29. Eyes substylate, head transverse, width across eyes nearly as great as maximum width of pronotum; body densely covered with flattened, appressed, scale-like hairs 30

Eyes not substylate; dorsum, if at all, only partially covered with appressed, scale-like hairs, although sometimes rather densely covered with decumbent wooly pubescence 31

30. Antennal segment one short, cylindrical; antennae lacking scale-like hairs; tibiae without dark spines; coloration not entirely black, hemelytra with large light areas ..... *Lasiolabopella*

Antennal segment one long, increasing in diameter distally; antennae with scale-like hairs; tibiae with dark spines; black ..... *Lasiolabops* Poppius

31. Pulvilli enlarged, flattened, free from claw apically, reaching to about apex of claw; clypeus prominent 32

Pulvilli usually very small, occasionally enlarged and fused with nearly entire ventral surface of claw 33

32. Dorsum rather densely covered with semierect or reclining, dark, heavy, setiform hairs ..... *Denticulophallus*

Dorsum with only fine reclining hairs or with reclining hairs and decumbent wooly pubescence ..... *Macrotylus*

33. Head including eyes concave behind, vertex finely carinate; anterior margin of pronotum obscured by posterior margin of head; small species, under 3.5 mm. long, body ovoid ..... *Sthenarus-Campylomma*

Head and eyes either convex or only weakly concave behind; posterior margin of vertex sometimes finely carinate and obscuring anterior margin of pronotum; if species under 3.5 mm. long, head never concave behind and not obscuring anterior margin of pronotum; species usually over 4.0 mm. long, moderately elongate 34

34. Dorsum with two distinct types of pubescence, usually with reclining setiform hairs and decumbent, somewhat flattened, wooly, sericeous pubescence, or very seldom with some clumps of scale-like, appressed sericeous hairs 40

Dorsum with single type of pubescence, never with wooly sericeous hairs 35

35. Pulvilli large, fused with almost entire ventral surface of claw ..... *Parasciodema*

Pulvilli minute 36

36. Antennal segment 2 about 1.4 times as long as width of posterior margin of pronotum; elongate black species; labium just surpassing procoxae ..... *Natalophylus*

Antennal segment 2 equal to or less than width of posterior margin of pronotum; shape, color, and labial length variable 37

37. Small, light colored species; dorsum with reclining black hairs or inconspicuous light hairs 38

At least pronotum dark; vestiture usually conspicuous, never only of black hairs 39

38. Dorsum with only reclining, black, setiform hairs; frons convex, clypeus not visible from above; parempodia weakly fleshy, convergent apically ..... *Widdringtoniola*
Dorsum with decumbent, fine, light hairs; frons produced anteriorly, clypeus prominent as viewed from above; parempodia hair-like and parallel ..... *Plagiognathidea*
39. Ratio of length of head to width of head about 1:1.25; all femora light at least proximally ..... *Tytthus*
Ratio of length of head to width of head 1:4; all femora dark at least proximally ..... *Odhiamboella*
40. Head, pronotum, and scutellum (also mesepisterna and metepisterna) with flattened, appressed, sericeous, scale-like hairs; hemelytra mostly with reclining setiform hairs except for a few scale-like hairs along claval suture; antennal segment 2 at least as long as width of posterior margin of pronotum and up to 1.6 times pronotal width; elongate species, usually with yellow maculae contrasting with dark background, sometimes solid brown or with inconspicuous maculae (Figs. 42–49) ..... *Karoocapsus*
Dorsum including hemelytra usually rather densely covered with decumbent, sericeous, wooly hairs and semierect or reclining setiform hairs, never with scale-like hairs as above; length of antennal segment 2 and coloration variable 41
41. Small, 3.5 mm. long or less; light colored with variable markings (Fig. 82); labium very long, reaching to middle of abdomen; antennal segment 2 at least as long as width of posterior margin of pronotum ..... *Stoebea*
Usually over 3.5 mm. long; coloration either light or dark, if light usually with many dark spots on dorsum or unicolorous and labium reaching to or surpassing mesocoxae; if dark usually brown or black, unicolorous and labium short, reaching only slightly past procoxae at most; length of antennal segment 2 variable 42
42. Labium short, not or only slightly exceeding posterior margin of procoxae; brown or black 43
Labium long, surpassing mesocoxae; usually light with heavily spotted dorsum; if labium just surpassing procoxae, clypeus, juga, and lora black, highly polished 45
43. Clypeus, juga, and lora at and below level of antennal bases black or dark brown, highly polished, shining, remainder of head dull or only weakly shining; parempodia weakly fleshy, convergent apically ..... *Capecapsus*
Clypeus, juga, and lora not highly polished or differing in texture from remainder of head; parempodia hair-like, parallel 44
44. All tibiae and antennae black; male genitalia as in Figs. 289–292 ..... *Parapseudosthenarus*

All tibiae light with black spines with black bases; male genitalia as in Figs. 293–312 ..... *Pseudosthenarus*

45. Clypeus, juga, and lora at and below level of antennal bases, black, highly polished, contrasting with remainder of head 46
Clypeus, juga and lora unicolorous with surrounding areas of head and of same texture 47

46. Parempodia hair-like, parallel; vesica of male usually forming a loop (Figs. 238, 241–243); dorsum usually with heavy black setiform hairs; females brachypterous; male genital capsule without ventral keel ..... *Coatonocapsus*
Parempodia weakly fleshy, convergent apically; vesica in male not forming a loop (Fig. 248); dorsum with fine, dark, setiform hairs; females macropterous; male genital capsule with ventral keel ..... *Ellenia*

47. Membrane marmorate; antennal segment 2 enlarged distally, clavate ..... *Anapsallus* Odhiambo
Membrane not marmorate, unicolorous or cells differing in coloration from remainder of membrane; antennal segment 2 linear or nearly so, not clavate 48

48. Large species, macropterous forms over 4.0 mm. long; dorsum with long, semierect setiform hairs; females occasionally brachypterous; parempodia hair-like, parallel ..... *Austropsallus*
Smaller species, less than 4.5 mm. long; dorsum with reclining, relatively short, setiform hairs; females macropterous; parempodia often slightly fleshy and weakly convergent apically 49

49. Wooly, sericeous hairs on dorsum in distinct patches; vesica long, forming complete loop ..... *Stibaromma* Odhiambo
Wooly sericeous hairs on dorsum (sometimes absent) more or less uniformly distributed; vesica short (e.g., Fig. 248) ..... *Psallus*

Genera with submacropterous and brachypterous forms

1. Hemelytra greatly reduced, about the same length as pronotum or less, covering only base of abdomen (Figs. 6 and 37); ant mimetic 2
Hemelytra reduced, either just covering abdomen or covering about half of abdomen, but never less than one and a half times length of pronotum (Figs. 32, 57, and 61); ant mimetic or not 4

2. Eyes removed from anterior margin of pronotum by distance greater than diameter of eye; anterior lobe of pronotum small ..... *Skukuza*
Eyes contiguous with anterior margin of pronotum; anterior lobe of pronotum variable 3

3. Scutellum swollen, protuberant; parempodia fleshy, convergent apically, recurved ..... *Nichomachus*
Scutellum flat, not swollen; parempodia hair-like, parallel ..... *Karoocapsus*

4. Hemelytra covering about half of abdomen, often truncate posteriorly (Figs. 24 and 65); sometimes ant mimetic 5
   Hemelytra just covering abdomen, often appearing fully winged in absence of comparison with macropterous forms (Fig. 57) 9
5. Eyes stylate, head conspicuously produced laterally beyond anterolateral angles of pronotum; shining black; coleopteroid ..... *Eminoculus*
   Eyes not stylate although may be protuberant; not entirely black; not coleopteroid 6
6. Frons with distinct spine projecting over clypeus (Fig. 24) ..... *Acrorrhinium*
   Frons without spine as above 7
7. Eyes removed from anterior margin of pronotum by distance equal to at least diameter of eye; ant mimetic ..... *Formicopsella*
   Eyes contiguous with anterior margin of pronotum 8
8. Pronotum with posterior lobe strongly swollen, elevated high above hemelytra; scutellum swollen ..... *Laemocoris*
   Pronotum with posterior lobe not strongly swollen; scutellum nearly flat (Fig. 32) ..... *Hallodapus*
9. Labium short, not or only slightly exceeding procoxae 10
   Labium long, reaching at least to mesocoxae, occasionally to middle of abdomen 12
10. Clypeus, juga, and lora nearly black, highly polished, contrasting with dull surface of remainder of head; parempodia weakly fleshy, convergent apically ..... *Capecapsus*
    Clypeus, juga, and lora not strongly contrasting with remainder of head in color and surface texture; parempodia hair-like and parallel 11
11. Tibiae light with black spines with black bases ..... *Pseudosthenarus*
    Tibiae black with black spines ..... *Parapseudosthenarus*
12. Clypeus, juga, and lora black, highly polished, shining, strongly contrasting with remainder of head ..... *Coatonocapsus*
    Clypeus, juga, and lora neither black nor strongly shining, not contrasting with remainder of head in color and surface texture 13
13. Antennae with numerous erect, black hairs about three times as long as diameter of segment on which they occur ..... *Austropsallus*
    Antennae without long, erect, black hairs 14
14. Hemelytra cream, pronotum, scutellum, and macula at cuneal fracture red; parempodia fleshy, convergent apically, recurved ..... *Aloea*
    Dorsum generally light with reddish, greenish, or brownish markings; parempodia hair-like and parallel ..... *Stoebea*

SUBFAMILY ORTHOTYLINAE
TRIBE HALTICINI

Namaquacapsus, new genus

MACROPTEROUS MALE: Robust; entire dorsum, thoracic pleura, abdominal venter, femora, and tibiae densely covered with erect black hairs about two and a half times as long as tibial diameter; antennal segment one with a few, erect, fine spines, segments 2, 3, and 4 with short reclining pubescence and a few long, erect, black hairs; labium with short erect hairs.

Head short, deflexed; eyes weakly granular, about half height of head; frons convex between antennal bases; antennal segment one moderately enlarged, swollen medially, segment 2 with proximal half narrow, distal half enlarged to about one and a half times diameter of proximal half, approaching diameter of segment one, segments 3 and 4 subequal in diameter (4 missing in holotype), slightly less than proximal diameter of segment 2; clypeus large, flattened dorsally, rounded ventrally; bucculae narrow; buccal cavity large, broad; gula about half length of distal diameter of antennal segment 2; pronotum with flattened collar about as wide as proximal diameter of antennal segment 2; lateral pronotal margins nearly straight posteriorly, broadly rounded anteriorly; calli obsolete; pronotum with anterior lobe short, depressed behind collar, posterior lobe elevated, inflated, mesoscutum obscured by pronotum; scutellum strongly convex, clavi steeply declining laterally from scutellum and commissure; corium rounded transversely, lateral margins strongly convex; cuneal incisure very deep, fracture perpendicular to longitudinal axis of body; cuneus strongly convex laterally; membrane with two cells; tibiae without rows of tiny, closely spaced spines; tarsal claws relatively short, weakly curved; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MALE GENITALIA: Figures 100, 101. Vesica membranous.

Female unknown.

TYPE SPECIES: *Namaquacapsus melanostethoides*, new species.

This genus is named for Namaqualand, the region of the type locality of *Namaquacapsus melanostethoides*.

Namaquacapsus is placed in the Halticini because of the flattened pronotal collar, dorsoventrally elongated head, dark coloration, and the structure of the male genitalia. The genus appears to be most closely related to *Orthocephalus* Fieber, from Europe and the Mediterranean, by virtue of the heavy vestiture and body

shape. *Namaquacapsus* shows specialized features within the Halticini, particularly in the type of vestiture and the reddish coloration of the hemelytra; the former condition may be an adaptation to an extremely arid environment.

Namaquacapsus melanostethoides, new species
Figures 1, 100, 101

MACROPTEROUS MALE: Basic coloration deep castaneous; anterior two-thirds and apex of corium and anterior two-thirds of cuneus red.

Head, pronotum, scutellum, antennae, labium, legs, and abdominal venter polished, shining; remainder of body, including anterior lobe of pronotum dull; eyes glabrous.

Posterior margin of vertex nearly straight, with broad rounded carina; antennae removed from margins of eyes; labium just surpassing mesocoxae; pronotum with anterior margin sinuate, posterior margin straight across mesoscutum, broadly rounded laterally; abdomen reaching to apex of corium; metatarsal segments 1 and 3 subequal in length, segment 2 about two-thirds length of segment 3.

MEASUREMENTS: Total length 5.36, maximum width 2.16, length head .60, width head .76, interocular space .60, length pronotum 1.00, width pronotum 1.92, length scutellum .64, width scutellum .96, length corium 2.36, length clavus 2.00, length cuneus 1.04, width cuneus .92, length claval commissure 1.04, distance apex commissure-apex membrane 2.36, length metatibia 1.92; length antennal segments 1—.32, 2—1.30, 3—.88, 4—.38 (from paratype); length labial segments 1—.42, 2—.42, 3—.20, 4—.40.

MALE GENITALIA: Figures 100, 101.

HOLOTYPE: Macropterous male, SOUTH AFRICA: *Cape Province*, Kamieskroon, Namaqualand, Museum Staff, Sept. 1930 (SAM).

PARATYPE: 1 macropterous male, same data as holotype (RTS).

This species is named for its similarity to *Melanostethus* Stål (Lygaeidae) in general coloration.

Namaquacapsus melanostethoides can be recognized by its dark red and almost black coloration and extremely long, dense, black pubescence.

No host or ecological data are available.

Nanniella Reuter

Nanniella Reuter, 1904, p. 6.

Nanniella was described by Reuter (1904) for a single species, *N. chalybea* Reuter, from Kinshasa; Poppius (1914a) added *N. reuteri* Poppius from "Nyassa." Both authors placed the genus in the Halticini. *Nanniella* was synonymized with *Falconia* Distant by Carvalho (1952a), but no explanation was given for the action. Comparison of type specimens of *F. poetica* Distant, the type species of the genus, from South America, and *Nanniella* from Africa, indicates that there is indeed a very close superficial resemblance between the two genera. However, a careful examination reveals that in fact they are much less closely related than general facies would indicate. The parempodia in both *Falconia* and *Nanniella* are apically convergent and recurved. The female genitalia, however, are diagnostic for the two genera: in *Falconia* the posterior wall possesses well developed K-structures characteristic of the Orthotylini; in *Nanniella* the posterior wall is a simple sclerotized plate and lacks K-structures, a feature which in combination with the convergent parempodia suggests that the genus belongs to the Halticini. Additional characters supporting this tribal placement for *Nanniella* are: the solid black coloration; the flattened, rather broad, pronotal collar; the club-shaped right clasper; the simple membranous vesica; and the dorsoventrally elongated head. *Nanniella* does not have noticeably enlarged hind femora, which are characteristic of most members of the Halticini.

Nanniella can be recognized by its heavily punctate, shining, black dorsum, vertical head with protuberant eyes removed from the anterior margin of the pronotum, and flattened pronotal collar. It is most closely related to *Acratheus* Distant from India, which is also heavily punctate on the dorsum. *Acratheus* has a light cuneus and membrane whereas in *Nanniella* the entire dorsum is black.

The available material suggests that several closely related species of *Nanniella* are present in Africa. Three specimens are known from South Africa which agree generically with the type series of *N. chalybea* deposited in the Musee Royal de l'Afrique Central, and a specimen identified by Poppius as *chalybea* in the Helsinki Museum which is from Kinshasa. A male from Sarnia, Natal (Fig. 2), deposited in the British Museum (Natural History), and a female from Umkomaas, Natal, deposited in the South African National Collection of Insects, have completely brown antennae and a band of dense wooly hairs immediately posterior to the pro-

notal collar. A female from Albert Falls, Umgeni River, Natal, deposited in the Lund University Collection (see Carvalho, et al., 1960), has dark antennae, but lacks the band of wooly hairs on the pronotum and has distinctly brown tibiae, whereas in other specimens from South Africa the tibiae are light. Specimens of *N. chalybea* from Kinshasa, Congo, have the first antennal segment light and lack the band of wooly hairs on the pronotum.

At the present time it seems undesirable to assign names or describe new species until a careful study of *Nanniella* and *Acratheus* is undertaken.

Halticus Hahn

Halticus Hahn, 1832, p. 113.

Only two species of the cosmopolitan genus *Halticus* are currently recorded from Africa (Carvalho, 1958b). A male specimen from Satara Camp, Kruger National Park, Transvaal, deposited in the J. A. Slater Collection, probably represents a new species. It has the second antennal segment about three times as long as the first, the femora generally black, and the posterior margin of the vertex narrowly white.

NICHOMACHINI, new tribe

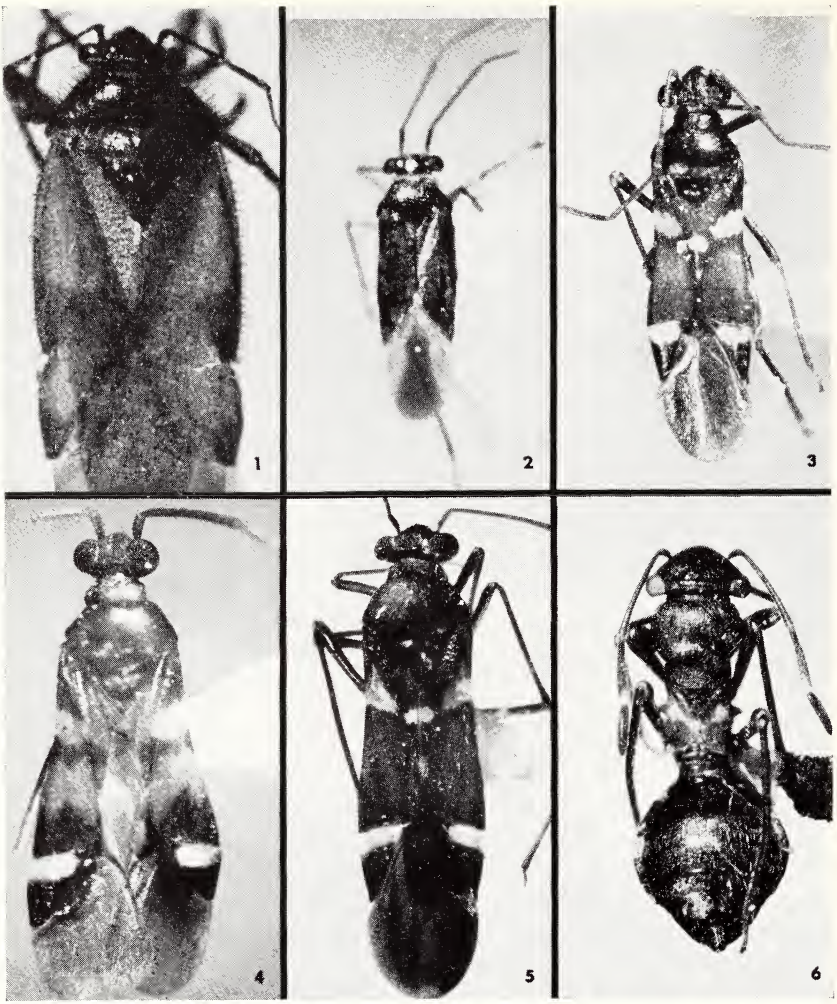
Nichomachus Distant

Nichomachus Distant, 1904a, p. 104.

Nichomachus can be characterized by the following redescription of the genus.

MACROPTEROUS MALE: Elongate, ant mimetic; head, pronotum, and scutellum granulose or rugulose, dull or weakly shining; corium and clavus mostly pruinose; basal fifth of corium and clavus, cuneus, cell of membrane, legs, and venter polished, shining; pronotum, scutellum, cuneus, femora, and antennal segment 1 with short, decumbent, sericeous hairs; scutellum, clavus, and corium with a few long, erect, shining hairs; antennal segments 2, 3, and 4 with dense short vestiture; tibiae with a few semierect spines about as long as tibial diameter.

Head nearly vertical, concave behind; vertex depressed between eyes, posterior margin carinate; frons transversely rugose, weakly convex, with faint longitudinal sulcus; eyes large, occupying entire sides of head; antennae inserted just above ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 slightly enlarged,



FIGS. 1–6. Halticini, Nichomachini. Fig. 1. *Namaquacapsus melanostethoides,* male, holotype. Fig. 2. *Nanniella* near *chalybea*, male (Sarnia, Natal). Fig. 3. *Nichomachus minutus*, male, holotype. Fig. 4. *Nichomachus rufescens*, male, holotype. Fig. 5. *Nichomachus sweeti*, male, holotype. Fig. 6. *Nichomachus sweeti,* female (Schoemannspoort, Cape Province).

segments 2 and 3 subequal in diameter, about three-fourths diameter of segments 1 and 4; labium just surpassing posterior margin of metasternum; pronotum with anterior lobe about one-fifth length of entire pronotum, forming poorly defined neck, anterior margin carinate, upturned, posterior lobe tumid; mesoscutum inclined anteriorly; scutellum strongly inflated, bulbous; lateral corial margins weakly sinuate, reflexed ventrally on anterior half, cuneal incisure obsolete; membrane with two cells; abdomen long, slender, just surpassing apex of cuneus; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MALE GENITALIA: Figures 96, 97. Left clasper long, slender, with a barb apically, basal lobe with spine formed of long, stiff, erect hairs; left clasper situated as in Figure 93A; right clasper extremely small, lanceolate; vesica membranous, with minute spines.

BRACHYPTEROUS FEMALE: See *Nichomachus sweeti.*

FEMALE GENITALIA: Figures 98, 99. Ring glands very small, contorted; posterior wall a simple sclerotized plate, oriented cephalocaudad.

Nichomachus is most closely related to *Pseudonichomachus*, but can be separated from it by the form of the anterior lobe of the pronotum, which is short in the former and long and neck-like in the latter. Distant (1904a) related *Nichomachus* to *Systellonotus*. Carvalho (1952a) placed the genus in the Pilophorini. The structure of the male and female genitalia and the type of sexual dimorphism in *Nichomachus* show no close relationship to the Pilophorini or *Systellonotus*, but suggest that the genus belongs to a distinct evolutionary line within the Orthotylinae. I have therefore placed it in a new tribe with several other Ethiopian genera (see tribal classification below).

A brachypterous female from Swartberg Pass, 25 miles north of Oudtshoorn, Cape Province and deposited in the J. A. Slater Collection, may be congeneric with *Nichomachus*. This specimen has an hourglass-shaped pronotum which is, however, very much different from the pronotum of *N. sweeti*. An additional female specimen from Mkuze Game Reserve, Natal, which is deposited in the J. A. Slater Collection, also appears to be related to *Nichomachus*. It is submacropterous, with only the connexival region of the dorsally flattened abdomen being exposed. The head is very similar in structure to that of *N. sweeti*, but the pronotum is hourglass-shaped, and similar in structure to that of the abovementioned female from the Swartberg Pass.

The four described species of *Nichomachus* are all from South-

ern Africa. The genus does not seem to be associated with the tropical African vegetative element but with the Southwest Cape related flora.

KEY TO MACROPTEROUS SPECIMENS OF *Nichomachus*

1. Dorsum mostly red or reddish brown, except for white hemelytral maculae 2
   Dorsum nearly uniform dark brown or black except for white hemelytral maculae 3
2. Scutellum dark brown, contrasting with reddish pronotum and corium; clavi with white transverse macula at about midpoint of claval commissure ..... *sloggetti*
   Scutellum unicolorous with pronotum and corium; clavi without white macula ..... *rufescens* (Fig. 4)
3. Large black species, 4.80 mm. long; distal fifth of antennal segment 3 usually white ..... *sweeti* (Fig. 5)
   Smaller, dark brown species, 4.24 mm. long; antennal segment 3 unicolorous brown ..... *minutus* (Fig. 3)

Nichomachus minutus, new species

Figure 3

MACROPTEROUS MALE: Basic coloration dark brown or castaneous; most of corium and clavus lighter brown than remainder of body; membrane smoky brown; hemelytra with white macula on basal third of corium, on calvi at about midpoint of claval commissure, and on basal third of cuneus; posterior margin of metepisternum white; scutellum and cuneus strongly shining.

MEASUREMENTS: Total length 4.24, maximum width 1.14, length head .36, width head .80, interocular space .34, length pronotum .70, width pronotum .98, length scutellum .46, width scutellum .46, length corium 1.74, length clavus 1.16, length cuneus .60, width cuneus .44, length claval commissure .76, distance apex commissure-apex membrane 1.78, length metatibia 1.80, length antennal segments 1—.30, 2—1.02, 3—.80, 4—.62; length labial segments 1—.36, 2—.24, 3—.52, 4—.42

MALE GENITALIA: Basic structure as in *N. sweeti.*

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province,* 4 mi. W. Gydo Pass summit, N. of Ceres, 26 Jan. 1968, J. A. & S. Slater, T. Schuh, M. H. Sweet (SANC).

This species is named for its relatively small size.

Nichomachus minutus most closely resembles *N. sweeti* but is much smaller and is generally brown rather than black.

The type locality was a dry sandy wash with macchia vegetation.

Nichomachus rufescens, new species
Figure 4

MACROPTEROUS MALE: Basic coloration bright brownish orange; corium at level of apex of scutellum with broad, transverse, transparent band; corium with complete, brown, transverse fascia contiguous with posterior margin of transverse band above; basal two-fifths of cuneus white, apical three-fifths castaneous; membrane light smoky brown; abdomen yellowish basally, castaneous apically; antennal segments 1 and 2 and metafemur only appendages present on holotype.

MEASUREMENTS: Total length 4.80, maximum width 1.22, length head .38, width head .92, interocular space .26, length pronotum .74, width pronotum 1.22, length scutellum .64, width scutellum .72, length corium 2.20, length clavus 1.68, length cuneus .80, width cuneus .48, length claval commissure .68, distance apex commissure-apex membrane 2.26; length antennal segments 1—.36, 2—1.42, 3—?, 4—?; length labial segments 1—.52, 2—.56, 3—.42, 4—.56.

MALE GENITALIA: Basic structure as in *N. sweeti*.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Bulshoek, Clw., S.A.M., 12–56 (SAM).

This species is named for its reddish coloration.

Nichomachus rufescens is most similar to *N. sloggetti* and also resembles *Pseudonichomachus capeneri*. The absence of the white transverse macula on the posterior portion of the clavus in *rufescens* will separate it from *sloggetti*. The generic differences in the shape of the pronotum will separate *rufescens* from *P. capeneri*.

Nichomachus sloggetti Distant

Nichomachus sloggetti Distant, 1904a, p. 104.

Distant's original description from a single macropterous male and the preceding key will distinguish *N. sloggetti* from congeneric species. The coloration of *sloggetti* is very similar to that of *N. rufescens* and also resembles closely that of *Pseudonichomachus capeneri* (see *rufescens* discussion).

MALE GENITALIA: Basic structure as in *N. sweeti*.

Only two male specimens of *N. sloggetti* are known: the holotype from Deelfontein, Cape Province, deposited in the British Museum (Natural History), and an individual from Zomerkomst, Politzi, Transvaal, 23.X.64, deposited in the South African National

Collection of Insects. A large number of species from the South African National Collection of Insects (see e.g. *Karoocapsus*) are known from Middelburg, Cape Province, and also from Zomerkomst, Politzi, Transvaal. These localities are very different floristically (Acocks, 1951), and there is some question about the accuracy of labeling. The occurrence of *N. sloggetti* in Deelfontein and Middelburg, would be more logical than in Deelfontein and Politzi because of the greater similarity of available habitats at Middelburg and Deelfontein. This situation merits further investigation to be sure that distributions within South Africa are not being interpreted incorrectly.

Nichomachus sweeti, new species

Figures 5, 6, 96–99

MACROPTEROUS MALE: Body generally black or nearly so; hemelytra with white maculae on basal third of corium, on clavi at about midpoint of claval commissure, and on basal third of cuneus; posterior margin of metepisternum white; distal sixth of antennal segment 3 yellow.

MEASUREMENTS: Length 4.80, maximum width 1.36, length head .34, width head .92, interocular space .34, length pronotum .82, width pronotum 1.16, length scutellum .52, width scutellum .56, length corium 2.14, length clavus 1.40, length cuneus .66, width cuneus .54, length claval commissure .90, distance apex commissure-apex membrane 2.24, length metatibia 2.10, length antennal segments 1—.26, 2—1.10, 3—.80, 4—.60; length labial segments 1—.40, 2—.42, 3—.40, 4—.44.

MALE GENITALIA: Figures 96, 97. See generic description.

BRACHYPTEROUS FEMALE: Strongly ant-mimetic, brachypterous; black; transverse fascia at level of apex of scutellum, posterior margin of hemelytra laterally, posterior margin of metepisternum, metacoxae distally, and antennal segment 3 white.

Entire body granulose or rugulose, weakly shining, with scattered, short, decumbent, shining hairs; abdomen also with scattered, long, erect, shining hairs; scutellum with several long, erect, shining hairs; antennae, tibiae, and tarsi with decumbent shining hairs.

Head broad, concave behind, frons convex; eyes small; posterior margin of vertex slightly concave and broadly carinate; antennal segment 1 only very slightly enlarged, segment 2 tapering distally to slightly less than diameter of segment 1, segments 3 and 4 subequal in diameter, slightly greater than diameter of segment 1;

antennae inserted just below eye and mesad of eye by distance nearly equal to length of antennal segment 1; labium just surpassing metacoxae; pronotum with narrow depressed collar, anterior lobe greatly swollen, posterior lobe about one-quarter length of anterior lobe, collar-like, posterior margin straight; mesoscutum strongly inclined anteriorly; scutellum inflated, nearly conical; hemelytra undifferentiated, lateral margins nearly straight, posterior margin sinuate, posterolateral angles forming acute projections; abdomen narrow basally, greatly expanded medially, pointed apically; all femora swollen distally; metatibiae bowed.

MEASUREMENTS: Total length 4.48, maximum width 1.60, length head .32, width head 1.08, interocular space .66, length pronotum .94, width pronotum .95, length scutellum .32, width scutellum .44, length hemelytra .90, length metatibia 2.10, length antennal segments 1—.28, 2—1.00, 3—.68, 4—.62; length labial segments 1—.50, 2—.50, 3—.40, 4—.56.

FEMALE GENITALIA: Figures 98, 99. See generic description.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province,* Schoemannspoort, 10 mi. N. of Oudtshoorn, elevation 1200 ft., 18 Nov. 1967, M. H. Sweet (SANC).

PARATYPES: *Cape Province*—3 macropterous ♂♂, 2 brachypterous ♀♀, same data as holotype; 1 macropterous ♂, Cape Peninsula, Noordhoek Beach, 23 Jan. 1968 (JAS, RTS).

This species is named for Dr. Merrill H. Sweet, of Texas A. & M. University, who collected most of the known specimens.

Nichomachus sweeti most closely resembles *N. minutus* but can be recognized by its larger size and much darker coloration.

The resemblance of the female of *N. sweeti* to species of *Crematogaster* ants from both Schoemannspoort and Noordhoek Beach is remarkable. The Noordhoek Beach specimen of *sweeti* was taken under *Helichrysum crispum* (L.) D. Don. (Compositae).

Pseudonichomachus, new genus

MACROPTEROUS MALE: Ant mimetic; head, pronotum, and scutellum smooth, weakly shining; anterior two-thirds of clavus, adjacent corium, cuneus, and cell of membrane strongly shining; remainder of corium pruinose; membrane dull; dorsum with scattered, decumbent, short hairs; antennae with dense short vestiture; tibiae with scattered semierect spines about as long as tibial diameter.

Head nearly vertical, concave behind; frons weakly convex, transversely rugose, longitudinally sulcate; posterior margin of vertex with low, broad carina; eyes occupying entire sides of head;

antennae inserted just above ventral margin and very close to eyes; antennal segment 1 slightly swollen, segments 2, 3, and 4 subequal in diameter, slightly less than diameter of segment 1; labium reaching or just surpassing mesocoxae; pronotum strongly constricted just anterior to middle, with narrow depressed collar, anterior lobe about two-thirds width of head, neck-like, posterior lobe inflated, nearly hemispherical; mesoscutum inclined anteriorly; scutellum bulbous; lateral corial margin strongly sinuate, anterior half strongly reflexed ventrally; clavus raised along commissure to nearly height of scutellum; cuneal incisure obsolete; membrane with single cell; abdomen narrow, reaching almost to apex of membrane; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MALE GENITALIA: Figures 93A–95. Basic structure as in *Nichomachus*.

Females unknown.

TYPE SPECIES: *Pseudonichomachus mimeticus*, new species.

This genus is named for its close relationship to *Nichomachus*.

Pseudonichomachus differs from *Nichomachus* by the former having a much longer, more neck-like, anterior pronotal lobe than the latter.

Both known species of this genus are from South Africa and are ground living.

Pseudonichomachus capeneri, new species

Figure 7

MACROPTEROUS MALE: Basic coloration reddish brown; apex of clavus, anterior quarter of corium, legs, antennae, and labium weakly castaneous; cuneus deep castaneous; abdomen light basally, castaneous apically; membrane smoky gray brown; hemelytra with white transverse maculae on anterior third and posterior third of corium, on basal quarter of cuneus, and on clavus at about midpoint of claval commissure; posterior margin of all epistrena above coxae and distal margin of all trochanters white.

Head and pronotum rather strongly shining.

Vertex slightly depressed between eyes, labium reaching to middle of mesocoxae; all appendages except antennal segments 1 and 2 and mesofemora and metafemora and tibiae missing in holotype.

MEASUREMENTS: Total length 4.80, maximum width 1.24, length head .38, width head 1.00, interocular space .24, length pronotum .88 (anterior lobe .28, posterior lobe .60), width pronotum 1.24, length scutellum .78, width scutellum .78, length corium 2.00, length clavus 1.60, length cuneus .82, width cuneus .50, length

claval commissure .66, distance apex commissure-apex membrane 2.12, length metatibia 2.18, length antennal segments 1—.32, 2—.96, 3—?, 4—?; length labial segments 1—.34, 2—.34, 3—.40, 4—.44.

MALE GENITALIA: Basic structure as in *P. mimeticus.*

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal,* Elandshoek II.1956, A. L. Capener (SANC).

PARATYPES: *Transvaal*—2 macropterous ♂♂, Zoutpansberg District, Khalarha District, 3700 ft., 23. iv. 1954, at light, very open bush and grass veld (Balfour-Browne) (BM[NH]).

This species is named for Mr. A. L. Capener of Pretoria, who has been one of the most active collectors of Miridae in South Africa over the last two decades and has therefore made available for this study a tremendous amount of invaluable material.

Pseudonichomachus capeneri can be separated from *P. mimeticus,* the only other described species in the genus, by its bright orangish to reddish brown coloration; *mimeticus* is dark brown to nearly black.

Pseudonichomachus mimeticus, new species

Figures 8, 93A–95

MACROPTEROUS MALE: General coloration blackish brown; head and anterior lobe of pronotum, corium at level of claval commissure, and femora, castaneous; distal third of antennal segment 3, broad band on distal half of mesotibiae and metatibiae, transverse fascia on corium at level of apex of scutellum (just reaching onto clavus), narrow transverse marking on clavus at midpoint of claval commissure, and narrow, anteriorly inclined, transverse bands two-thirds of width of corium (reaching lateral corial margin) at apex of clavus, dull white; anterior quarter of cuneus, posterior margin of all mesepisterna above coxae, and distal margin of trochanters white; all tarsi and abdominal sternite 2 light brown.

Head, pronotum and scutellum weakly shining.

Labium just surpassing mesocoxae.

MEASUREMENTS: Total length 4.08, maximum width 1.10, length head .20, width head .82, interocular space .26, length pronotum 1.06 (anterior lobe .40, posterior lobe .66), width pronotum 1.10, length scutellum .62, width scutellum .58, length corium 1.66, length clavus 1.26, length cuneus .76, width cuneus .40, length claval commissure .60, distance apex commissure-apex membrane 1.70, length metatibia 1.86; length antennal segments 1—.26, 2—1.04,

3—.80, 4—.35; length labial segments 1—.36, 2—.32, 3—.32, 4—.38.

MALE GENITALIA: Figures 93A–95. Basic structure as in *Nichomachus*.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, top Magoebaskloof, 12 Dec. 1967, J. A. & S. Slater, T. Schuh, J. Munting (SANC).

PARATYPES: *Cape Province*—1 macropterous ♂, Cape Town (Bridwell). *Transvaal*—1 macropterous ♂, same data as holotype; 1 macropterous ♂, 22 mi. S. Barberton, 4900 ft. elevation, 24 Mar. 1968 (USNM, JAS, RTS).

This species is named for its ant-like appearance.

See discussion under *P. capeneri* for separation of species.

TRIBE ORTHOTYLINI

Cyrtorhinus Fieber

Cyrtorhinus Fieber, 1858, p. 313.

Cyrtorhinus was monographed by Carvalho and Southwood (1955). The genus presently contains six species distributed primarily in the Old World tropics with one species common to Europe and North America.

Cyrtorhinus melanops Reuter

Figures 9, 102, 103

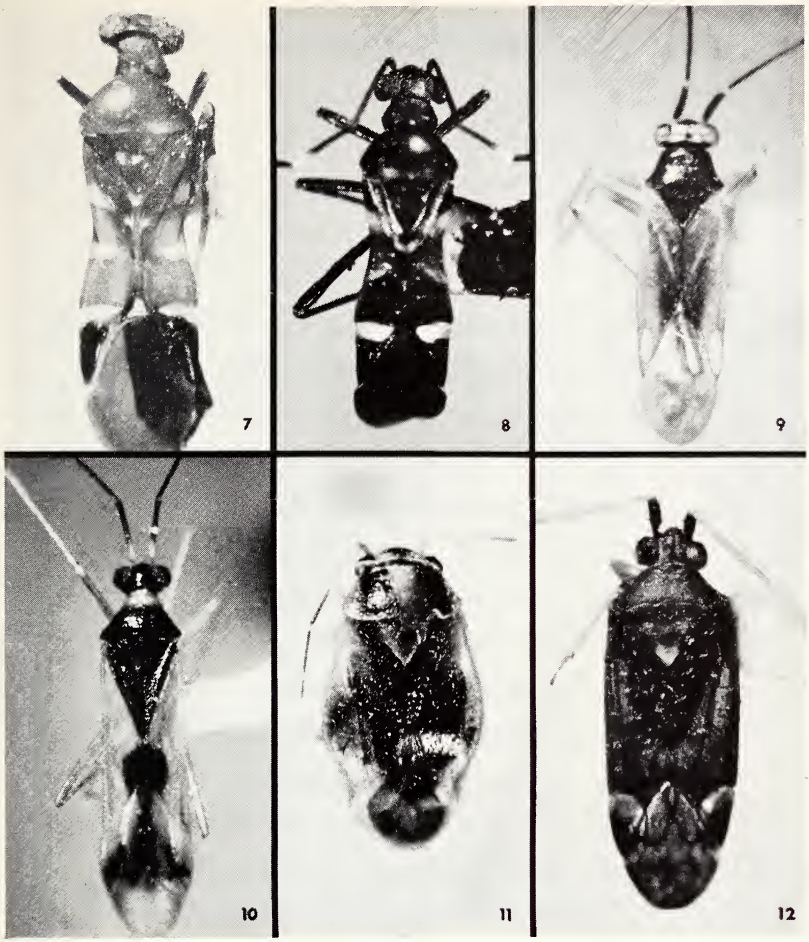
Cyrtorhinus melanops Reuter, 1905a, p. 6.—Carvalho, Dutra, and Becker, 1960, pp. 459–460, 475 (in part).

Cyrtorhinus melanops can be most easily recognized by the apically convergent, recurved parempodia, orthotyline-type male genitalia (Figs. 102, 103), the dark head, pronotum, and scutellum, the light hemelytra, and the shape of the head and body (Fig. 9).

No biological information is available for this species, but it is possible that it is primarily predatory, as is *Cyrtorhinus caricis* (Fallen) (Southwood and Leston, 1958).

Cyrtorhinus melanops is known only from Ethiopia and South Africa (Carvalho, 1958b). Carvalho et al. (1960), incorrectly recorded specimens of *Tytthus parviceps* from 10 miles north of Matatiele, Cape Province, as *C. melanops* (see also *T. parviceps*).

SPECIMENS EXAMINED: SOUTH AFRICA: *Cape Province*—1 macropterous ♂, Kokstad, 6.III.51 (Brinck and Rudebeck). *Trans-*



FIGS. 7–12. Nichomachini, Orthotylini. Fig. 7. *Pseudonichomachus capeneri*, male, holotype. Fig. 8. *Pseudonichomachus mimeticus*, male, holotype. Fig. 9. *Cyrtorhinus melanops*, male (Rustenburg, Transvaal). Fig. 10. *Felisacodes bryocorina*, male (Grootvatersbosch Forest Reserve, Cape Province). Fig. 11. *Pseudoambonea capeneri*, female, holotype. Fig. 12. *Pseudoloxops transvaalensis*, male (Messina, Transvaal).

vaal—1 macropterous ♂, Hartebeespoort Dam, 20 mi. W. Pretoria, 30 October 1967; 3 macropterous ♀♀, Little Sabie River, Sabie, 29 Nov. 1967; 1 macropterous ♀, Rustenburg, I-4-11-1957 (Capener); 2 macropterous ♂♂, Rustenburg, I-5-1957 (Capener); 1

macropterous ♂, Rietfontein, 4.12.06 (SANC, TM, LU, JAS, RTS).

Felisacodes Bergroth

Rhodesiella Poppius, 1914a, pp. 64–65 (preocc.).
Felisacodes Bergroth, 1926, p. 64 (new name).—Odhiambo, 1967, p. 1681.
Madagascariella Carvalho, 1953a, pp. 44–45. **New Synonymy.**

Odhiambo (1967) noted that until the male genitalia of *Felisacodes* were examined the correct tribal placement of the genus could not be determined. I have dissected both the male and female genitalia of *F. bryocorina* (Poppius) from South Africa. Those of the male are typical of the Orthotylini, with a membranous vesica lacking spiculi. The female has well developed K-structures which unquestionably places *Felisacodes* in the Orthotylini. *Zanchiella* is the most closely related genus.

Odhiambo (1967) examined the holotype of *Madagascariella longipides* Carvalho and noted that it and *Felisacodes* were extremely closely related, if not congeneric. I have also compared specimens of *F. bryocorina* with the holotype of *M. longipides* in the Paris Museum. The structure and coloration of the two are very similar, the most obvious difference being a more strongly rugose pronotum in *Madagascariella.* I do not believe this feature to be generically significant and therefore synonymize *Madagascariella* Carvalho with *Felisacodes* Bergroth.

List of described species of *Felisacodes*

bryocorina Poppius (*Rhodesiella*), 1914a, p. 65. Rhodesia; South Africa.
dibuora Odhiambo (*Felisacodes*), 1967, pp. 1681–1683. Cameroon.
longipides Carvalho (*Madagascariella*), 1953, pp. 44–45. Madagascar.

Felisacodes bryocorina (Poppius)

Figure 10

Rhodesiella bryocorina Poppius, 1914a, p. 65.
Felisacodes bryocorina Carvalho, Dutra, and Becker, 1960, pp. 462–463.

Felisacodes bryocorina can be distinguished from all other South African mirids by the elongate body (total length 4.12 mm., maximum width 1.04 mm.), the hyaline hemelytra, the row of punctures

on the clavus parallel to the claval commissure, and the extremely long appendages, with antennal segment 1 being longer than the width of the head. *F. bryocorina* can be separated from *F. dibuora*, the only other species of *Felisacodes* in Africa, in that *dibuora* has a light colored scutellum and *bryocorina* has a dark scutellum, which is unicolorous with the posterior lobe of the pronotum.

Three males and one female of *F. bryocorina* are in the British Museum (Natural History). I have selected a male as the lectotype. It bears the labels: "S. Rhodesia, Chirinda, 12.VI.1911, Swynnerton" and "LECTOTYPE *Rhodesiella bryocorina* Poppius, det. R. T. Schuh."

The only host plant record for this species is *Plectranthus fruticosus* L'Hes. (Labiatae). The plants were growing in a heavily shaded forest.

SPECIMENS EXAMINED: SOUTH AFRICA: *Cape Province*—40 macropterous ♂♂, 23 macropterous ♀♀ (1 nymph in alcohol), Grootvatersbosch For. Res., 14 mi. N. Heidelburg, 5 Feb. 1968 (Adults and nymphs on *Plectranthus fruticosus* L'Hes.); 2 macropterous ♀♀, Port St. Johns, Pondoland, Sept. 1923 (Turner); 1 macropterous ♂, Storms River Mouth, 13 Feb. 1968; 1 macropterous ♂, Tsitsikama Forest, Stormsrivierpiek, 13.I.51 (Brinck and Rudebeck). *Natal*—1 macropterous ♂, Kloof, 1500 ft., Aug. 1926 (Turner) (SANC, BM[NH], TM, SAM, HM, LU, USNM, JAS, RTS).

"The **Orthotylus** complex"

Several groups of species that can be placed in *Orthotylus* Fieber or closely related genera are present in South Africa. The only comprehensive work on *Orthotylus* is that of Southwood (1953) which is restricted to the British species. This work is unfortunately of limited use outside of Europe for it does not define the genus on a world basis and the subgenera of Southwood are based only on European species. Lindberg (1951; 1953) has dealt extensively with the species of *Orthotylus* from the Canary Islands and segregated *Canariocoris* Lindberg from *Orthotylus*. Knight (1968) described several new species of *Melanotrichus* Reuter, which he considered as a distinct genus, from the western United States.

The extreme variation found in *Orthotylus* is described in part by Southwood (1953) and can be judged also by the number of generic synonyms associated with the genus (see Carvalho, 1958b). *Orthotylus* is probably cosmopolitan, although Carvalho does not record it from South America. Poppius (1914a) listed only four

species from Africa (including *Chlorosomella geniculata* Reuter). Very little has been done to advance our knowledge of *Orthotylus* in Africa since Poppius' work.

In the collections I have examined from South Africa there are approximately 20 species that can be assigned to *Orthotylus* and related genera. Several distinct groups of species exist, and the type of character variation in them is difficult to understand.

At least two species from South Africa appear to be related to the European genus *Pachylops* Fieber. The claspers of the males are modified and bizarre in one species, which has a slender, elongate labium, while the other species has much more conventional male genitalia, and a short apically thickened labium, very similar to *Pachylops* species from Europe. The coloration of these species is essentially brownish or reddish and the dorsum is polished and shining.

Two specimens very close to *Chlorosomella* (= *Orthotylus*) *geniculata* Reuter are known from Politzi, Transvaal.

A long series of light green males from light traps, primarily at Grootfontein, Middelburg, Cape Province, probably represents a single rather variable species. These specimens have the black, scale-like hairs of the subgenus *Orthotylus* (*Melanotrichus*); they also have claspers that are of a type that occurs in several species that lack the black scale-like hairs.

Two small groups of light green species, with the clasper type found in the "*Melanotrichus*" species mentioned above, can be distinguished on labial length. Eight additional species which vary in characters of the eyes, beak length, male genitalia, and general body shape have also been examined.

One of the most common "Orthotylus" species is velvety green and lives on *Acacia*. Two specimens appearing to be closely related to this species are known from Djab, South West Africa and are deposited in the Transvaal Museum; they have the hemelytra velvety red instead of green.

A very small species with a dark head, pronotum, and scutellum and light hemelytra is known from Malips Drif, Transvaal.

Pseudambonea, new genus

MACROPTEROUS FEMALE: Head nearly vertical, body thickset; pronotum distinctly transversely rugose, head, scutellum, and hemelytra smooth, head with scattered, semierect, light hairs about as long as tibial diameter; remainder of dorsum with decumbent light hairs about as long as tibial diameter; antennae with short, light

hairs about as long as diameter of segment 3; antennal segment 1 with a few, erect, fine, light spines on inner surface; labium with some short, erect, light hairs; thoracic pleura glabrous; femora with some decumbent light hairs and a few very long, fine, erect hairs on ventral surfaces; tibiae and tarsi with reclining, short, light hairs and a few semierect light spines about the length of tibial diameter; abdomen with reclining light hairs about as long as tibial diameter.

Head strongly declivous, slightly wider than anterior margin of pronotum; eyes occupying about half height of head, not noticeably granular; antennae inserted at level of ventral margin of eyes; antennal segment 1 moderately enlarged, segment 2 distinctly tapering proximally, distally about three-fourths diameter of segment 1, segments 3 and 4 subequal in diameter, equal to proximal diameter of segment 2 (about three-fourths distal diameter of segment 2); clypeus large, rounded transversely, strongly curved posteroventrally; bucculae small; buccal cavity short; gula short, length about equal to diameter of antennal segment 1; pronotum only very slightly narrowed anteriorly, anterior margin finely carinate, upturned, lateral margins nearly straight; pronotum flattened, calli indistinct; entire posterior margin of pronotum slightly upturned; mesoscutum concealed beneath pronotum; scutellum very slightly elevated; hemelytra strongly convex transversely; lateral corial margins strongly and somewhat irregularly convex, hemelytra widest at level just posterior to midpoint of claval commissure; cuneal incisure deep, fracture at right angles to longitudinal axis of body; cuneus and membrane strongly declivous; membrane with two cells; femora narrow; only metatibiae with longitudinal rows of tiny closely-spaced spines; claws stout, strongly curved, thickened basally; parempodia fleshy, convergent apically, recurved; pulvilli minute.

FEMALE GENITALIA: Figure 106. Posterior wall with well develoed K-structures.

MACROPTEROUS MALE: Structurally similar to female but more elongate.

MALE GENITALIA: Figures 104, 105. Vesica membranous with sclerotized spiculi.

TYPE SPECIES: *Pseudambonea capeneri*, new species.

This genus is named for its very close resemblance to *Ambonea* Odhiambo.

Pseudambonea appears superficially to be closely related to *Ambonea* in the Pilophorini. The structure of the posterior wall of the female, in particular, indicates that there is actually no close relationship between the two genera. This contention is supported

also by the structure of the male genitalia. The genus can be most easily recognized by the compact body form, the posteriorly concave, strongly declivous, broad head, the single type of pubescence, the orthotyline pretarsal structures and the type of male and female genitalia. *Ambonea* can be easily separated from *Pseudambonea* in that it has wooly pubescence as well as setiform hairs on the dorsum.

Pseudambonea capeneri, new species
Figures 11, 104–106

MACROPTEROUS FEMALE: Dorsum generally light brown or tan; broad median longitudinal band on head including clypeus (excluding posterior magin of vertex), pronotum very broadly on either side of midline, and clavi (except anteriorly along suture) brown; posterior half of hemelytra and cuneus mesally more or less strongly suffused with brown or reddish brown; membrane smoky brown; antennal segment 1, proximal half of antennal segment 2, labium, and legs including procoxae cream; distal half of antennal segment 2, antennal segments 3 and 4, and all tarsal segments 3 dark brown; metafemora with broad red band distally; mesocoxae and metacoxae, thoracic pleura, and most of abdominal venter reddish brown; anterior half of abdominal segment 9 light.

Entire body highly polished and shining.

Posterior margin of vertex with distinct raised carina; antennal fossae removed from anterior margins of eyes by distance equal to distal diameter of antennal segment 2; labium reaching apex of mesocoxae; anterior pronotal margin weakly sinuate, posterior margin straight across scutellum, very broadly rounded laterally; posterior margin of membrane cells broadly rounded; abdomen just surpassing apex of cuneus; metatarsal segment 2 slightly longer than segment 1, segment 3 about 2 times length of segment 1.

MEASUREMENTS: Total length 3.36, maximum width 1.92, length head .16, width head 1.04, interocular space .60, length pronotum .64, width pronotum 1.40, length scutellum .52, width scutellum .72, length corium 1.64, length clavus 1.36, length cuneus .64, width cuneus .56, length claval commissure .72, distance apex commissure-apex membrane 1.52, length metatibia 1.48; length antennal segments 1—.32, 2—1.08, 3—.52, 4—.40; length labial segments 1—.34, 2—.32, 3—.20, 4—.24.

FEMALE GENITALIA: Figure 106.

MACROPTEROUS MALE: Appearing uniformly gray brown; coloration may be result of teneral condition of only known male specimens.

MALE GENITALIA: Figures 104, 105.

HOLOTYPE: Macropterous ♀, SOUTH AFRICA: *Cape Province,* 16 mi. north of Steytlerville, 24.X.64, A. L. Capener (SANC).

PARATYPES: 3 macropterous ♀♀, 2 macropterous ♂♂, same data as holotype (SANC, RTS).

This species is named for the collector, Mr. A. L. Capener.

As the only known species in the genus, *P. capeneri* can be recognized by the characters noted in the generic discussion.

Pseudoloxops Kirkaldy

Loxops Fieber, 1858, p. 314 (preocc.).
Pseudoloxops Kirkaldy, 1905, p. 268 (new name).

Pseudoloxops Kirkaldy is widely distributed in the southern Palearctic and Old World tropics including the Southwest Pacific. It currently includes 16 described species. The genus can be recognized by the following combination of characters: body ovoid; coloration usually carmine-red and yellow-white; frons bluntly produced; antennal segment 1 and dorsum with long, shaggy pubescence; parempodia convergent apically, recurved; and male and female genitalia of the "*Orthotylus*-type". The shaggy pubescence is often badly rubbed.

Several specimens probably representing three new species of *Pseudoloxops*, in addition to the species described below, are known from South Africa. They are: a male from Satara Camp, Kruger National Park, deposited in the J. A. Slater Collection; a female from Malelane, Transvaal, deposited in the Transvaal Museum, probably the same species as the Satara specimen; a female from Port St. Johns, Cape Province, deposited in the British Museum (Natural History), probably closely related to the above specimens, and a female from Keiskama Hoek, King Williams Town District, Cape Province, deposited in the South African National Collection of Insects, distinct from all of the above specimens.

Pseudoloxops transvaalensis, new species
Figures 12, 107, 108

MACROPTEROUS MALE: Red as follows—pronotum, mesoscutum, clavus, corium, apical half of cuneus, veins of membrane, midline of frons, vertex very narrowly, juga, antennal segment one, thoracic pleura, distal two-thirds of metafemora, and venter of abdomen laterally; vertex, frons, scutellum (heavily suffused with red medially), antennal segment 2 (segments 3 and 4 missing from

holotype), thoracic sternum, all coxae, profemora and mesofemora entirely, metafemora proximally, all tibiae, all tarsi, and abdominal venter, irregularly, cream; basal half of cuneus orange.

Entire body surface smooth, dull; dorsum with moderately dense, semierect, wooly hairs about as long as 1½ times diameter of antennal segment 2; pronotum, scutellum, clavus, and corium with some decumbent, flattened, sericeous hairs (in patches on clavus and corium); antennal segment 1 with many long, shaggy, dark hairs as on dorsum, segment 2 with very short, decumbent, light pubescence; labium with some erect, short, light hairs; femora with reclining hairs and a few long, fine, erect hairs on ventral surfaces; tibiae with only very sparse, fine, reclining light hairs and a few semierect light spines slightly longer than tibial diameter; thoracic pleuron glabrous; abdominal venter with long, reclining, light hairs.

Eyes very large, strongly protuberant, occupying nearly entire sides of head as viewed from above, vertex flat, nearly horizontal, posterior margin poorly defined, ecarinate; frons transversely rugose, produced into broad, blunt, rounded projection occupying entire space between antennal bases as viewed from above; anterior margins of eyes strongly sinuate; antennae inserted at middle of anterior margins of eyes, fossae contiguous with eyes; antennal segment 1 distinctly enlarged, somewhat swollen medially, segment 2 cylindrical, slightly more than half diameter of segment 1; bucculae only slightly expanded; buccal cavity reaching prosternum; labium reaching to trochanteral joint of mesocoxae; pronotum with anterior margin finely carinate, upturned, sinuate, lateral margins nearly straight, distinctly convergent anteriorly, posterior margin excavated across mesoscutum; calli obscure, with shallow longitudinal depression between them; mesoscutum broadly exposed, about half length of flat scutellum; lateral corial margins straight, parallel; cuneal incisure obsolete, fracture at right angles to corial margin; metatibiae only with longitudinal rows of tiny closely spaced spines; metatarsal segments 1 and 2 subequal in length, segment 3 slightly longer than segment 2; claws strongly curved, broad basally; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MEASUREMENTS: Total length 3.68, maximum width 1.44, length head .36, width head .84, interocular space .32, length pronotum .44, width pronotum 1.24, length scutellum .64, width scutellum .92, length corium 1.84, length clavus 1.44, length cuneus .60, width cuneus .30, length claval commissure .84, distance apex commissure-apex membrane 1.44, length metatibia 1.96, length antennal segments 1—.48, 2—.80, 3—.28, 4—.32.

MALE GENITALIA: Figures 107, 108. Vesica membranous with sclerotized spiculi.

MACROPTEROUS FEMALE: Similar to male but with the eyes smaller and vertex relatively wider; pronotum more flattened than in male, posterior margin not excavated; lateral corial margins slightly convexly rounded.

FEMALE GENITALIA: Posterior wall with well developed K-structures.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal,* Claudiushoop, 11 mi. N. Dendron, 15.12.65, M. Johannsmeier (SANC).

PARATYPES: *Transvaal*—1 macropterous ♂, Messina, XII-30-I-2-1957 (Capener); 1 submacropterous ♀, Punda Milia, KNP., 16.I.65 (Hoffman) (SANC, RTS).

ADDITIONAL SPECIMENS: *South West Africa*—1 macropterous ♀, Abachaus, IX. 1946 (Hobohm) (TM).

This species is named for its occurrence in the Transvaal.

P. transvaalensis is characterized by long wooly pubescence, a bluntly produced frons, deep red coloration with the basal half of the cuneus orange, and the structure of the male genitalia. The specimen from Abachaus, South West Africa, is in very poor condition and therefore has not been included in the paratype series.

Nothing is known of the biology of this species.

Pseudopilophorus, new genus

MACROPTEROUS FEMALE: Elongate, ant mimetic; entire body smooth, dull; pronotum indistinctly transversely rugose; body with moderately dense, sericeous, decumbent pubescence; antennae with very fine, short, semiappressed vestiture; femora and tibiae with decumbent hairs.

Head vertical, elongate dorsoventrally, frons and gula nearly parallel; eyes large, somewhat reniform in lateral view, contiguous with anterior margin of pronotum; posterior margin of vertex carinate, slightly arched above dorsal margin of eyes; vertex depressed just anterior to posterior margin; frons nearly flat; antennae inserted just above ventral margin of eyes; antennal segment 1 only slightly enlarged, segment 2 tapering proximally, distal diameter about equal to diameter of segment 1, segment 3 about equal to proximal diameter of segment 2, segment 4 of slightly smaller diameter than segment 3; clypeus large; labrum compressed laterally; gula about length of antennal segment 1; buccal cavity large, elongate oval; labium very short; pronotum campanulate, flat, somewhat

inclined posteriorly; mesoscutum exposed, flattened; scutellum convex; hemelytra with lateral margins strongly sinuate, narrowest at about middle of corium; clavi elevated along commissure; cuneal fracture angled anteromedially; membrane with 2 cells; profemora and tibiae of conventional structure; mesofemora slightly larger proximally than distally; mesotibiae flattened laterally, tapered, greatest width about one-third distance from femoral joint; metafemora and tibiae similar in structure to mesolegs but much longer and conspicuously bowed; mesotibiae and metatibiae with longitudinal rows of tiny closely spaced spines; parempodia fleshy, apically convergent, recurved; pulvilli minute; abdomen strongly constricted basally.

FEMALE GENITALIA: Figures 109, 112. Posterior wall with well developed K-structures; sclerotized rings with lateral margins strongly infolded.

MACROPTEROUS MALE: Very similar to female.

MALE GENITALIA: Figures 110, 111. Vesica membranous with long sclerotized spiculum.

TYPE SPECIES: *Pseudopilophorus capeneri*, new species.

This genus is named for its resemblance to *Pilophorus*.

Pseudopilophorus superficially resembles *Pilophorus*; however, the structure of the male and female genitalia place it in the Orthotylini, rather than in the Pilophorini. This is the only ant-mimetic genus in the Orthotylini known to occur in Africa and it is not obviously related to any other described genus. *Pseudopilophorus* can be recognized by its ant-mimic appearance, coloration pattern, convergent recurved parempodia, and male and female genital structures.

Pseudopilophorus capeneri, new species

Figures 13, 109–112

MACROPTEROUS FEMALE: Posterior two-thirds of pronotum, scutellum (except as noted below), thoracic pleura and venter, and abdomen slate gray; head, anterior half of pronotum, protibiae on dorsal and ventral surfaces, antennal segment 3, distal half of antennal segment 4, labial segments 1 and 2, labrum, and dorsal stripe on profemora orangish to mahogany; proximal half of antennal segment 4, labial segments 3 and 4, procoxae, profemora, lateral surfaces of protibiae, mesotibiae distally, all tarsi, metacoxae, oval maculae covering most of posterior half of scutellum and most of cunei cream to light yellow; remainder of legs castaneous to black; corium and clavus generally gray brown; membrane and posteromesial por-

tion of cuneus smoky gray; much of body surface with dull whitish bloom.

Mesial margins of eyes straight, diverging only slightly ventrally in anterior view; antennal fossae nearly contiguous with eyes; labium just attaining middle of mesosternum; anterior margin of pronotum straight, posterior margin sinuate, concave across mesoscutum; abdomen not quite attaining apex of membrane; posterior margin of large membrane cell broadly rounded; metatarsal segments subequal in length.

MEASUREMENTS: Total length 4.96, maximum width 1.44, length head .20, width head 1.04, interocular space .48, length pronotum .84, width pronotum 1.32, length scutellum .96, length corium 2.44, length clavus 1.92, length cuneus .92, width cuneus .52, length claval commissure 1.12, distance apex commissure-apex membrane 1.96, length metatibia 4.20; length antennal segments 1—.32, 2—1.76, 3—1.28, 4—.72; length labial segments 1—.30, 2—.32, 3—.28, 4—.32.

FEMALE GENITALIA: Figures 109, 112.

MALE GENITALIA: Figures 110, 111.

HOLOTYPE: Macropterous ♀, SOUTH AFRICA: *Transvaal*, Tzaneen, 11–16 Dec. 1963, A. L. Capener (SANC).

PARATYPES: Macropterous ♂, 10 macropterous ♀♀, same data as holotype (1 specimen—host plant *Terminalia sericea*). SWAZILAND—Eranchi, XII-15-31-1954 (Capener) (SANC, JAS, RTS).

This species is named for Mr. A. L. Capener.

As the only species in the genus, *P. capeneri* can be recognized by the characters noted in the generic discussion.

This species has been taken on *Terminalia sericea* Burch. (Combretaceae), but no other biological information is available.

Zanchiella, new genus

MACROPTEROUS MALE: Small, elongate, elliptical, or nearly parallel sided; head, pronotum, and scutellum smooth; pronotum weakly transversely rugulose; hemelytra hyaline or subhyaline; dorsum with shining or dull, moderately long, semierect hairs; head broad, narrowed behind eyes; eyes large, granular, with or without short hairs; vertex weakly convex; antennae inserted slightly below middle of anterior margin of eyes which are more or less emarginate; antennal segment 1 slightly enlarged distally, segment 2 of slightly smaller diameter than segment 1, segments 3 and 4 subequal in diameter, about two-thirds diameter of segment 2; bucculae weakly

developed; gula short; labium long; pronotum with very narrow collar; calli low, indistinct; lateral margins of pronotum slightly concave; mesoscutum narrowly exposed, separated from scutellum by distinct, deep, transverse impression; scutellum usually broadly convexly elevated; lateral margins of hemelytra usually broadly convexly rounded; cuneal incisure very shallow, fracture slightly angled anteromedially; clavus with row of very fine punctures adjacent to scutellum and commissure and also row of punctures parallel to claval suture; two cells in membrane, inner vein nearly parallel to inner margin of clavus; abdomen reaching approximately to base of membrane; metatibiae with several longitudinal rows of tiny, closely-spaced spines; all tibiae with a few scattered, light, reclining spines about length of tibial diameter; tarsal claws strongly curved; parempodia fleshy, apically convergent, recurved; pulvilli minute.

MALE GENITALIA: Vesica membranous, without spiculi.

MACROPTEROUS FEMALE: Structurally similar to macropterous male; eyes slightly smaller and vertex correspondingly wider in female than in male.

FEMALE GENITALIA: Posterior wall with well developed K-structures.

TYPE SPECIES: *Zanchiella bowkeriae*, new species.

This genus is named for its close resemblance to *Zanchius* Distant.

Zanchiella can be recognized by the generally hyaline hemelytra with a row of punctures along the claval suture (see however *Z. ericae*) and the relatively short appendages. It is most closely related to *Felisacodes* and *Zanchius* in Africa.. The row of punctures on the clavus, the shape of the head, and the hyaline hemelytra, ally *Zanchiella* to *Felisacodes*; the general body form, particularly the structure of the hemelytra, and the type of vestiture, relate *Zanchiella* to *Zanchius*. The convergent recurved parempodia, the membranous vesica in the male, and the posterior wall with well developed K-structures in the female support the placement of *Zanchiella* in the Orthotylini.

KEY TO SPECIES OF *Zanchiella*

1. Basic coloration greenish (some specimens yellowish), cuneus red, contrasting with remainder of hemelytra; hemelytra not hyaline ..... *ericae* (Fig. 16)

   Basic coloration sometimes greenish, but cuneus and remainder of hemelytra never contrastingly colored; hemelytra hyaline or subhyaline 2

2. Clavus dark brown except for narrow light area along lateral margin; frons, clypeus, and pronotum partially red; veins of membrane cells dull red ..... *capensis* (Fig. 15)
   Clavus entirely light or with dark marking only on posterior third and along mesial margin; frons, clypeus, pronotum, and veins of membrane not red 3
3. Anterior third of pronotum tan, posterior two-thirds very dark brown to black; posterior third of clavus suffused with dark brown ..... *natalensis* (Fig. 17)
   Pronotum and clavus nearly unicolorous light yellow or green 4
4. Basic coloration light yellow; hemelytra with distinct brown fascia between apex of claval commissure and base of membrane ..... *bowkeriae* (Fig. 14)
   Basic coloration of hemelytra light greenish; head, pronotum, and scutellum light brownish; transverse fascia on hemelytra obsolete or very faint ..... *sweeti* (Fig. 18)

Zanchiella bowkeriae, new species

Figure 14

MACROPTEROUS MALE: Head, pronotum, scutellum, hemelytra, thoracic venter, and legs very light yellowish with darker markings as noted below; pronotum lateroventrally and posterolaterally and scutellum anterolaterally suffused with brown; corium with irregular brown transverse macula between apex of clavus and base of membrane; inner margin of costal vein and lateral margin of cuneus obscurely suffused with green; eyes black; antennal segment 1 and distal third of segment 2 dark brown, proximal two-thirds of segment 2 light brown or yellow, distal half of segment 2 with broad reddish band; antennal segments 3 and 4 light brown; membrane smoky brown, veins slightly darker; abdomen very light green to nearly white.

Hemelytra hyaline, weakly shining.

Frons slightly produced between eyes; anterior margin of eyes conspicuously emarginate at antennal bases; labium just attaining distal end of metacoxae; punctures on clavus small but distinct.

MEASUREMENTS: Total length 4.52, maximum width 1.34, length head .30, width head .66, interocular space .24, length pronotum .52, width pronotum 1.02, length scutellum .46, width scutellum .62, length corium 1.98, length clavus 1.30, length cuneus .81, width cuneus .40, length claval commissure .72, distance apex commissure-apex membrane 2.00, length metatibia 2.20; length antennal segments 1—.42, 2—1.50, 3—.82, 4—approx. .74; length labial segments 1—.28, 2—.30, 3—.40, 4—.38.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, 22 mi. S. Barberton, 4900 ft. elevation, 24 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults on *Bowkeria cymosum* McOwan) (SANC).

PARATYPES: 4 macropterous ♂♂, 3 macropterous ♀♀, same data as holotype (SANC, JAS, RTS).

This species is named for the host plant genus *Bowkeria.*

Zanchiella bowkeriae is most closely related to *Z. capensis* and *Z. natalensis.* It can be most easily recognized by the light colored pronotum in combination with the conspicuous dark fascia on the posterior half of the corium.

This species is known only from the type locality on *Bowkeria cymosum* McOwan (Scrophulariaceae). The host genus is endemic to South Africa (Phillips, 1951).

Zanchiella capensis, new species

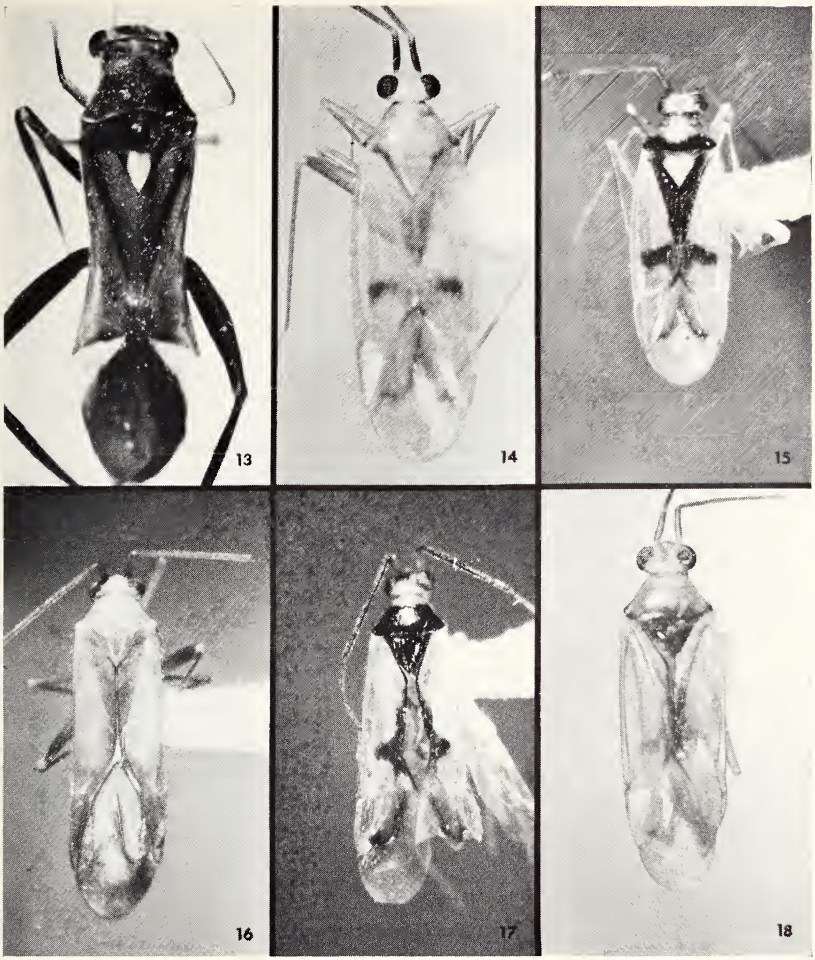
Figure 15

MACROPTEROUS MALE: Basic coloration very light yellowish; frons, clypeus, basal third of antennal segment 1, pronotum dorsally (except for a rounded, light, central marking and the posterior quarter), mesoscutum, and extreme apex of cuneus, bright red; remainder of antennae brown; eyes black; pronotum on pleural region and posterior quarter dorsally dark brown; clavus mesiad of row of punctures along claval suture dark brown; transverse macula on corium between apex of cuneus and base of membrane, and veins of membrane dull red brown; thoracic pleuron light reddish brown (except as above); abdomen lateroventrally and genital segments red, remainder white.

Pronotum very obscurely rugulose, polished, shining; hemelytra hyaline, weakly shining.

Frons slightly convexly produced between eyes; eyes weakly emarginate at antennal bases; labium just surpassing apex of mesocoxae.

MEASUREMENTS: Total length 3.20, maximum width 1.12, length head .26, width head .58, interocular space .26, length pronotum .44, width pronotum .84, length scutellum .40, width scutellum .58, length corium 1.64, length clavus 1.10, length cuneus .66, width cuneus .30, length claval commissure .64, distance apex commissure-apex membrane 1.44, length metatibia 1.86; length antennal segments 1—.32, 2—1.16, 3—.66, 4—.60; length labial segments 1—.30, 2—.30, 3—.42, 4—.40.



FIGS. 13–18. Orthotylini. Fig. 13. *Pseudopilophorus capeneri*, male, holotype. Fig. 14. *Zanchiella bowkeriae*, male, holotype. Fig. 15. *Zanchiella capensis*, male, holotype. Fig. 16. *Zanchiella ericae*, male (Giants Castle, Natal). Fig. 17. *Zanchiella natalensis*, male, holotype. Fig. 18. *Zanchiella sweeti*, female (Fountains, Pretoria, Transvaal).

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province,* Ysterhoutrug Picnic Site, 18 mi. NE Knysna, 10 Feb. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (SANC).

PARATYPES: *Cape Province*—1 macropterous ♂, same data as holotype; 1 macropterous ♀, Storms River Mouth, 14-15.X.1964 (Capener) (SANC, RTS).

This species is named for its occurrence in the Cape Province.

Zanchiella capensis is most colsely related to *Z. natalensis* and *Z. bowkeriae* but can be separated from them by the characters noted in the above key.

No host or biological information is available for this species.

Zanchiella ericae, new species

Figure 16

MACROPTEROUS MALE: Basic coloration greenish with strong yellow tinge, or nearly all yellow; cuneus red; membrane light smoky gray, veins slightly reddish; antennae and legs light brownish, antennal segments 3 and 4 and all tarsal segments slightly darker than remainder of appendages; labial segments 1 and 2 greenish yellow, segments 3 and 4 brown; eyes dark brown.

Dorsum generally smooth and very finely granulose, weakly shining; hemelytra subhyaline; dorsum with scattered, fine, erect or semierect, moderately long, light brown hairs; antennae with a fine erect spine on interior surface of segment 1; eyes glabrous.

Frons rather prominently convexly rounded between eyes, clypeus visible from above; anterior margins of eyes only weakly concave, not noticeably emarginate; labium slightly surpassing metacoxae; pronotal collar extremely narrow; anterior margin of pronotum weakly sinuate; posterior margin of pronotum broadly excavated across scutellum; row of punctures on clavus obsolete; tibial spines semierect.

MEASUREMENTS: Total length 3.92, maximum width .92, length head .30, width head .60, width vertex .26, length pronotum .30, width pronotum .76, length scutellum .50, width scutellum .62, length corium 1.96, length clavus 1.28, length cuneus .84, width cuneus .30, length claval commissure .76, distance apex commissure-apex membrane 2.00, length metatibia 2.06; length antennal segments 1—.38, 2—1.44, 3—.98, 4—.54; length labial segments 1—.34, 2—.34, 3—.36, 4—.34.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Giants Castle Park, 5800 ft. elevation, 6 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Erica leucopelta* Tausch.) (SANC).

PARATYPES: 5 macropterous ♂♂, 6 macropterous ♀♀, same data as holotype (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: *Cape Province*—3 macropterous ♀♀, Bainskloof Pass Summit, 21 Jan. 1968; 2 macropterous ♂♂, 3 macropterous ♀♀, Fernkloof Nat. Res., Hermanus, 3 Feb. 1968; 1 macropterous ♀, 2 mi. S. Goukamma, Knysna, 8 Feb. 1968; 1 macropterous ♂, 1 macropterous ♀, Hermanus, 1 Feb. 1968; 4 macropterous ♂♂, 15 macropterous ♀♀ (in alcohol—1 ♂, 2 ♀♀, 4 nymphs), just W. of Knysna, 8 Feb. 1968 (Adults and nymphs on *Erica floribunda* Lodd.); 1 macropterous ♂, 1 macropterous ♀, 6 mi. E. Plettenburg Bay, elevation 500 ft., 12–13 Feb. 1968; 2 macropterous ♂♂, 4 macropterous ♀♀ (in alcohol—1 ♂), Ysterhoutrug Picnic Site, 18 mi. NE Knysna, 10 Feb. 1968 (Adults and nymphs on *Erica* sp.). *Natal*—9 ♂♂, 12 ♀♀ (6 nymphs in alcohol), same data as holotype; 1 macropterous ♂, 1 macropterous ♀, Sani Pass, 6200 ft., 10 Mar. 1968 (Adults and nymphs on *Erica leucopelta* Tausch.). *Orange Free State*—7 macropterous ♂♂, 2 macropterous ♀♀, Golden Gate, 12.X.66 (Capener) (Host plant—*Erica maesta*). *Transvaal*—6 macropterous ♀♀ (in alcohol—1 ♂, 1 nymph), 22 mi. S. Barberton, 4900 ft. elevation, 24 Mar. 1968 (Adults and nymphs on *Erica drakensbergensis* Guth. & Bol.) (SANC, HM, BM[NH], JAS, RTS).

This species is named for the host plant genus, *Erica*.

I am placing this species in *Zanchiella* with some reservations. The other four species of the genus are very closely related based on the presence of claval punctures (obscure in *sweeti* and absent in *ericae*), the general body shape (much less oval in *sweeti* and *ericae* than in the other species), and the coloration pattern. *Zanchiella ericae* is isolated within the genus, but it seems unwise at the present time to erect a new genus for the reception of this species until the taxonomy of *Zanchiella* and related genera is better understood.

The variation in coloration and relative proportions between specimens from different localities is in many cases extreme, and if an adequate series were not available many specimens would almost certainly be considered as representing distinct species. The most obvious variation is in the ratio of the total length to maximum width, the ratio of length to width of the cuneus, and the ratio of total width of the head to the interocular space. The Giants Castle specimens have a very elongate aspect with a long narrow cuneus and rather large eyes and a narrow vertex. Specimens from Fernkloof Nature Reserve, Hermanus, are at the opposite extreme in all

of these characters. Specimens from other localities show intermediate conditions, but there is no obvious geographical pattern to the variation. Most specimens are light green with some yellowish suffusion, but others are almost totally yellow. Because of this variation I have designated only those specimens from the type locality as paratypes. The structure of the male genitalia of all specimens examined is very similar.

Z. ericae is apparently restricted to the genus *Erica* (Ericaceae), and seems to occur in nearly all regions of South Africa where *Erica* is present. Known host species include *E. floribunda* Lodd., *E. maesta, E. leucopelta* Tausch., and *E. drakensbergensis* Guth. and Bol.

Zanchiella natalensis, new species

Figure 17

MACROPTEROUS MALE: Anterior portion of vertex and frons including clypeus brown; posterior half of vertex, head below eyes, and anterior third of pronotum very light brown; posterior two-thirds of pronotum and entire scutellum very dark brown; hemelytra hyaline, nearly transparent; clavus along scutellum and commissure very dark brown; posterior third of clavus and macula on corium between apex of clavus and base of membrane brown; membrane, particularly veins, smoky brown; mesial margin of costal vein and lateral margin of clavus suffused with green; antennae dark brown; labium white; thoracic pleura generally brown; coxae and legs very light brown or yellowish; base of abdomen and genital segment dark brown; remainder of abdomen light greenish.

Pronotum and scutellum polished, shining, with transverse rugosities.

Head very weakly produced between eyes; anterior margins of eyes weakly emarginate; labium just surpassing apex of metacoxae.

MEASUREMENTS: Total length 3.64, maximum width 1.08, length head .28, width head .62, interocular space .20, length pronotum .44, width pronotum .84, length scutellum .42, width scutellum .52, length corium 1.68, length clavus 1.28, length cuneus .66, width cuneus .30, length claval commissure .66, distance apex commissure-apex membrane 1.74, length metatibia 1.94; length antennal segments 1—.40, 2—1.24, 3—.81, 4—.79; length labial segments 1—.26, 2—.30, 3—.58, 4—.20.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Olivier-

shoek Pass Summit, 5400 ft. elevation, 25 mi. S. Harrismith, 4 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (SANC).

PARATYPES: *Natal*—1 macropterous ♂, Cathedral Peak, Jan. 1964 (Capener); 1 macropterous ♂ (?), Drakensberg, 1-22.I.1927 (Turner); 1 macropterous ♂, same data as holotype. *Transvaal*—1 macropterous ♀, Wylies Poort, 10.2.41 (Capener) (SANC, BM [NH], RTS).

This species is named for its occurrence in Natal.

Zanchiella natalensis is most closely related to *Z. capensis* and *Z. bowkeriae*. It can be recognized by the pronotum being light on the anterior third and dark on the posterior two-thirds, in combination with the dark transverse macula on the posterior half of the corium.

Zanchiella sweeti, new species

Figure 18

MACROPTEROUS MALE: Elongate, nearly parallel sided; head (excepting posterior margin of vertex and genae), pronotum, scutellum, clavus along posterior two-thirds of commissure, and transverse macula on corium at level of base of membrane orangish brown; genae, posterior half of vertex, hemelytra (excluding membrane), thoracic venter, legs, and labium very light green; abdominal venter green; proximal fifth of antennal segment 1 light green, distal four-fifths red; antennal segment 2 brown on proximal end, remainder with broad reddish brown bands alternating with light coloration; antennal segments 3 and 4 brown; membrane light smoky gray.

Head polished, smooth, and shining; pronotum and scutellum obscurely transversely rugulose, weakly shining; hemelytra subhyaline, dull; membrane rugulose; dorsum with semierect, moderately long, light hairs; anterolateral angles of pronotum with single, long, erect, fine seta; antennae with short, decumbent, light vestiture; abdomen with moderately long, reclining, light hairs.

Frons weakly convexly produced between eyes; anterior margins of eyes weakly emarginate; labium just surpassing metacoxae; calli rather widely separated, demarcated posteriorly by weak furrow; posterior pronotal margin very slightly convex; punctures on clavus faint; tibiae with scattered, very fine, short, reclining light spines, hardly distinguishable from light tibial hairs; metatarsal segment 1 about half length of segment 2; segments 2 and 3 subequal in length.

MEASUREMENTS: Total length 3.24, maximum width .98, length

head .28, width head .60, interocular space .20, length pronotum .42, width pronotum .78, length scutellum .34, width scutellum .46, length corium 1.58, length clavus 1.04, length cuneus .58, width cuneus .30, length claval commissure .60, distance apex commissure-apex membrane 1.52, length metatibia 1.80; length antennal segments 1—.38, 2—1.14, 3—.74, 4—.64; length labial segments 1—.30, 2—.28, 3—.38, 4—.34.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Pretoria, Fountains, 15 December 1967, M. Sweet, at light (SANC).

PARATYPES: *Transvaal*—11 macropterous ♂♂, 8 macropterous ♀♀, same data as holotype; 2 macropterous ♀♀, Pretoria, Springbok Park, Jan. 1966 (Paliatseas) (SANC, BM[NH], JAS, RTS).

This species is named for the collector, Dr. Merrill H. Sweet.

Zanchiella sweeti can be recognized by the basic greenish coloration of the hemelytra and the inconspicuous transverse macula on the posterior half of the corium.

Zanchius Distant

Zanchius Distant, 1904c, p. 477.—Carvalho, 1956b, p. 66.

Zanchius can be characterized as follows—

MACROPTEROUS MALE: Body flattened, structure delicate; coloration light; dorsal vestiture of moderately long, semierect, light hairs; head usually flattened and quadrate (or somewhat broader than long); eyes conspicuously set forward, small, granular, protuberant, with short hairs present in some species; vertex flat or nearly so; frons convex, clypeus not or only barely visible from above; antennae inserted just above ventral margin of eyes, fossae nearly contiguous with eyes; antennal segment 1 long, cylindrical, moderately enlarged; antennal segment 2 slightly smaller in diameter than segment 1, segments 3 and 4 subequal in diameter, of slightly smaller diameter than segment 2; labium surpassing mesocoxae; calli distinct, set off by a transverse impression posteriorly; mesoscutum broadly exposed; scutellum nearly flat; hemelytra hyaline or subhyaline, very long; abdomen reaching at most to cuneal incisure; membrane with 2 cells; legs long and slender; tibiae with a few very thin, light colored spines about length of tibial diameter; metatibiae with several longitudinal rows of tiny closely spaced spines; metatarsal segment 1 shorter than segments 2 and 3; claws curved; parempodia fleshy, apically convergent, recurved; pulvilli minute.

MALE GENITALIA: Vesica membranous, without spiculi, of the Orthotylini-type.

MACROPTEROUS FEMALE: Very similar to macropterous male.

FEMALE GENITALIA: Posterior wall with well developed K-structures.

Zanchius is most closely related to *Zanchiella* in South Africa. The absence of the row of punctures paralleling the claval suture, the flattened head, and the absence of hemelytral maculae in *Zanchius* will help to separate it from *Zanchiella* in which there is a distinct row of punctures on the clavus, the head is somewhat globose, and the hemelytra usually have a contrasting dark macula. The structure of the parempodia and male and female genitalia support placement of *Zanchius* in the Orthotylini.

Distant (1904c) described *Zanchius* from India. The known range of the genus now includes the Southern Palearctic, South Africa, Southeast Asia, and the islands of the Southwest Pacific. Twelve species are currently placed in the genus, including those described as new below.

Three female specimens from Roodeplaat, Transvaal, deposited in the South African National Collection of Insects, probably represent a fifth new species in addition to those described as new in this paper. They differ from the other South African species of the genus in being somewhat smaller and generally orangish in coloration rather than green or white. Also available are several male and female specimens of what appears to be a new species of *Zanchius;* they are much smaller than any of the species of *Zanchius* described below and have the eyes only slightly set forward on the head, but agree closely with *Zanchius* in nearly all other characteristics. These specimens are deposited in the South African National Collection of Insects and the J. A. Slater Collection.

KEY TO SOUTH AFRICAN SPECIES OF *Zanchius*

1. Antennal segment 1 with a black stripe on lateral surface; antennal segment 2 black proximally; general coloration light green or yellow-green ..... *nigrolineatus* (Fig. 22)
   Antennal segment 1 without black stripe; coloration either very light greenish or white 2
2. Basic coloration white, hemelytra usually faintly suffused with light green; pronotum and hemelytra with elongate, longitudinal, yellow-orange markings ..... *buddleiae* (Fig. 20)
   Basic coloration either white or very light green or greenish yellow without yellow-orange markings 3
3. Basic coloration dull white; large species, length 4.40 mm.; head

broad, ratio width across eyes to median length 37:14 ..... *alba* (Fig. 19)

Basic coloration very light green to nearly white; smaller species than above, length 3.48 mm.; head quadrate, ratio width across eyes to median length 2:1 ..... *leucosideae* (Fig. 21)

Zanchius alba, new species

Figure 19

MACROPTEROUS MALE: Entire body and appendages dull white or cream; hemelytra translucent but not hyaline, with only weak, scattered pigmentation; appendages and labium infuscate apically.

Body surface smooth, dull; dorsum with rather long (about length of diameter of antennal segment 1), scattered, semierect, light hairs; antennae with short, fine, decumbent pubescence; venter of abdomen with rather dense, semidecumbent, light hairs; femora with semidecumbent, light hairs (about length of tibial diameter); tibiae with short, decumbent, light hairs and a few very light, fine, semierect spines about length of tibial diameter.

Head short, much broader than long, vertical; eyes protuberant, noticeably granular, with some very short hairs; head constricted behind eyes; vertex nearly flat; frons weakly convex, not produced beyond anterior margin of eyes as viewed from above; clypeus not visible from above; antennae inserted just above ventral margin of eyes; antennal segment 1 moderately enlarged, nearly cylindrical, segment 2 about three-fourths diameter of segment 1, segments 3 and 4 subequal in diameter, about three-fourths diameter of segment 2; head in frontal view triangular below eyes; bucculae small; labium just surpassing metacoxae; pronotum with anterior lobe somewhat swollen, demarcated by distinct transverse impression behind calli, anterolateral angles sharply rounded, anterior margin weakly sinuate, posterior lobe flattened, posterior margin shallowly excavated; mesoscutum about one-half length of scutellum; transverse impression separating scutellum and mesoscutum sinuate; scutellum weakly convex; lateral margins of hemelytra weakly convex, cuneal incisure shallow but distinct; fracture angled slightly anteromedially; metatarsal segment 1 half length of segment 3, segment 3 slightly shorter than segment 2.

MEASUREMENTS: Total length 4.40, maximum width 1.20, length head .28, width head .74, interocular space .36, length pronotum .36, width pronotum .82, length scutellum .48, width scutellum .74, length corium 2.24, length clavus 1.38, length cuneus .84, width cuneus .34, length clavał commissure .68, distance apex

commissure-apex membrane 1.90, length metatibia 2.30; length antennal segments 1—.48, 2—1.50, 3—1.00, 4—.34; length labial segments 1—.32, 2—.38, 3—.34, 4—.40.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Oliviershoek Pass Summit, 5400 ft. elevation, 25 mi. S. Harrismith, 4 March 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Buddleia salviifolia* [L.] Lam.) (SANC).

PARATYPES: *Natal*—2 macropterous ♂♂, 6 macropterous ♀♀, Cathedral Peak, Jan. 1964 (Capener); 1 macropterous ♂, 1 macropterous ♀, Giants Castle Park, 5800 ft. elevation, 6 Mar. 1968 (Adults and nymphs on *Buddleia salviifolia* [L.] Lam.); 14 macropterous ♂♂, 27 macropterous ♀♀, same data as holotype; 1 macropterous ♂, 9 macropterous ♀♀, Sani Pass, 6200 ft., 10 Mar. 1968 (SANC, TM, BM[NH], USNM, JAS, RTS).

ADDITIONAL SPECIMENS: *Natal*—7 macropterous ♂♂, 5 macropterous ♀♀, 17 nymphs (in alcohol), same data as holotype. *Transvaal*—3 males, 3 nymphs (in alcohol), 20 mi. NE Machadodorp, Schoemannskloof, 4300 ft., 22 Mar. 1968 (ex: *Buddleia salviifolia*) (RTS).

This species is named for its very light coloration.

Zanchius alba is the largest South African species of the genus. It is totally white or cream colored, becoming somewhat brownish in specimens preserved in alcohol. *Z. alba* is most easily separated from other South African species, particularly *Z. leucosideae*, by the length-width ratio of the head (see key).

Zanchius alba was taken on *Buddleia salviifolia* (Loganiaceae) at all collection localities, but never at the same localities as *Z. buddleiae*, which apparently has the same host.

Zanchius buddleiae, new species

Figure 20

MACROPTEROUS MALE: Basic coloration of body and appendages dull, opaque white; hemelytra translucent, nearly devoid of white pigmentation, weakly and irregularly suffused with blue-green (this is absent in some specimens); dorsum with yellow-orange markings as follows—vertex medially at level of posterior margin of eyes with small round spot, posterior lobe of pronotum medially and on each side about one-third distance mesially from lateral margins with elongate markings, clavus with elongate streak, corium with elongate streaks along claval suture, claval commissure, and parallel to lateral margin of posterior half of clavus, cuneus with

round spot basomedially, and large cell of membrane with small spot medially.

Body surface, pubescence, and structure very similar to *Z. alba* and *Z. leucosideae*, except as follows—head more or less quadrate, labium just attaining distal end of metacoxae, and posterior margin of pronotum very weakly sinuate.

MEASUREMENTS: Total length 2.92, maximum width .80, length head .28, width head .54, interocular space .24, length pronotum .28, width pronotum .60, length scutellum .38, width scutellum .50, length corium 1.50, length clavus 1.00, length cuneus .56, width cuneus .22, length claval commissure .58, distance apex commissure-apex membrane 1.24, length metatibia 1.60; length antennal segments 1—.28, 2—1.10, 3—.52, 4—.46; length labial segments 1—.24, 2—.26, 3—.34, 4—.26.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Nat. Botanical Gardens, Pretoria, 22 November 1967, J. A. & S. Slater, T. Schuh (Adults and nymphs on *Buddleia salviifolia* [L.] Lam.) (SANC).

PARATYPES: 9 macropterous ♂♂, 23 macropterous ♀♀, same data as holotype (SANC, HM, JAS, RTS).

ADDITIONAL SPECIMENS: 30 macropterous ♂♂, 3 macropterous ♀♀, 4 nymphs (in alcohol), same data as holotype (RTS).

This species is named for the host plant genus, *Buddleia*.

Zanchius buddleiae most closely resembles *Z. alba*, but is much smaller, has orange markings on the pronotum and hemelytra and has a rather quadrate head compared to the broad head of *alba* (see key).

Zanchius buddleiae is apparently host specific on *Buddleia salviifolia* (Loganiaceae).

Zanchius leucosideae, new species

Figure 21

MACROPTEROUS MALE: Basic coloration dull light green; legs, antennae, and labium infuscate apically.

Entire body surface smooth, dull or weakly shining; hemelytra

---

→

FIGS. 19–22. Orthotylini. Fig. 19. *Zanchius alba*, male, holotype. Fig. 20. *Zanchius buddleiae*, male (Pretoria, Transvaal). Fig. 21. *Zanchius leucosideae*, male, holotype. Fig. 22. *Zanchius nigroleneatus*, male, holotype.


19


20


21


22

subhyaline; vestiture essentially as in *Z. buddleiae*, except eyes glabrous.

Structurally very similar to *Z. alba* and *Z. buddleiae*, except as follows—head more or less quadrate (see measurements); labium noticeably surpassing metacoxae; posterior margin of pronotum broadly excavated across mesoscutum.

MEASUREMENTS: Total length 3.48, maximum width 1.10, length head .30, width head .60, interocular space .24, length pronotum .28, width pronotum .70, length scutellum .52, width scutellum .64, length corium 1.84, length clavus 1.14, length cuneus .70, width cuneus .30, length claval commissure .70, distance apex commissure-apex membrane 1.80, length metatibia 2.34, length antennal segments 1—.38, 2—1.36, 3—.84, 4—.42, length labial segments 1—.26, 2—.32, 3—.58, 4—.42.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Sani Pass, 6200 ft., 10 Mar. 1968, T. Schuh, S. Slater, M. Sweet (SANC).

PARATYPES: *Natal*—1 macropterous ♂, same data as holotype; 1 macropterous ♂, Sani Pass, 6000 ft., 10 Mar. 1968. *Orange Free State*—2 macropterous ♀♀, 5 mi. N. Golden Gate Park, 17 Oct. 1967 (SANC, RTS).

This species is named for the host plant genus, *Leucosidea.*

Zanchius leucosideae resembles *alba* and *buddleiae*, but can be separated from the former by its more quadrate head and from the latter by its uniformly pale green coloration.

Zanchius leucosideae is known to occur only on *Leucosidea sericea* Eckl. and Zeyh. (Rosaceae), which is endemic to South Africa (Phillips, 1951).

Zanchius nigrolineatus, new species

Figure 22

MACROPTEROUS MALE: Basic coloration very light green or yellow green, hemelytra hyaline; veins of membrane greenish, membrane yellowish; antennae yellowish, segment 1 with broad black stripe laterally, extending entire length of segment, except for extreme distal end, segment 2 black proximally; tibiae yellowish; dull gray spot present at middle of inner vein of large cell and near apex of small cell; black spot present on vein at inner apical angle of large cell.

Entire body and appendages smooth, shining; dorsum with light, moderately long (about length of greatest diameter of antennal segment 1), semierect hairs; antennae with short decumbent pubes-

cence, segment 1 with some longer semierect hairs; abdominal venter with moderately long, semierect hairs; legs with fine light hairs; tibiae with a few very fine, light spines about length of tibial diameter.

Head quadrate, eyes set far forward, distance from posterior margin of eye to posterior margin of head slightly less than longitudinal diameter of an eye; vertex flat; frons convexly rounded between antennal bases, clypeus just visible from above; eyes distinctly protuberant, granular, with short hairs (visible at 50×); antennae inserted just above ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 moderately enlarged, greatest diameter near base, segment 2 about two-thirds diameter of segment 1, segments 3 and 4 subequal in diameter, about two-thirds diameter of segment 2; bucculae moderately developed; labium reaching distal end of metacoxae; pronotum flat, depressed behind weakly elevated calli; anterior, lateral, and posterior margins of pronotum nearly straight; mesoscutum exposed, about one-third length of scutellum, separated from scutellum by medially interupted, weak, transverse impression; scutellum flat; lateral margins of hemelytra weakly convexly rounded; cuneal incisure obsolete, fracture at right angles to lateral corial margin; veins of membrane heavy, inner vein nearly parallel to mesial margin of cuneus; apex of abdomen not quite attaining cuneus; metatarsal segment 1 about one-half length of segment 2, segment 2 about 1½ times length of segment 1.

MEASUREMENTS: Total length 3.56, maximum width 1.16, length head .30, width head .56, interocular space .24, length pronotum .39, width pronotum .84, length scutellum .50, width scutellum .60, length corium 1.76, length clavus 1.24, length cuneus .64, width cuneus .28, length claval commissure .70, distance apex commissure-apex membrane 1.55, length metatibia 1.96; length antennal segments 1—.36, 2—1.34, 3—.64, 4—approx. .70; length labial segments 1—.22, 2—.26, 3—.36, 4—.38.

MALE GENITALIA: Not illustrated. See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Kruger Nat. Park, 3 mi. E. Skukuza Camp, 25 Apr. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (SANC).

PARATYPES: *Transvaal*—3 macropterous ♂♂, 6 macropterous ♀♀, same data as holotype; 1 macropterous ♂, Kruger Nat. Park, Oliphants River near Oliphants Camp, 30 Apr. 1968 (SANC, JAS, RTS).

This species is named for the black stripe on the first antennal segment.

Zanchius nigrolineatus is the most distinctive of the South Af-

rican species of the genus, especially in the structure of the head and pronotum. It can be easily separated from the other described species by the black stripe laterally on antennal segment 1.

The specimens from the type locality were taken on *Lantana* sp. (Verbenaceae).

SUBFAMILY PHYLINAE

TRIBE HALLODAPINI

Acrorrhinium Noualhier

Acrorrhinium Noualhier, 1895, p. 176.
Cinnamus Distant, 1909a, p. 441. **New Synonymy.**

Acrorrhinium can be characterized as follows—

MACROPTEROUS MALE: Very elongate, nearly parallel sided; coloration pattern either mottled or with one or two contrasting hemelytral maculae.

Body surface smooth, dull, or weakly shining; dorsum usually with short decumbent hairs, sometimes with erect peg-like hairs; antennae with short dense vestiture; abdominal venter with semi-decumbent shining hairs.

Eyes protuberant, nearly hemispherical, removed from anterior margin of pronotum by at least one-third diameter of eye; head neck-like behind eyes; vertex horizontal; frons strongly convex, produced into more or less attenuated spine above clypeus, with five anteromedially directed transverse rugosities posterior to spine; clypeus compressed laterally, nearly vertical; antennae inserted at or just below middle of anterior margin of eyes, fossae contiguous with or only slightly removed from anterior margins of eyes; antennal segment 1 somewhat enlarged, about equal to length of head, segment 2 about three-fourths diameter of segment 1, occasionally increasing in diameter distally, segments 3 and 4 subequal in diameter, about three-fourths diameter of segment 2; labium reaching or surpassing metacoxae; pronotum with distinct transverse impression demarcating narrowed anterior lobe with flat collar about as wide as diameter of antennal segment 1, and steeply inclined, strongly swollen, broad posterior lobe; mesoscutum exposed, separated from scutellum by well defined transverse impression, inclined anteriorly; scutellum distinctly convex; clavus more or less inclined mesially to form ridge along claval commissure; cuneal incisure usually distinct; membrane with two cells, the outer small, elongate, triangular, the inner large, rectangular, reaching to about apex of cuneus; legs long; tibiae with longitudinal rows of tiny, closely spaced, black

spines and scattered semierect spines about length of tibial diameter; tarsal claws long, smoothly curved; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 113–144. Genital capsule usually with a posteroventral spine; vesica strongly twisted, S-shaped; phallotheca L-shaped; left clasper trough-like, right clasper lanceolate.

BRACHYPTEROUS FEMALE: See *A. drakensbergensis* and *A. formicarium.*

FEMALE GENITALIA: Figures 145, 146. Sclerotized rings small, unusual in Hallodapini; posterior wall a simple sclerotized plate.

Acrorrhinium can be separated from all other members of the Phylinae by the spiniform frons.

Wagner (1970b) felt that *Acrorrhinium* was closely related to *Aeolocoris* and created a new tribe, the Aeolocorini, for these and other genera. I do not recognize this tribe, although as can be seen from the following discussion, *Acrorrhinium* and related genera do form a distinct group within the Hallodapini. Wagner based this relationship on the form of the male genitalia of *Aeolocoris vidali* (Wagner) and on external characters in *A. vidali* and *Acrorrhinium conspersum*, although he did not have access to the male genitalia of the latter species. The male genitalia of the *Acrorrhinium* species in South Africa show a specialized condition over those of *Aeolocoris*, at least as illustrated by Wagner (1970b), particularly in the apical region of the vesica which bears peculiar spine-like projections in *Acrorrhinium* and is simple in *Aeolocoris*. Other characters in *Acrorrhinium*, including the sclerotized rings in the female, and the spiniform frons, also suggest considerable specialization. Even though the genus does possess a number of specialized characters, it does show its closest relationship to *Aeolocoris* and allied genera, including *Azizus*, *Trichophorella*, and *Marmorodapus*, based on the coloration pattern (which is often marmorate), the peculiar peg-like hairs (although these are much less common in *Acrorrhinium* than in other genera), and the virtual absence of hemelytral fasciae (present in some species of *Acrorrhinium*).

Examination of the holotype female of *Cinnamus rhinocerus* Distant in the British Museum (Natural History), indicates that this species is not a member of the Cylapinae as indicated by Carvalho (1952a), but actually a species of *Acrorrhinium*, very closely related to *A. pusae* Ballard. The general body form, including the spiniform frons, and the pattern of coloration of *rhinocerus* are similar to *A. pusae* and *A. lupa.* I am therefore synonymizing *Cinnamus* Distant with *Acrorrhinium* Noualhier.

The South African species of *Acrorrhinium* can be divided into two rather distinct groups: the *A. brincki* group includes *A. brincki*, *A. drakensbergensis*, *A. capensis*, *A. oudtshoornensis*, and *A. monticola*, all of which have castaneous markings on the corium as well as contrasting white hemelytral maculae (except in *monticola*, which is nearly unicolorous dull gray, although this may be a secondary loss of the more distinct color pattern found in the other species), dark unicolorous femora (see however *brincki*), and a dark first antennal segment contrasting with the much lighter second segment; the *A. muntingi* group includes *A. muntingi* and *A. incrassata* (and possibly a third undescribed species represented by a single macropterous specimen, lacking the abdomen, from Matjiesfontein, Cape Province, deposited in the British Museum [Natural History]), which are larger than the species of the *brincki* group, have the hemelytra rounded in transverse cross section, forming a humped appearance, and have femora and first antennal segments that are relatively light colored with numerous contrasting spots. Also the head is much smaller relative to the total body size in the *muntingi* group than in the *brincki* group. In South Africa, *A. formicarium* forms what is probably a third group, based on the rather anomalous structure of the female. Until males are known it will be difficult to assess the exact relationship of *formicarium* within the genus. Of the species of *Acrorrhinium* occurring outside South Africa, *acutum* Odhiambo, *hebes* Odhiambo, *pauliana* Carvalho, *nilgiriensis* (Distant), *monoceros* (Distant), *lupa* (Delattre), and *spicatus* (Distant) are all probably related to the *brincki* group; *conspersus* Noualhier, *pusae* (Ballard), and *rhinocerus* (Distant) seem to form another distinct group within the genus.

Most of the known species of *Acrorrhinium* are from light traps; the females are unknown for four of the eight South African species and of the four species where females are known, only *A. brincki* includes macropterous specimens, and in this case no brachypterous specimens are known. Odhiambo (1959c) records macropterous females for *A. acutum*. The large series of *A. muntingi* taken at light with no females may indicate that the females are only rarely macropterous in this species, if at all, or that they are not attracted to lights. All species are probably ground living judging from those that have been observed in the field. The macropterous forms do not appear particularly ant mimetic when alive, but behavior of the brachypterous forms is very ant-like (see species discussion for *A. oudtshoornensis*).

List of described species of *Acrorrhinium*

acutum Odhiambo (*Acrorrhinium*), 1959c, p. 673. Kenya.
brincki Carvalho and Becker (*Acrorrhinium*), 1960, p. 453. South Africa: Natal.
capensis, new species. South Africa: Cape Province.
conspersus Noualhier (*Acrorrhinium*), 1895, p. 176. Anatolia; Syria.
drakensbergensis, new species. South Africa: Natal; Transvaal; Lesotho.
formicarium Poppius (*Ectmetocranum*), 1914a, p. 36. South Africa: Cape Town.
hebes Odhiambo (*Acrorrhinium*), 1959c, p. 676. Kenya.
incrassata, new species. South Africa: Cape Province, Transvaal.
lupa Delattre (*Seversyia*), 1950, p. 152. Ivory Coast: Bouaké.
monoceros Distant (*Armachanus*), 1904c, p. 478. Ceylon.
monticola, new species. South Africa: Cape Province.
nilgiriensis Distant (*Armachanus*), 1909b, p. 60. South India: Nilgiri Hills.
oudtshoornensis, new species. South Africa: Cape Province.
pauliani Carvalho (*Acrorrhinium*), 1953a, p. 45. Madagascar.
pusae Ballard (*Armachanus*), 1927, p. 67. North India: Bihar.
rhinocerus Distant (*Cinnamus*), 1909a, p. 442. **New Combination.** Ceylon.
spicatus Distant (*Armachanus*), 1904b, p. 203. Northwestern Australia.

KEY TO SOUTH AFRICAN SPECIES OF *Acrorrhinium*

Macropterous specimens

1. Metafemora with light ground color and numerous small brownish or reddish spots 2
   Metafemora either entirely dark or dark distally and light proximally 3
2. Vertex and frons light with narrow, median, longitudinal reddish stripe; antennal segment 2 incrassate distally ..... *incrassata*
   Vertex and frons mottled dorsally, without longitudinal reddish stripe; antennal segment 2 of uniform diameter ..... *muntingi*
3. Metafemora light proximally and dark distally ..... *brincki*
   Metafemora dark, unicolorous 4

4. Corium with reddish or castaneous areas strongly contrasting with white maculae; tibiae without dark dorsal stripe as below 5
   Corium generally dull grayish brown with only weakly contrasting light maculae; tibiae with dark brown longitudinal dorsal stripe ..... *monticola*
5. Corium with at least part of lateral margin dark (castaneous) (Fig. 23) 6
   Corium with lateral margin (exocorium) light unicolorous ..... *drakensbergensis*
6. Membrane with light halo-like areas between cunei; large species, length 6.40 mm.; ground color reddish brown ..... *capensis*
   Membrane unicolorous, without halo-like area; small species, length 5.20 mm.; ground color dark castaneous ..... *oudtshoornensis* (Fig. 23)

Brachypterous specimens

1. Hemelytra strongly upturned apically; entire dorsum and legs castanous, polished, covered with long, erect, light hairs ..... *formicarium*
   Hemelytra flat; dorsum and legs dull, if castaneous or partly so, with only short, decumbent hairs 2
2. All tarsal segments dark brown ..... *oudtshoornensis*
   All tarsal segments tan ..... *drakensbergensis* (Fig. 24)

Acrorrhinium brincki Carvalho and Becker
Figures 113, 120–123

Acrorrhinium brincki Carvalho, Dutra, and Becker, 1960, pp. 453–454.

Acrorrhinium brincki is very similar to *A. drakensbergensis,* described below, but differs from it in having the metafemora light proximally and dark distally; no other species in South Africa has this type of metafemoral coloration. This species was originally described from a macropterous female. Male specimens are now available and it is apparent that the structure of the two sexes is very similar.

MEASUREMENTS: Macropterous ♂—Total length 5.92, greatest width 1.70.

MALE GENITALIA: Figures 113, 120–123.

This species is known from relatively high elevations along the Drakensberg Escarpment (circa 1875 meters; 6000 feet) and from the high veld of the Transvaal. No biological information is available. Moderate numbers of male and female specimens were collected at an UV light in a light rain at Giants Castle Park, Natal, in early March, 1968. This is an area with a high proportion of macchia-related plants.

SPECIMENS EXAMINED: *Natal*—1 macropterous ♀, Royal Natal National Park, The Hostel, 3.IV.51, at light in evening (Brinck and Rudebeck) (holotype); 1 macropterous ♂, Royal Natal National Park, Tendele Camp, 5400 ft., 4–5 Mar. 1968, UV light; 1 macropterous ♀, Natal National Park, iii.1932 (Ogilvie); 1 macropterous ♂, Mont-aux-Sources, 4–6.IV.1954 (Vari); 1 macropterous ♂, 11 macropterous ♀♀, Giants Castle Park, 5800 ft. elevation, 6 Mar. 1968, UV light. *Transvaal*—1 macropterous ♂, Lake Chrissie, 6 Nov. 1967; 1 macropterous ♀, Pretoria, 6.IV.1954, at light in evening (Rudebeck) (paratype) (SANC, TM, LU, BM [NH], JAS, RTS).

Acrorrhinium capensis, new species

Figures 116, 131–133

MACROPTEROUS MALE: Basic coloration light mahogany; antennal segments 2 and 3 and all tibiae yellow; ostiolar peritreme, anterior half of corium, and quadrate macula at apex of corium adjacent to cuneal fracture white; elongate rectangular macula on endocorium just posterior to middle and contiguous with anterior white macula castaneous; membrane smoky brown with round, white, halo-like area between cunei; costal vein on corium at cuneal fracture orange; tarsi brown.

Dorsal surface with scattered, short, decumbent, sericeous hairs; antennal segment 1 with decumbent dark hairs; antennal segments 2, 3, and 4 with dense, short vestiture; femora with scattered, short, dark, decumbent hairs.

Eyes removed from anterior margin of pronotum by distance equal to one-third diameter of eye; vertex with weak transverse impression at level of posterior margin of eyes; spiniform frons not obscuring clypeus from above; antennal segment 1 moderately enlarged with several erect black spines on interior surface; antennal segments 3 and 4 slightly smaller in diameter than segment 2, segment 2 about one-half diameter of segment 1; labium reaching to about abdominal sternite 3; posterior margin of pronotum evenly concave; tibiae with dark spines; metatarsal segments 1 and 2 subequal in length; segment 3 one-and-a-half times length of segment 2.

MEASUREMENTS: Total length 6.40, maximum width 1.84, length head .76, width head .82, interocular space .36, length pronotum .62, width pronotum 1.32, length scutellum 1.04, width scutellum 1.08, length corium 3.04, length clavus 2.56, length cuneus 1.00, width cuneus .62, length claval commissure 1.46, distance apex commissure-apex membrane 2.76, length metatibia 4.12; length

antennal segments 1—.78, 2—2.76, 3—2.08, 4—.96; length labial segments 1—.74, 2—.72, 3—?, 4—?.

MALE GENITALIA: Figures 116, 131–133.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Knysna, Garden of Eden, 16–20.I.1955, A. J. T. Janse (TM).

PARATYPE: *Cape Province*—1 macropterous ♂, Cape Town, Kirstenbosch, 5–29.XII.1954 (Janse) (RTS).

See key and *A. oudtshoornensis* discussion for separation of *capensis* from other South African species.

Acrorrhinium drakensbergensis, new species

Figures 24, 114, 124–127, 145, 146

MACROPTEROUS MALE: General coloration dull brown; antennal segment 1, entire cuneus, procoxae and mesocoxae, and genital segment castaneous; elongate streak medially on clavus near claval suture and heavy quadrate macula submedially on endocorium deep mahogany; vertex between and behind eyes, anterior two-thirds of pronotum on either side of midline, antennal segment 1 proximally, distal two-thirds of antennal segment 4, area around antennal fossae, streaked area above and below eyes posteriorly extending onto pronotum, and distal margin of mesotrochanters and metatrochanters suffused with red; midline of pronotum, anterior half endocorium (anterior to large castaneous macula), exocorium generally, antennal segments 2 and 3 and proximal third of segment 4, all tibiae and tarsi, and basal 2 segments of abdomen yellowish white; metacoxae gray to whitish; labium and profemora light brown; membrane with a round, halo-like, white suffused area between cunei.

Entire body smooth, dull or only weakly shining; dorsum and thorax ventrally with scattered, short, decumbent, silvery hairs; antennae with very short, dense, shining hairs; coxae and femora with a few, scattered, semidecumbent hairs.

Eyes removed from anterior margin of pronotum by distance equal to about one-third diameter of eye; vertex shallowly transversely sulcate at level of anterior margin of eyes; spiniform frons not obscuring clypeus from above; antennal segment 1 moderately enlarged, almost twice diameter of segment 2, segment 2 slightly greater in diameter than segments 3 and 4; labium reaching onto anterior third of abdomen; tibiae with a few very fine, light hairs and a few light spines mostly on ventral surfaces, about the length of tibial diameter; metatarsal segments subequal in length.

MEASUREMENTS: Total length 4.96, maximum width ?, length head .66, width head .70, interocular space .30, length pronotum .56, width pronotum 1.20, length scutellum .72, width scutellum .90, length corium 2.34, length clavus 1.74, length cuneus .68, width cuneus .26, length claval commissure 1.00, distance apex commissure-apex membrane 2.18, length metatibia 3.40; length antennal segments 1—.70, 2—2.32, 3—1.70, 4—1.00; length labial segments 1—.58, 2—.62, 3—.56, 4—.66.

MALE GENITALIA: Figures 114, 124–127.

BRACHYPTEROUS FEMALE: Head, thorax, and scutellum mostly yellowish; abdomen, procoxae and mesocoxae, all femora and labium deep brown with reddish suffusion; antennal segments 2 and 3 (and basal quarter of 4—from paratype), metacoxae, and all tibiae and tarsi light yellowish; posterior portion of vertex, collar area of pronotum (and remainder of pronotum faintly), and most of scutellum on either side of light longitudinal midline (and distal three-fourths of antennal segment 4—from paratype) reddish (also longitudinal reddish stripes at level of antennal fossae on genae, at dorsal and ventral margins of eyes on posterior portion of head and extending onto pronotum, and 2 longitudinal stripes on proepimeron); hemelytra mostly light transclucent, broadly suffused with brown along scutellum and claval commissure; small roundish mark at level of apex of scutellum on corium and large trapezoidal macula (with long extension from the anterior mesial corner) at level of claval commissure medially on corium, very dark brown; antennal segment 1 light brown.

Body surface and vestiture similar to male; eyes with a few very short hairs.

Structure of head similar to male, eyes smaller and vertex relatively wider than in male; labium reaching posterior margin of abdominal sternite 3; pronotum not strongly constricted anteriorly, nearly flat longitudinally; pronotal collar about as wide as diameter of antennal segment 1, well defined laterally, indistinct dorsally; posterior margin of pronotum shallowly and evenly concave; scutellum flattened longitudinally, weakly convex transversely; hemelytra greatly reduced, undifferentiated, reaching middle of abdominal tergite 4; posterior margin of hemelytra evenly rounded beginning at claval commissure, slightly upturned; abdomen broad medially (no gravid specimens examined but the abdomen presumably becomes swollen and bulbous), pointed at anus; tibiae as in male.

MEASUREMENTS: Total length 4.40, maximum width ?, length head .76, width head .70, interocular space .40, length pronotum

.60, width pronotum .84, length scutellum .56, width scutellum .63, length hemelytron 1.40, length metatibia 3.68; length antennal segments 1—.80, 2—2.56, 3—2.00, 4—1.16; length labial segments 1—.70, 2—.56, 3—.70, 4—.62.

FEMALE GENITALIA: Figures 145, 146.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Royal Natal Nat. Pk., Tendele Camp, 5400 ft., 4–5 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet, UV Light Trap (SANC).

PARATYPES: *Cape Province*—1 macropterous ♂, Knysna, Keurbooms River, Jan. 1931 (Barnard). *Natal*—1 macropterous ♂, same data as holotype; 1 bracypterous ♀, *idem*, but not at UV light; 1 macropterous ♂, Howick; 1 macropterous ♂, P. Shepstone, 5.97. *Transvaal*—1 macropterous ♂, Blouberg, Motlakeng, 5–6000 ft., 6–15.1.1955; 1 macropterous ♂, Pretoria, 22.12.1910 (Swierstra). LESOTHO—3 brachypterous ♀♀, Sani Pass, 8000 ft., 10 Mar. 1968 (SANC, TM, BM[NH], JAS, RTS).

This species is named for its occurrence on the Drakensberg.

Acrorrhinium drakensbergensis appears to be most closely related to *A. brincki*, *A. capensis*, and *A. oudtshoornensis*. The unicolorous metafemora will separate it from *brincki*, the light unicolorous corial margin from *oudtshoornensis* and *capensis*. The brachypterus females of *drakensbergensis* are very similar to those of *oudtshoornensis* but can be separated as in the key.

In the series of males examined the length of the labium varies from just surpassing the metacoxae to reaching about one-third the length of the abdomen.

The three brachypterous females from Lesotho, Sani Pass, were collected in association with *Chrysocoma tenuifolia* Berg. (Compositae).

Acrorrhinium formicarium (Poppius)

Ectmetocranum formicarium Poppius, 1914a, p. 37.

Acrorrhinium formicarium is one of the most specialized species in the genus and to date is known only from the brachypterous female. The structure of the head is the only feature that obviously relates this species to the other members of the genus. The clypeus is strongly flattened and greatly produced and the frontal spine is proboscis-like. The entire body and all of the appendages are castaneous, highly polished, and covered with long, erect, light-colored hairs. The posterior margin of the pronotum is upturned. The scutellum is slightly elevated. The hemelytra are upturned just past the apex of the scutellum and form two points nearly as high as

the dorsum of the bulbous abdomen. The tibiae lack the longitudinal rows of tiny spines found in all other species of *Acrorrhinium*. The figure of *A. formicarium* in Poppius (1921) is basically accurate. When the male of this species is known it will be much easier to assess its relationship to other species in the genus.

Poppius (1914a) stated that the two type females of *A. formicarium* were deposited in the Paris Museum. In fact, none are in Paris, but at least one is in the Helsinki Museum, and I am designating it as the lectotype. It bears the labels: "Museum Paris, Cape-Town, E. Simon, Coll. Noualhier 1898"; "*Ectmetocranum formicarium* n. gen. et sp. B. Poppius det."; "Mus. Zool. H:fors, Spec. typ. No. 7786, *Ectmetocranum formicarium* Popp."; and "LECTOTYPE *Ectmetocranum formicarium* Poppius, det. R. T. Schuh."

Acrorrhinium incrassata, new species

Figures 119, 138–140

MACROPTEROUS MALE: General coloration light brownish yellow with the following dull red markings: narrow stripe on dorsal midline of head (interrupted at level of posterior margin of eyes), narrow stripe on either side of midline of anterior lobe of pronotum, posterior third of scutellum on either side of midline, two lines on head at level of dorsal margin of eyes and just below dorsal margin of eyes running anteriorly from eyes to antennal fossae and posteriorly to pronotum, line near ventral margin of eyes between eye and pronotum, lower margin of juga, two parallel lines on entire lateral margin of pronotum, numerous small spots on all femora (particularly mesofemora and metafemora), and suffused areas at apex of clavus and corium at cuneal fracture; posterior lobe of pronotum, most of scutellum, elongate area on corium along claval suture at level of midpoint of claval suture, venter of mesothorax, and most of genital segment black; antennal segment 2 distally, antennal segments 3 and 4, and all tarsi dark brown; irregular marking on corium contiguous laterally with elongate black area described above and diffuse marking on clavus at same level white; much of corium and cuneus suffused with brown, veins lighter; membrane light yellow gray; pronotum and scutellum with distinct yellow midline dorsally.

Entire body smooth, dull; dorsum with a few scattered, decumbent, very short, silvery hairs antennal segments 2, 3, and 4 with dense, short, shining vestiture; tibiae and tarsi with short, dull hairs.

Eyes removed from anterior margin of pronotum by distance

equal to about one-third diameter of eye; spine-like projection of frons very short; antennal segment 1 only very slightly enlarged, segment 2 increasing in diameter distally to same diameter as segment 1, segments 3 and 4 about same diameter as segment 2 proximally, about two-thirds diameter of segment 1; labium attaining distal end of metacoxae; pronotal collar about equal in width to diameter of antennal segment 3; posterior margin of pronotum shallowly concave; femora with a few, very fine, erect spines; tibiae with scattered dark spines about equal in length to tibial diameter; metatarsal segments subequal in length.

MEASUREMENTS: Total length 7.52, maximum width 2.24, length head .90, width head .90, interocular space .40, length pronotum .80, width pronotum 1.60, length scutellum 1.10, width scutellum 1.30, length corium 3.60, length clavus 2.68, length cuneus 1.24, width cuneus .56, length claval commissure 1.60, distance apex commissure-apex membrane 3.40, length metatibia 4.32; length antennal segments 1—1.02, 2—2.72, 3—1.96, 4—1.02; length labial segments 1—.78, 2—.84, 3—.64, 4—.74.

MALE GENITALIA: Figures 119, 138–140.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province,* Grootfontein, Middelburg, 4.XI.65, E. Schoombee (SANC).

PARATYPES: 1 macropterous ♂, same data as holotype, except 3.XII.1965. *Transvaal*—1 macropterous ♂, Zomerkomst, Politzi, 23.X.64 (Johannsmeier) (SANC, RTS).

This species is named for the incrassate second antennal segment.

See discussion under *A. muntingi* for distinguishing characteristics.

Acrorrhinium monticola, new species

Figures 117, 134–137

MACROPTEROUS MALE: General coloration dull gray-brown; anterior lobe of pronotum, scutellum (except as noted below), cuneus, thoracic pleura and venter, abdominal venter, and labial segments 2, 3, and 4 dark brown; medium brown as follows: dorsal surface of frons, much of vertex between eyes posteriorly, posterior lobe of pronotum (except as below), diffuse area medially on corium, antennal segment 1, and all femora; white as follows: clypeus, lora, metathoracic scent gland opening, longitudinal stripe on extreme posterior pronotal lobe medially and midlaterally (midlateral stripes not present in paratype), longitudinal stripe on posterior lobe of scutellum, ovoid spot just anterior to brown area medially on corium, and apex of corium at cuneus; antennal segments 2 and

3 yellow-white, segment 2 white basally; tibiae cream with contrasting longitudinal dorsal stripe; tibiae distally, and tarsi black.

Entire body smooth, dull; dorsum with scattered (almost scale-like), short, decumbent, sericeous hairs; antennal segment 1 with short, dark, decumbent hairs; femora with scattered short hairs; tibiae with a few semidecumbent hairs distally.

Eyes removed from anterior margin of pronotum by distance equal to about one-third diameter of eye; spine-like process of frons short, blunt; antennal segment 1 moderately enlarged, with several erect, black spines on interior surface, segments 2 and 3 of equal diameter, about half diameter of segment 1 (segment 4 missing); labium reaching posterior margin of abdominal sternite 5 (from paratype); posterior pronotal margin straight; femora with a few erect, thin, black spines mostly on dorsal surface; tibiae with scattered dark spines with dark bases; metatarsal segments subequal in length.

MEASUREMENTS: Total length 6.80, maximum width ?, length head .88, width head .90, interocular space .36, length pronotum .74, width pronotum 1.36, length scutellum 1.10, width scutellum .96, length corium 3.28, length clavus 2.52, length cuneus 1.16, width cuneus .80, length claval commissure 1.48, distance apex commissure-apex membrane 2.76, length metatibia 4.36; length antennal segments 1—1.00, 2—2.52, 3—2.08, 4—?; length labial segments 1—.80, 2—.84, 3—.68, 4—.80.

MALE GENITALIA: Figures 117, 134–137.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province,* Bainskloof Pass Summit, 21 Jan. 1968, J. A. & S. Slater, T. Schuh, M. Sweet (SANC).

PARATYPE: 1 macropterous ♂, same data as holotype, but at UV light (RTS).

This species is named for its occurrence in the mountains of the Southwest Cape.

A. monticola is distinctive among the South African species of *Acrorrhinium* by virtue of its dull gray coloration and the dark brown stripe on the dorsal surface of the tibiae.

Acrorrhinium muntingi, new species

Figures 118, 141–144

MACROPTEROUS MALE: General coloration light yellowish brown, with dark brown markings as follows: vertex between eyes irregularly, distinct transverse lines anteriorly on vertex (behind

spine), most of pronotum on either side of light midline, scutellum broadly around anterior and lateral margins, hemelytra suffused mostly on clavus and cuneus, labial segments 2, 3, and 4, thorax ventrally, abdomen ventrally (particularly anterior two-thirds of genital segment), antennal segment 1, and numerous small round spots on all femora; tibial spines with dark bases; tarsi black; midline of posterior lobe of scutellum suffused with red; pregenital abdominal segments lighter than most of venter and suffused with green.

Body smooth, weakly shining; dorsum with short, scattered, decumbent, silvery hairs; antennal segment 1 with dark decumbent hairs; antennal segments 2, 3, and 4 with short, very dense, shining vestiture; femora with scattered short hairs.

Eyes removed from anterior margin of pronotum by distance equal to about one-third diameter of eye; spine of frons very short; antennal segment 1 slightly greater in diameter than segment 2 (only segments 1 and 2 present in holotype); labium just surpassing metacoxae; posterior margin of pronotum slightly concave; femora with a few moderately long very thin spines; tibiae with scattered dark spines about length of tibial diameter; metatarsal segments subequal in length.

MEASUREMENTS: Total length 7.68, maximum width 2.00, length head .78, width head .92, interocular space .36, length pronotum .76, width pronotum 1.52, length scutellum 1.10, width scutellum 1.24, length corium 3.68, length clavus 2.84, length cuneus 1.40, width cuneus .54, length claval commissure 1.72, distance apex commissure-apex membrane 3.64, length metatibia 4.44; length antennal segments 1—1.06, 2—2.88, 3—?, 4—?; length labial segments 1—.82, 2—.82, 3 plus 4—1.54.

MALE GENITALIA: Figures 118, 141–144.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, 3.XII.1965. E. Schoombee (SANC).

PARATYPES: 8 macropterous ♂♂, same data as holotype; 2 macropterous ♂♂, same data as holotype, but "October, M. Johannsmeier" (SANC, JAS, RTS).

This species is named for Mr. Jack Munting, formerly Curator of the South African National Collection of Insects, Pretoria.

A. muntingi and *A. incrassata* can be separated from the *brincki* group as indicated in the generic discussion. *A. muntingi* has a spotted first antennal segment, a second antennal segment of uniform diameter, and a mottled vertex, whereas *incrassata* has the

first antennal segment spotted but the second segment is enlarged distally; the vertex of *incrassata* is light, marked only with a median longitudinal red stripe.

Acrorrhinium oudtshoornensis, new species
Figures 23, 115, 128–130

MACROPTEROUS MALE: General coloration dark gray-brown, suffused with red; antennal segments 2 and 3 (4 missing in holotype) and tibiae light yellowish gray; anterior third of corium and quadrate macula at apex of corium along cuneal fracture white; small area on corium at apex claval commissure suffused with white; quadrate macula on endocorium just posterior to and contiguous with white anterior portion of corium velvety castaneous; tarsi almost black; membrane dull gray-brown.

Entire body smooth, dull; abdominal venter weakly shining; dorsum with scattered, short, decumbent hairs; antennal segment 1 and femora with scattered, dark, decumbent hairs; antennal segments 2 and 3 with dense, short, shining vestiture.

Eyes removed from anterior margin of pronotum by distance equal to one-half diameter of eye; vertex with weak, longitudinal, median sulcus between eyes; spiniform frons conical, not obscuring clypeus from above; antennal segment 1 moderately enlarged, almost twice diameter of segment 2, segment 2 of slightly greater diameter than segment 3; labium attaining distal end of metacoxae; posterior margin of pronotum very shallowly concave; tibiae and tarsi with scattered dark spines with dark bases; metatarsal segments subequal in length.

MEASUREMENTS: Total length 5.20, maximum width 1.38, length head .66, width head .70, interocular space .36, length pronotum .60, width pronotum 1.16, length scutellum .78, width scutellum .92, length corium 2.40, length clavus 1.86, length cuneus .72, width cuneus .44, length claval commissure 1.06, distance apex commissure-apex membrane 2.20, length metatibia 3.32; length antennal segments 1—.58, 2—2.00, 3—1.54, 4—?; length labial segments 1—.64, 2—.64, 3—.40, 4—.60.

MALE GENITALIA: Figures 115, 128–130.

BRACHYPTEROUS FEMALE: Antennal segment 1, abdomen, procoxae and mesocoxae, and all femora dark gray brown suffused with red; most of head, pronotum, scutellum, and claval area of hemelytra yellowish gray; corial region of hemelytra, antennal segments 2 and 3, tibiae, and metacoxae yellow or yellow white; antennal segment

4 red; tarsi black; corium medially with heavy velvety black macula and an anteriorly contiguous oval white macula.

Body surface texture and vestiture as in male; eyes with a few very short hairs.

Structure very similar to that of brachypterous female of *A. drakensbergensis*; metatarsal segment 2 about half length of segment 3, segment 1 subequal in length to segment 3.

MEASUREMENTS: Total length 4.48, maximum width ?, length head .88, width head .80, width vertex .42, length pronotum .64, width pronotum .88, length scutellum .64, width scutellum .70, length hemelytra 1.84; length antennal segments 1—.80, 2—2.52, 3—1.80, 4—.92; length labial segments 1—.70, 2—.76, 3—.66, 4—.78.

FEMALE GENITALIA: See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Swartberg Pass, elevation 5000 ft., 25 mi. N. of Oudtshoorn, Platberg, 19 Nov. 1967, M. H. Sweet (SANC).

PARATYPES: *Cape Province*—1 macropterous ♂, same data as holotype; 1 macropterous ♂, 3 brachypterous ♀♀, just N. Outiniqua Pass Summit S. of Oudtshoorn, 7 Feb. 1968 (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: 3 nymphs (in alcohol), just N. Outiniqua Pass Summit S. of Oudtshoorn, 7 Feb. 1968 (RTS).

This species is named for Oudtshoorn, the district in which all known specimens have been collected.

A. oudtshoornensis is most closely related to *A. capensis*, but is much smaller, much darker in coloration, and lacks the light halo-like area on the membrane.

The Outiniqua Pass specimens of *oudtshoornensis* were collected under *Helichrysum orbiculare* (Thunb.) Druce (Compositae) in association with workers of the ant *Anoplolepis* sp. The females of this species are very ant-like in their movements.

Azizus Distant

Azizus Distant, 1910a, p. 11.

Azizus is probably most closely related to *Aeolocoris*. It can be recognized by the large eyes of the males, the well defined pronotal collar, the mottled coloration, and the erect peg-like hairs on the dorsum and first antennal segment. The genus as presently constituted may bring together species that actually belong in different genera.

The type species of the genus, *A. basilicus* Distant, is from India, whereas all other known species are from Africa.

List of described species of *Azizus*

basilicus Distant (*Azizus*), 1910a, p. 11. India: Bengal.
basilewskyi Carvalho (*Azizus*), 1951b, p. 110. Congo.
* *dispar* Odhiambo (*Azizus*), see *Hallodapus dispar* (Odhiambo) **New Combination.**
oculatus Poppius (*Megacoeloides*), 1914a, p. 33. Togo; Swaziland.

Azizus near **oculatus** (Poppius)

Megacoeloides oculatus Poppius, 1914a, p. 33.

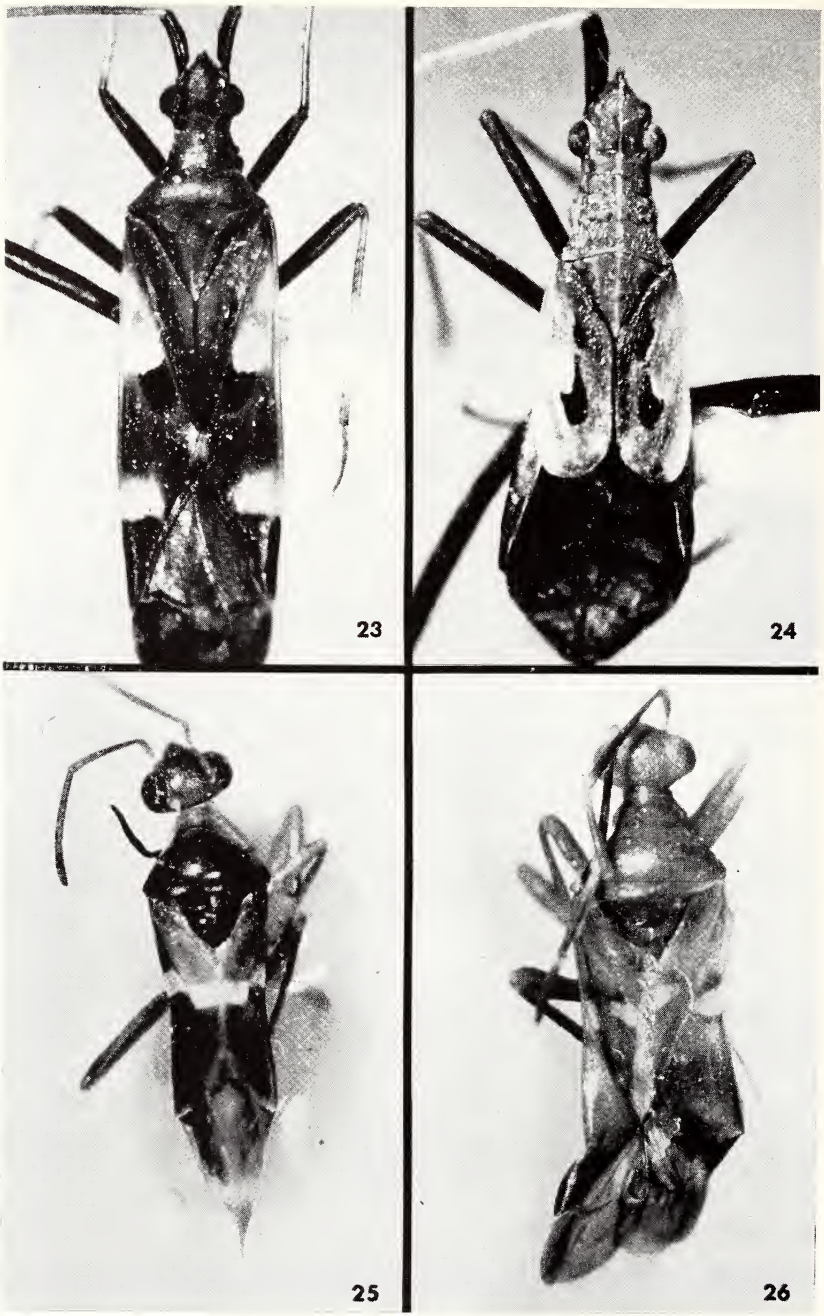
A single male specimen with the data "Eranchi, Swaziland, XII-1954, Capener" is in the J. A. Slater Collection. Comparison of this specimen with type material of *A. oculatus* (see below) indicates that it is congeneric, if not conspecific, with *oculatus*. Unfortunately the male genitalia of the Swaziland specimen are very lightly sclerotized, probably because of its teneral condition, and therefore a critical comparison could not be made with other specimens of *oculatus*.

A male and female of *Azizus oculatus* from Togo, apparently part of Poppius' type series, are in the Helsinki Museum. Neither of these specimens appear to be the "type" of Poppius, but I am informed that it is also in Helsinki (personal communication, Martin Meinander). On subsequent examination of all specimens originally studied by Poppius a lectotype will have to be designated.

Carinogulus, new genus

MACROPTEROUS MALE: Elongate, ant mimetic; head, pronotum, and scutellum granular or finely rugulose, weakly shining; posterior third of corium, apex of clavus, cuneus, cell of membrane, and adjacent membrane at base of cell highly polished, shining; legs and venter polished, shining; dorsum with short, decumbent, light hairs and sometimes scutellum, corium, and clavus also with a few long erect hairs; eyes glabrous; antennae with very short, light, appressed pubescence; labium with a few, short, erect hairs; femora with short, decumbent, light hairs, sometimes metafemora with longer, erect, rather dense hairs on ventral surface; tibiae with short decumbent, light hairs, and semierect, fine, light spines about as long as tibial diameter; abdominal venter with reclining light hairs.

Head strongly deflexed, either concave behind, or narrowed


23
24
25
26

behind eyes to form a short neck about as long as diameter of antennal segment 2 and as wide as interocular space; frons nearly vertical; eyes granular, large, reaching ventrally almost to gula; vertex raised above level of pronotal collar by at least diameter of antennal segment 2; vertex weakly convex or sometimes slightly depressed between eyes; frons transversely rugose; anterior margins of eyes sinuate; antennae inserted slightly above ventral margins of eyes; antennal fossae contiguous with anterior margins of eyes; antennal segment 1 slightly enlarged, segment 2 tapering proximally, distal diameter about equal to diameter of segment 1, segments 3 and 4 subequal to or slightly greater in diameter than distal end of segment 2; clypeus rounded transversely, prominent, separated from frons by distinct cleft; bucculae moderately expanded, crescent-shaped; gula moderately long, inclined, with distinct carina running from posterior margin of buccal cavity to posterior margin of head; pronotum tumid and strongly inclined posteriorly, strongly narrowed anteriorly, lateral margins nearly straight, posterior margin broadly rounded laterally, calli indistinct, defined only by slightly roughened surface texture; pronotal collar wide, flat; mesoscutum exposed, inclined anteriorly, steep-sided laterally; scutellum tumid, reaching dorsally to about height of pronotum; lateral corial margins reflexed ventrally on anterior half, distinctly sinuate, narrowest at level of midpoint of claval commissure; cuneal incisure obsolete; membrane with 2 cells; abdomen long, very narrow; femora nearly round, slightly enlarged in diameter apically, weakly bowed; tibiae with longitudinal rows of tiny, closely spaced spines; tarsal claws evenly curved, moderately long; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 147–159. Vesica twisted, S-shaped; apex of vesica weakly or strongly attenuated; phallotheca either with "thumb-like" structure near basal opening (Figures 156, 159) or without "thumb" and with apex of complex structure (Figures 148, 152); left clasper trough-like; right clasper lanceolate.

Females unknown.

TYPE SPECIES: *Carinogulus varii*, new species.

This genus is named for the distinctive carinate gula.

←

FIGS. 23–26. Hallodapini. Fig. 23. *Acrorrhinium oudtshoornensis*, male, holotype. Fig. 24. *Acrorrhinium drakensbergensis*, female (Sani Pass, 8000 ft., Lesotho). Fig. 25. *Carinogulus hobohmi*, male, holotype. Fig. 26. *Carinogulus kochi*, male, holotype.

Carinogulus can be recognized by the relatively long, carinate gula in conjuction with the type of hemelytral fasciae that is also found in *Glaphyrocoris* (Figures 25, 26). Two distinct species groups exist within the genus: *C. kochi* and *C. varii* have the head convex behind and similar in structure to *Systellonotus*; *C. hobohmi* and *C. transvaalensis* have the head concave behind and similar in structure to *Glaphyrocoris*. Neither *Systellonotus* nor *Glaphyrocoris* have a carinate gula, however.

All species of *Carinogulus* are known only from macropterous males. No biological or ecological information is available, but the genus is probably ground living and adapted to very arid areas, as it is known only from the dry interior of the northern Transvaal and from South West Africa.

Carinogulus is probably most closely related to *Glaphyrocoris* from North Africa, but at the present time this affinity is unclear, because of the confused state of the taxonomy of *Glaphyrocoris* and closely related genera. The following discussion emphasizes some of the important aspects relative to the status of *Carinogulus* and its close relatives.

Carvalho (1952a) synonymized *Linoceraea* Horvath with *Glaphyrocoris* Reuter, but gave no explanation for the action. Hoberlandt (1953b), who was probably not aware of Carvalho's synonymy, noted that *Linoceraea* is most closely related to *Laemocoris*, *Trachaelonotus*, and *Cyrtopeltocoris*. Linnavuori (1964) moved *Laemocoris kiritschenkoi* (Poppius) to *Trachaelonotus* and discussed the relationship of *Trachaelonotus*, in the sense *T. kiritschenkoi*, to *Laemocoris* and *Glaphyrocoris*. In this discussion Linnavuori apparently based his conception of *Glaphyrocoris* on *G. lunigera* (Horvath), which is not the type species of *Glaphyrocoris*, but was originally described in *Linoceraea* and transferred to *Glaphyrocoris* by Carvalho (1952a). Comparison of *Glaphyrocoris unifasciatus* Reuter, the type species of the genus, and a redescription of *G. lunigera* (Hoberlandt, 1953b) reveals the following important differences between the two species: 1) *G. unifasciatus* lacks a ridge or raised carina on the posterior margin of the vertex which is present in *lunigera*; 2) the head and eyes are distinctly concave behind in *unifasciatus* so that the anterior margin of the pronotum is obscured, whereas in *lunigera* the head is not concave behind and the anterior margin of the pronotum is not obscured; and 3) the transverse fascia in *unifasciatus* is narrow and very sharply delimited, whereas in *lunigera* it is broad and somewhat diffuse. Linnavuori's (1964) figures of *T. kiritschenoi* agree

closely with the characters outlined above for *G. lunigera*, but not with those of *G. unifasciatus*.

Linnavuori (1965) synonymized *Trachaelonotus*, in the sense of *T. unifasciatus* Reuter, the type species of the genus, with *Glaphyrocoris*, in the sense of *lunigera* Horvath. This action created a secondary homonym because *Glaphyrocoris* and *Trachaelonotus* both contained a species named *unifasciatus*. Linnavuori therefore proposed the new name *iranicus* for *Trachaelonotus unifasciatus* Reuter. The above discussion would seem to indicate, however, that *Linoceraea* is not synonymous with *Glaphyrocoris*, but instead possibly a synonym of *Trachaelonotus*. This situation would make the new name *iranicus* a junior objective synonym and the name *unifasciatus* would have to be applied under Article 59c of the International Code of Zoological Nomenclature.

The relationships of the above-mentioned genera are additionally complicated when the genus *Hypomimus* Lindberg is considered. Examination of the holotype of *Hypomimus albosellatus* Lindberg indicates that it is very closely related to *Glaphyrocoris unifasciatus*. Linnavuori (1961; 1964; 1965) and Odhiambo (1959c) have described additional species of *Hypomimus*, and these species must be carefully studied to confirm whether they form a distinct genus or are actually members of *Glaphyrocoris*.

KEY TO SPECIES OF *Carinogulus*

1. Head concave behind; dorsum with only decumbent hairs; hemelytral fascia nearly straight and parallel sided 2
   Head convex behind, forming very short neck; dorsum with decumbent hairs and some erect long hairs on scutellum and hemelytra; hemelytral fascia more or less irregular, not parallel sided 3
2. Hemelytral maculae uninterrupted, forming continuously parallel sided fascia across corium and clavus ..... *transvaalensis*
   Hemelytral macula on corium placed anterior to that on clavus by distance equal to about width of macula ..... *hobohmi* (Fig. 25)
3. Vertex slightly depressed, with distinct sulcus anteriorly; general coloration castaneous ..... *varii*
   Vertex weakly convex, without sulcus; general coloration bright orange brown ..... *kochi* (Fig. 26)

Carinogulus hobohmi, new species
Figures 25, 151–153

MACROPTEROUS MALE: Basic coloration dark brown to mahogany, head and anterior third of pronotum somewhat lighter

than posterior two-thirds of pronotum; anterior three-fifths of clavus, except basally, rusty brown; parallel sided transverse macula on corium at level of apex of scutellum and transverse macula of similar width on clavus just posterior to corial macula white (Fig. 25); distal third of antennal segment 2 and fascia of uniform width on membrane at level of apex of cuneus suffused with white; mesotrochanters and metatrochanters, distal end of mesocoxae, distal two-thirds of metacoxae, and ostiolar peritreme white.

Dorsum weakly shining; rust brown area on clavus dull; remainder of hemelytra including membrane highly polished; dorsum and venter with scattered, short, decumbent hairs; metafemora with rather dense erect hairs on ventral surface.

Head concave behind; posterior margin of vertex finely carinate, just covering anterior margin of pronotum; vertex broad, nearly flat; antennal segment 1 scarcely enlarged, segment 2 increasing slightly in diameter distally to about diameter of segment 1, segments 3 and 4 subequal in diameter, slightly greater than distal diameter of segment 2; pronotal collar slightly wider than diameter of antennal segment 1; posterior margin of pronotum nearly straight across mesoscutum, convex laterally; cuneal fracture angled anteromedially; abdomen reaching almost to apex of cuneus.

MEASUREMENTS: Total length 4.08, maximum width 1.04, length head .48, width head .76, interocular space .32, length pronotum .68, width pronotum 1.04, length scutellum .56, width scutellum .68, length corium 1.96, length clavus 1.12, length cuneus .68, width cuneus .32, length claval commissure .76, distance apex commissure-apex membrane 1.60, length metatibia 1.60; length antennal segments 1—.22, 2—.90, 3—.56, 4—.43; length labial segments 1—.34, 2—.36, 3—.36, 4—.36.

MALE GENITALIA: Figures 151–153.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH WEST AFRICA: Abachaus, Otjiwarongo District, III.1950, G. Hobohm (TM).

This species is named for the collector, G. Hobohm.

Carinogulus hobohmi is most closely related to *C. transvaalensis* by the posteriorly convex head, parallel sided hemelytral maculae, and the structure of the male genitalia, in which the phallotheca lacks the thumb-like process found in the other two species in the genus. *C. hobohmi* can be separated from *transvaalensis* by the form of the hemelytral maculae, which are offset in the former (Figure 25) but form an uninterrupted fascia in the latter.

An additional specimen of *Carinogulus* from 10 miles south

of Okaukeujo, South West Africa, collected on May 14, 1958, at 1100 meters elevation, deposited in the California Academy of Sciences, resembles *hobohmi* rather closely in the form of the head and body, but differs in that the hemelytral maculae are irregular. This specimen may represent a new species.

Carinogulus kochi, new species

Figures 26, 158, 159

MACROPTEROUS MALE: Basic coloration bright brownish orange; antennal segments 2, 3, and 4 (except as below), extreme apex of corium, cuneus, cell of membrane, and genital capsule castaneous; membrane smoky brown; distal end of antennal segment 1, bases of antennal segments 3 and 4, ostiolar peritreme, and incomplete transverse maculae on clavus and corium white (Fig. 26); hemelytral maculae outlined in castaneous; metacoxae and metatrochanters light; all tarsi lighter than tibiae.

Surface texture, vestiture, and structure as in *C. varii* except vertex weakly convex and without distinct longitudinal sulcus.

MEASUREMENTS: Total length 4.48, greatest width ?, length head .46, width head .86, interocular space .32, median length pronotum .72, width pronotum 1.18, length scutellum .60, width scutellum .80, length corium 2.00, length clavus 1.66, length cuneus .62, width cuneus .38, length claval commissure .96, distance apex commissure-apex membrane 1.70, length metatibia 2.10; length antennal segments 1—.34, 2—1.14, 3—.76, 4—.54; length labial segments 1—.36, 2—.48, 3—?, 4—?.

MALE GENITALIA: Figures 158, 159.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Alexandersbay, 9.XII.48, Koch/Son (TM).

See discussion under *C. varii*.

Carinogulus transvaalensis, new species

Figures 147–150

MACROPTEROUS MALE: Very similar in coloration and structure to *C. hobohmi*; basic color deep castaneous, legs somewhat lighter than body; antennal segments 1 and 2 light brown, segment 2 cream on distal half; protarsi and mesotarsi light (metatarsi missing in holotype), contrasting with dark tibiae; anterior half of clavus dull as in *hobohmi* but unicolorous with remainder of hemelytra; corium and clavus with complete white transverse fascia situated at level

of anterior third of claval commissure, slightly wider laterally than mesially, not reaching lateral corial margin (only anterior half of left hemelytron present in holotype); metafemora club-like, slightly more swollen on distal half than in *hobohmi*; protibiae and mesotibiae with only a very few, short, semierect spines on ventral surfaces; metatibiae mutic.

MEASUREMENTS: Total length ?, maximum width ?, length head .48, width head .84, interocular space .36, length pronotum .80, width pronotum 1.08, length scutellum .48, width scutellum .60, length corium 1.80, length clavus 1.40, length cuneus ?, width cuneus ?, length claval commissure .84, distance apex commissure-apex membrane ?, length metatibia 1.72; length antennal segments 1—.24, 2—.92, 3—.60, 4—?; length labial segments 1—.36, 2—.32, 3—.36, 4—.42.

MALE GENITALIA: Figures 147–150.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Blouberg, Leipsig Miss. Stat., 3–5.I.1955, Trans. Mus. Exp. (TM).

This species is named for its occurrence in the Transvaal.

Carinogulus transvaalensis can be recognized by its castaneous coloration and the complete white transverse fascia of nearly uniform width just anterior to the middle of the claval commissure (see also discussion under *C. hobohmi*).

Carinogulus varii, new species
Figures 154–157

MACROPTEROUS MALE: Generally castaneous, including antennae and legs, except as noted below (antennal segments 3 and 4 missing in holotype); incomplete transverse maculae on clavus and corium and ostiolar peritreme white; all tarsi and metacoxae light brown; membrane dark smoky brown with a white "halo" basally.

Median third of clavus and corium (anterior posterior orientation) dull, tomentose, remainder polished, shining; scutellum, clavus, and corium with a few long, fine, erect hairs.

Head weakly convex behind eyes, forming short neck about as long as diameter of antennal segment 2 and as wide as vertex between eyes; vertex slightly depressed between eyes and with distinct median longitudinal sulcus anteriorly; antennal segment 1 slightly enlarged, segment 2 tapering proximally, distal diameter about equal to diameter of segment 1, segments 3 and 4 subequal to distal diam-

eter of segment 2; labium slightly surpassing mesocoxae; posterior margin of pronotum straight across mesoscutum, convexly rounded laterally; metatarsal segments 1 and 2 subequal in length, segment 3 about 1½ times length of segment 2.

MEASUREMENTS: Total length 4.80, maximum width 1.04, length head .60, width head .92, interocular space .30, length pronotum .84, width pronotum 1.12, length scutellum .44, width scutellum .56, length corium 2.08, length clavus 1.60, length cuneus .60, width cuneus .40, length claval commissure .92, distance apex commissure-apex membrane 1.92, length metatibia 2.32; length antennal segments 1—.28, 2—1.40, 3—?, 4—?; length labial segments 1—.42, 2—.40, 3—.40, 4—.40.

MALE GENITALIA: Figures 154–157.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH WEST AFRICA: Farm DJAB, Rehoboth Dist., 7.V.1959, L. Vari (TM).

This species is named for the collector, Dr. L. Vari, Curator of Insects at the Transvaal Museum, Pretoria.

Carinogulus varii is most closely related to *C. kochi*. Both species have the head convex behind, have a few erect, long hairs on the scutellum and hemelytra, a somewhat irregular fascia, a short apical spine on the vesica, and a thumb-like projection on the phallotheca. *C. varii* is uniformly castaneous as opposed to *kochi* which is bright brownish orange. The eyes of *varii* are slightly larger and more protuberant than those of *kochi*, but without both species for comparison, this character is difficult to use (see also key to species of *Carinogulus*).

Formicopsella Poppius

Formicopsella Poppius, 1914a, pp. 42–43.

Formicopsella is closely related to *Sohenus* Distant from India and to *Myombea* and *Skukuza* from Africa, especially by the structure of the head. The genus can be recognized by the eyes being removed from the anterior margin of the pronotum by a distance nearly equal to the diameter of an eye, the antennae inserted at about the middle of the anterior margin of the eyes, and the absence of a spine on the scutellum. The pattern of coloration is very similar to all of the above mentioned genera and to *Pangania*, with a complete, transverse, hourglass-shaped, white fascia medially on the corium and a transverse white macula at the apex of the corium along the cuneal fracture.

Formicopsella regneri Poppius
Figures 38, 160–162

Formicopsella regneri Poppius, 1914a, p. 43.

As the only described species in the genus (see however *Skukuza zeugma*), *Formicopsella regneri* can be recognized by the characters noted in the generic discussion. Poppius (1914a) stated that the dorsum of *regneri* possessed only decumbent white hairs, whereas in fact the dorsum and genae have scattered, erect, white hairs about as long as the protibial diameter, in addition to the decumbent hairs. This omission by Poppius was apparently the result of the rubbed condition of the holotype. Poppius also noted that the labium reached almost to the "spitze" of the metacoxae. In specimens from South Africa the labium reaches the posterior margin of the mesosternum in macropterous males and is slighlty shorter in brachypterous females. Poppius may have experienced difficulty in determining the exact length of the labium relative to the body because the head is flexed forward in the card-mounted holotype.

Although *regneri* was described from a macropterous female, all female specimens known from South Africa are brachypterous. The general structure of the brachypterous forms is similar to that of the macropterous males and females except that the pronotum is less steeply inclined posteriorly and the hemelytra are undifferentiated and cover only about the basal third of the abdomen.

MEASUREMENTS: macropterous ♂—Total length 4.44, maximum width 1.24, width head .88, interocular space .40; brachypterous ♀—Total length 4.68, maximum width 1.00, width head .96, interocular space .54.

MALE GENITALIA: Figures 160–162.

The host of this arboreal species is *Acacia karroo* Hayne (see also discussion under *Pangania fasciatipennis*).

SPECIMENS EXAMINED: *Cape Province*—11 macropterous ♂♂, Kimberley, 17–18 Jan. 1968, UV light. *Natal*—2 brachypterous ♀♀, Estcourt; 1 macropterous ♂, Eshowe, 15 Nov. 1967; 1 macropterous ♂, Weenen, i.ii.1928 (Thomasset). *Transvaal*—1 brachypterous ♀, 1 nymph, Malips Drif, 8.12.65 (Hoffman); 1 macropterous ♂, Middelfontein near Nylstroom, XII-17-1953 (Capener); 5 nymphs (in alcohol), 1.7 mi. N. Mooketsi, 13 Dec. 1967; 2 macropterous ♂♂, Moorddrift, 12.1914 (Swierstra); 10 macropterous ♂♂, 14 brachypterous ♀♀ (in alcohol—4 macropterous ♂♂, 2 brachypterous ♀♀, 11 nymphs), Pienaarsriver Dam, 15 mi. NE Pretoria, 2 November 1967 (Adults and nymphs on *Acacia*

karroo Hayne) (SANC, TM, BM[NH], HM, JAS, RTS). TANZANIA—Daressalam, Pangani, 10-30-09 (Regner) (holotype) (HM).

Hallodapus Fieber

Hallodapus Fieber, 1858, p. 307—Odhiambo, 1959c, pp. 667–668.

Hallodapus can be characterized as follows—

Small, ant mimetic; males usually macropterous, females sometimes brachypterous; coloration variable, usually with complete or incomplete white transverse fascia on anterior half of hemelytra and white quadrate macula at lateral apex of corium; legs variable in color, never completely dark; vestiture of short decumbent or long erect hairs or a combination of the two types; vertex weakly longitudinally sulcate or not; eyes granular, with or without short, erect hairs, contiguous with anterior margin of pronotum, protuberant, slightly larger in males than females; antennae long, segment 1 slightly enlarged, segment 2 linear, slightly greater in diameter than segments 3 and 4, slightly less than segment 1; pronotal collar flat, wide; pronotum steeply inclined posteriorly in macropterous forms, only slightly inclined in brachypterous forms; hemelytra parallel sided, at most weakly sinuate laterally; membrane with two cells, smaller cell sometimes obsolete; tibiae occassionally with very long thin spines; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 163–177. Vesica usually very long, with several bends; phallotheca L-shaped, usually simple and tubular, sometimes with dorsal projection; left clasper trough-like; right clasper lanceolate.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

Hallodapus is closely related to *Trichophthalmocapsus*, *Boopidella*, and *Laemocoris*. *Hallodapus transvaalensis*, described as new below, is particularly closely related to *Trichophthalmocapsus* and *Laemocoris* by virtue of its having a wing edge stridulatory mechanism (see discussion of structure under *Trichophthalmocapsus*), a character which is common to all known species of those genera. Other species of *Hallodapus* which have the wing edge stridule are: *H. descriminatus* (Distant), *H. maculatus* (Distant), *H. montandoni* (Reuter), *H. dispar* (Odhiambo), *H. poseidon* (Kirkaldy) and *H. rufescens* (Burmeister). The remaining species of *Hallodapus* do not have the wing edge stridulatory mechanism. The following species, however, have not been examined for the structure: *H. brunneus* (Poppius), *H. centrimaculatus* (Poppius), *H. indicus* Poppius, *H. persimilis* Poppius, *H. pumilis* Horvath, *H. ravenar* Poppius, and *H. sibiricus* Poppius.

The males of *Hallodapus* are very similar to those of *Laemocoris*, except that in the latter genus the scutellum is usually swollen and forms a spine-like projection, and in the former the scutellum is nearly flat. The females of *Hallodapus* are usually brachypterous, the hemelytra being undifferentiated and covering about half of the abdomen; the pronotum is much less steeply inclined posteriorly than in the macropterous forms. The brachypterous females of *Laemocoris* usually have the pronotum strongly swollen.

Hallodapus is widespread in the Old World, occurring primarily in tropical regions. A single species has been recorded from the New World (Carvalho, 1958a); it is, however, not a species of *Hallodapus*, but belongs to the Bryocorinae, as I have confirmed by examination of the holotype of *Eritocoris albiceps* Lethierry in the Brussels Museum. *Eritocoris* is a junior synonym of *Hallodapus* and therefore *albiceps* will have to be placed in another existing genus or in a new genus. This action, however will have to await study of *albiceps* by a specialist of the Bryocorinae.

All species of *Hallodapus* for which field data are available are ground living. The males of all African species are known only from macropterous forms, but Southwood and Leston (1958) note that *H. rufescens* in Great Britain is generally brachypterous in both sexes.

List of species of *Hallodapus* from Africa

albofasciatus Motschulsky (*Leptomerocoris*), 1863, p. 86. Widely distributed in Africa and Orient.

* *chariensis* Odhiambo (*Trichophthalmocapsus*), see *albofasciatus* (Motschulsky) **New Synonymy.**

discoidalis Poppius (*Plagiorhamma*), 1914a, p. 56. Tanzania.

dispar Odhiambo (*Azizus*), 1959c, pp. 668–670. **New Combination.** Uganda.

pilosa Reuter (*Plagiorhamma*), 1882, p. 31. Guinea.

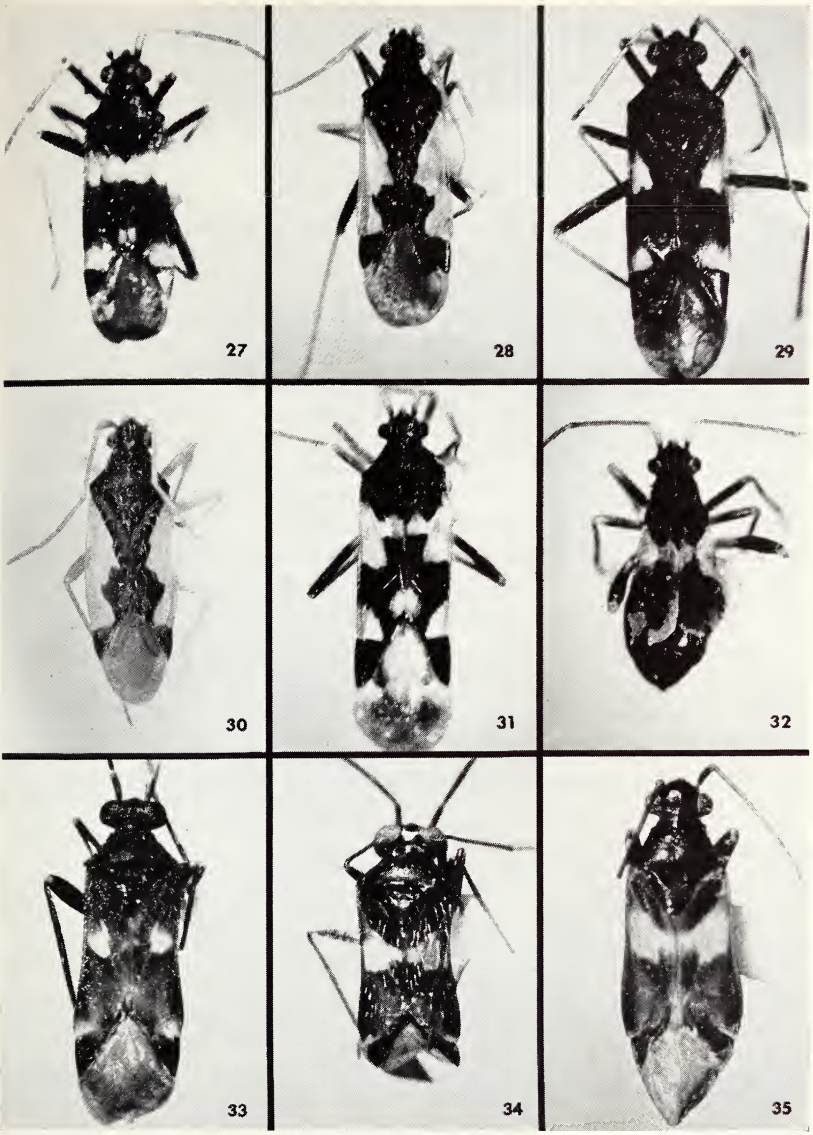
poseidon Kirkaldy (*Laemocoris*), 1902b, p. 315. Guinea.

pseudosimilis new species. South Africa: Transvaal.

quadrimaculatus new species. South Africa: Transvaal.

→

FIGS. 27–35. Hallodapini. Fig. 27. *Hallodapus albofasciatus*, male (Pretoria, Transvaal). Fig. 28. *Hallodapus pseudosimilis*, male, holotype. Fig. 29. *Hallodapus quadrimaculatus*, male, holotype. Fig. 30. *Hallodapus similis*, female (Pretoria, Transvaal). Fig. 31. *Hallo-*



dapus transvaalensis, male, holotype. Fig. 32. *Hallodapus transvaalensis*, female (5 mi N. Louis Trichardt, Transvaal). Fig. 33. *Trichopthalmocapsus australis*, male, holotype. Fig. 34. *Trichophthalmocapsus hessei*, male, holotype. Fig. 35. *Trichophthalmocapsus hessei*, female (Warmbad, South West Africa).

* *reuteri* Poppius (*Tyraquellus*), see *albofasciatus* (Motschulsky) **New Synonymy.**

similis Poppius (*Plagiorhamma*), 1914a, p. 55. East Africa; South Africa: Transvaal.

* *tenuis* Odhiambo (*Hallodapus*), see *albofasciatus* (Motschulsky) **New Synonymy.**

transvaalensis, new species. South Africa: Natal, Transvaal.

verticicus Odhiambo (*Hallodapus*), 1967, pp. 1671–1673. Central African Republic.

vittatus Odhiambo (*Trichophthalmocapsus*), 1959c, pp. 661, 663–664, 685. **New Combination.** Uganda; Abyssinia.

KEYS TO SOUTH AFRICAN SPECIES OF *Hallodapus*

Macropterous specimens

1. Exocorium entirely cream or white 2
   Exocorium not entirely cream or white 3
2. Metafemora entirely cream or white ..... *similis* (Fig. 30)
   Metafemora cream or white on proximal third, castaneous on distal two-thirds ..... *pseudosimilis* (Fig. 28)
3. Hemelytra without complete white transverse fascia ..... *quadrimaculatus* (Fig. 29)
   Hemelytra with complete white transverse fascia, femora not entirely castaneous 4
4. White transverse fascia of nearly uniform width ..... *albofasciatus* (Fig. 27)
   White transverse fascia wide on corium, narrow on clavus ..... *transvaalensis* (Fig. 31)

Brachypterous specimens

1. Posterior margins of hemelytra almost entirely white ..... *transvaalensis* (Fig. 32)
   Posterior margins of hemelytra almost entirely castaneous ..... *albofasciatus*

Hallodapus albofasciatus (Motschulsky)

Figures 27, 163–165

Leptomerocoris albofasicatus Motschulsky, 1863, p. 86.
Tyraquellus reuteri Poppius, 1914a, pp. 51–52. **New Synonymy.**
Hallodapus tenuis Odhiambo, 1959c, pp. 664–668, 685. **New Synonymy.**
Trichophthalmocapsus chariensis Odhiambo, 1967, pp. 1678–1681. **New Synonymy.**

Hallodapus albofasciatus in South Africa can be recognized by the long, light colored, nearly erect pubescence on the dorsum, the

conspicuous erect hairs on the eyes, the yellow antennae (except the proximal half of segment 1 which is brown), the yellow tibiae, the light colored mesocoxae and metacoxae and proximal third of the mesofemora and metafemora, the complete, broad, "jagged-edged," white, transverse hemelytral fascia, and the more or less quadrangular macula on the corium at the cuneal fracture.

MALE GENITALIA: Figures 163–165.

H. albofasciatus differs from *H. similis* and *H. pseudosimilis* in that the exocorium is not entirely light and the eyes are hairy, from *transvaalensis* in that the transverse fascia of the hemelytra is nearly uniformly broad whereas in *transvaalensis* it is broad on the corium and narrow on the clavus, and from *quadrimaculatus* which does not have a complete transverse fascia and has only short decumbent pubescence dorsally.

Hallodapus albofasciatus has been recorded previously from Ceylon, Java, and Madagascar (Carvalho, 1958a). Comparison of specimens from Southeast Asia and northern and southern Africa indicates that indeed only a single very widespread species is involved. Study of specimens in the British Museum (Natural History) identified by Linnavuori as *Hallodapus reuteri* (Poppius), and of the original description of *reuteri*, indicates that it is synonymous with *albofasciatus* and by priority must bear the latter name. Examination of the holotype of *Trichophthalmocapsus chariensis* Odhiambo in the Paris Museum indicates that it is also synonymous with *albofasciatus* and must bear the latter name by priority. *Hallodapus scotti* (China) from Rodriguez Island, is very similar to *albofasciatus* and its distribution would support the contention that the 2 may be synonymous. This species is at present known only from a brachypterous female, and therefore a decision on formal synonymy will have to await comparison of the genitalia when males become available. Also, examination of the holotype of *Hallodapus tenuis* Odhiambo in the British Museum (Natural History) reveals that this species is a synonym of *albofasciatus* and must bear the latter name by priority.

The type specimen of *Hallodapus albofasciatus* was recorded as destroyed by Bergroth (1917), and therefore it seems desirable to designate a neotype. Distant (1904c) recorded this species from Ceylon as *Tyraquellus albofasciatus*. The specimens examined by Distant agree substantially with the original description of Motschulsky (1863) and are from Ceylon. I have selected a male as the neotype. It bears the following labels: "Ceylon (Green)";

"Distant Coll. 1911–383"; and "NEOTYPE *Leptomerocoris albofasciatus* Motschulsky, det. R. T. Schuh". It is deposited in the British Museum (Natural History).

Hallodapus albofasciatus is ground living. Two specimens from 15 mi. NE of Machododorp, Transvaal, were taken under *Acanthospermum australe* (Loefl.) Kuntze (Compositae).

SPECIMENS EXAMINED: *Natal*—1 macropterous ♂, P. Town; 1 macropterous ♂, St. Lucia Estuary, 14 Nov. 1967. *Orange Free State*—1 macropterous ♂, Emmaus. *Transvaal*—1 macropterous ♀, 10 mi. E. Machododorp, 30 Nov. 1967, at light; 1 macropterous ♂, 1 macropterous ♀, 1 brachypterous ♀, 15 mi. NE Machadodorp, 4500 ft. elevation, 26–27 Mar. 1968; 1 macropterous ♀, Lyttleton, 12 Jan. 1968, UV light; 1 macropterous ♂, Pretoria, 2 Nov. 1967, at light; 1 macropterous ♂, Pretoria, 14.1.06; 1 macropterous ♂, Pretoria, 18.1.06; 1 macropterous ♂, Pretoria, 23.I.07 (Janze); 1 macropterous ♂, South Africa, B.M. 1926–40 (SANC, TM, BM[NH], JAS, RTS).

Hallodapus pseudosimilis, new species

Figures 28, 166–168

Hallodapus similis Carvalho, Dutra, and Becker, 1960 (*nec* Poppius), pp. 454–455.

MACROPTEROUS MALE: Elongate, nearly parallel sided; head, pronotum, and scutellum nearly black; proximal third of antennal segment 1, distal half of metafemora, most of clavus, inner apical portion of corium, cuneus, and thoracic pleura castaneous; exocorium, anterior half of endocorium, and anterior half of lateral claval margin white; membrane generally smoky brown, white at apex of cuneus; all coxae, femora (except as above), and tibiae, ostiolar peritreme, and labium cream; tarsi cream proximally, brown distally; abdomen brownish basally, grading to castaneous apically.

Body surface dull; dorsum, particularly head, pronotum, and scutellum, with scattered, decumbent, short, sericeous hairs and moderately long, semierect, shining hairs; inner surface of antennal segment 1 with a few, erect, fine spines about the length of segmental diameter; antennal segments 2, 3, and 4 with very short, apppressed, shining pubescence; abdominal venter with reclining light hairs; femora with decumbent hairs and very slender long hairs ventrally.

Frons strongly convex; vertex broad, nearly flat, not sulcate, posterior margin slightly concave and with very fine, raised carina;

eyes protuberant, contiguous with anterior margin of pronotum, not reaching gula; clypeus visible from above; antennae inserted just above ventral margin of eyes; fossae slightly removed from eyes; antennal segment 1 only slightly enlarged, segment 2 of slightly greater diameter distally than proximally, segments 3 and 4 about two-thirds diameter of segment 2; pronotum elevated posteriorly, lateral margins very shallowly concave, posterior margin weakly sinuate, calli indistinct; mesoscutum exposed, elevated above hemelytra, inclined anteriorly, separated from scutellum by a distinct transverse impression; scutellum convex; hemelytra nearly parallel sided; membrane with only one visible cell, inner vein nearly parallel to mesial margin of cuneus; cuneus inset from corial margin by distance equal to about diameter of antennal segment 1; cuneal fracture slightly angled anteromedially; abdomen just surpassing base of cuneus; tibiae with a few semierect, light spines about as long as tibial diameter; metatarsal segment 1 about half length of segment 2, segment 2 subequal in length to segment 3.

MEASUREMENTS: Total length 3.20, maximum width 1.04, length head .26, width head .48, interocular space .23, length pronotum .34, width pronotum .90, length scutellum .50, width scutellum .64, length corium 1.48, length clavus 1.08, length cuneus .42, width cuneus .26, length claval commissure .58, distance apex commissure-apex membrane 1.46, length metatibia 1.44; length antennal segments 1—.30, 2—.84, 3—.78, 4—.48; length labial segments 1—.32, 2—.32, 3—.26, 4—.38.

MALE GENITALIA: Figures 166–168.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, 30 Nov. 1967, 10 mi. E. Machadodorp, J. A. & S. Slater, T. Schuh, at light (SANC).

PARATYPES: *Transvaal*—1 macropterous ♂, Lyttelton, 18 Dec. 1967, at light; 1 macropterous ♂, *idem*, 22 Dec. 1967, UV light; 2 macropterous ♂♂, *idem*, 27 Dec. 1967, UV light; 1 macropterous ♂, Waterkloof Ridge, Pretoria, 9.4.54, at light in evening (Rudebeck); 1 macropterous ♂, Pretoria, 10.XI.1957 (Vari); 1 macropterous ♂, *idem*, 23.12.1959, light trap (Neubecker); 1 macropterous ♂, *idem*, 6 Nov. 1967, at light; 3 macropterous ♂♂, *idem*, 7 Nov. 1967, at light (SANC, TM, LU, JAS, RTS).

This species is named for its similarity to *Hallodapus similis*. See discussion under *H. similis*.

No biological information is available for this species. All known

specimens are from the highveld of the Transvaal and were taken at lights.

Hallodapus quadrimaculatus, new species
Figures 29, 169–171

MACROPTEROUS MALE: Elongate, parallel sided; basic coloration black or brownish black; antennal segment 1 proximally, labial segments 1 and 2, prothoracic and mesothoracic pleura, procoxae and mesocoxae, all femora, and all of tarsal segment 3 castaneous; quadrate maculae on anterior half of corium and at apex of corium, white; distal two-thirds of antennal segment 1, antennal segments 2, 3, and 4, metacoxae, all tibiae, and all tarsal segments 1 and 2 yellowish or light brown; labial segments 3 and 4 brown; membrane generally smoky brown; cells of membrane somewhat darker than surrounding membrane.

Abdominal venter polished, shining, remainder of body finely granulose, dull; dorsum with short decumbent light hairs; antennal segment 1 with light, very fine, erect spine on interior surface, segments 2, 3, and 4 with very short, fine, decumbent pubescence; abdominal venter with short, reclining, shining hairs; femora with very fine, short, appressed hairs and some long erect hairs on ventral surface; tibiae with very fine decumbent pubescence, a few short semierect spines no longer than tibial diameter, and longitudinal rows of tiny, closely spaced spines.

Head declivent; eyes moderately large, protuberant, leaving genae exposed ventrally; vertex flattened, not sulcate, posterior margin with fine raised carina; antennal segment 1 moderately enlarged, segment 2 about two-thirds diameter of segment 1, segments 3 and 4 subequal in diameter, of slightly smaller diameter than segment 2; bucculae weakly developed; gula short; labial segment 1 reaching onto prosternum, labium reaching apex of metacoxae; pronotal collar almost as wide as diameter of antennal segment 1; calli obsolete; pronotum with lateral margins shallowly concave, posterior margin sinuate, shallowly concave across mesoscutum; mesoscutum exposed, raised, inclined anteriorly, separated from scutellum by distinct transverse impression; scutellum convex; cuneal incisure obsolete, cuneal fracture angled slightly anteromedially; membrane with 2 cells, vein demarcating smaller cell obscure; abdomen reaching middle of cuneus; metatarsal segment 1 half length of segment 2, segment 2, subequal in length to segment 3.

MEASUREMENTS: Total length 3.72, maximum width 1.12, length head .28, width head .65, interocular space .24, length pronotum .38, width pronotum 1.02, length scutellum .62, width scutellum .80, length corium 1.80, length clavus 1.38, length cuneus .62, width cuneus .26, length claval commissure .72, distance apex commissure-apex membrane 1.60, length metatibia 1.90; length antennal segments 1—.32, 2—1.04, 3—.98, 4—.72; length labial segments 1—.40, 2—.40, 3—.40, 4—.40.

MALE GENITALIA: Figures 169–171.

MACROPTEROUS FEMALE: Very similar to male.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Pretoria, 4 Dec. 1967, J. A. & S. Slater, T. Schuh, at light (SANC).

PARATYPES: *Transvaal*—1 macropterous ♂, Pretoria, 10.XI. 1957 (Vari); 2 macropterous ♂♂, Pretoria, 6 Nov. 1967, at light; 11 macropterous ♂♂, 3 macropterous ♀♀, Pretoria, 7 Nov. 1967, at light; 1 macropterous ♂, Pretoria, 23 Nov. 1967, at light; 2 macropterous ♂♂, 1 macropterous ♀, Pretoria, 26 Dec. 1967, at light (Sweet); 1 macropterous ♂, Lyttleton, 27 Dec. 1967, UV light (SANC, TM, HM, JAS, RTS).

This species is named for its possession of four quadrate maculae on the hemelytra.

Hallodapus quadrimaculatus is the only South African species of the genus that has only short decumbent dorsal pubescence and four quadrate hemelytral maculae. It is probably most closely related to *Hallodapus poseidon* but is larger and has the procoxae and mesocoxae completely castaneous whereas they are almost totally light brown or cream in *poseidon*.

H. quadrimaculatus is known only from Pretoria and all specimens are from lights.

A macropterous female from Warmbaths, Transvaal, deposited in the J. A. Slater Collection, resembles *quadrimaculatus* in general coloration, but has long erect as well as short appressed dorsal pubescence. Two brachypterous females from Oliviershoek Pass Summit, Natal, deposited in the J. A. Slater Collection, resemble the above specimen closely in pattern of coloration and vestiture and may be conspecific with it. A macropterous female from Satara Camp, Kruger National Park, Transvaal, deposited in the J. A. Slater Collection, has a color pattern similar to *quadrimaculatus* but the white maculae on the anterior half of the corium extend slightly onto the clavus; the dorsal vestiture is composed only of long erect hairs.

Hallodapus similis (Poppius)
Figures 30, 172–174

Plagiorhamma similis Poppius, 1914a, p. 55.
Hallodapus similis Odhiambo, 1959c, p. 667.

Hallodapus similis is one of four species of *Hallodapus* in Africa which has the exocorium entirely white; *H. suturalis* (Fieber) (incorrectly attributed to Herrich-Schaeffer by Carvalho, 1958a), from the Palearctic, is the only other species in the genus with this pattern of coloration. *H. similis* can be separated from *H. pseudosimilis*, the only other South African species of *Hallodapus* with a completely white exocorium, by virtue of its having completely white metathoracic pleura and metafemora whereas *pseudosimilis* has the metafemora castaneous distally and white proximally and has the metathoracic pleura castaneous.

Although *similis* and *pseudosimilis* appear to be very closely related on general facies, the structure of the male genitalia in the two species is quite different. The phallotheca in *similis* (Fig. 173) has a dorsal projection similar to the type found in *Pangania fasciatipennis*; this structure is not found in any other known species of *Hallodapus* for which the male genitalia have been examined. The phallotheca of *pseudosimilis* (Fig. 168) is similar to that found in *H. transvaalensis* and *H. albofasciatus*. The vesica of *similis* (Fig. 172) is twisted and S-shaped, whereas in *pseudosimilis* the vesica is bent in a more complex fashion (Fig. 166), much like it is in *transvaalensis* and *quadrimaculatus*. This complex genitalic picture points up the need for much further study of the phyletic relationships within the Hallodapini.

No biological or ecological data are available for this species. It is known only from Pretoria and is sympatric with *pseudosimilis*.

SPECIMENS EXAMINED: *Transvaal*—1 macropterous ♀, Pretoria, 10.XI.1957 (Vari); 4 macropterous ♀♀, Pretoria, 7 Nov. 1967, at light; 1 macropterous ♂, 1 macropterous ♀, Pretoria, 4 Dec. 1967, at light (SANC, TM, RTS).

Hallodapus transvaalensis, new species
Figures 31–32, 175–177

MACROPTEROUS MALE: Very elongate, parallel sided; basic coloration castaneous; anterior half of corium, except extreme base, transverse fascia on clavus, quadrate macula at apex of corium, round macula between apex of claval commissure and base of mem-

brane, distal four-fifths of antennal segment 1, ostiolar peritreme, distal four-fifths of procoxae and mesocoxae, entire metacoxae, and proximal third of metafemora white; proximal fifth of antennal segment 1, distal two-thirds of metafemora, and abdomen castaneous; thoracic pleura and venter dark brown to black; labial segment 1 and proximal fifth of procoxae and mesocoxae reddish; antennal segments 2, 3, and 4, labial segments 2, 3, and 4, profemora and mesofemora, all tibiae, and all tarsal segments light brown; apical two-fifths of membrane and apices of cells smoky brown, remainder of membrane almost white.

Head pronotum, scutellum, and thoracic pleura finely granular, dull; hemelytra smooth, dull to weakly shining; abdominal venter polished, shining; entire dorsum with numerous, very long, erect or semierect, sericeous hairs; antennal segment 1 with a few long, semierect, slender spines on interior surface, all segments with rather dense vestiture of reclining light hairs of length about equal to diameter of segment on which they occur; abdomen with numerous, long, semierect, light hairs; all femora and tibiae with short, decumbent, light hairs and long, fine, light, spine-like hairs (many about twice the length of tibial diameter of leg on which they occur); eyes with short hairs.

Head declivent; eyes protuberant; vertex broad, posterior margin with fine raised carina; vertex and frons convex; clypeus visible from above, compressed laterally; antennae inserted just below middle of anterior margin of eyes; antennal segment 1 only slightly enlarged, segment 2 about two-thirds diameter of segment 1, segments 3 and 4 of slightly smaller diameter than segment 2; bucculae weakly developed; gula short; labial segment 1 reaching onto prosternum, labium reaching onto anterior third of abdomen; pronotum steeply inclined, posterior and lateral margins nearly straight; calli obsolete; mesoscutum exposed, elevated, separated laterally from scutellum by distinct impression, impression obsolete medially; scutellum weakly convex; hemelytra parallel sided, lateral margins with obscure finely serrate stridulitrum; cuneal incisure obsolete, cuneal fracture perpendicular to lateral corial margin; membrane with two distinct cells, inner vein nearly parallel to mesial margin of cuneus; abdomen not quite reaching apex or corium; legs moderately long; inner surface of metafemora glabrous, with coarse granular texture (stridulatory plectrum); all tibiae with longitudinal rows of tiny, closely spaced spines; metatarsal segment 1 about half length segment 2, segment 2 subequal in length to segment 3.

MEASUREMENTS: Total length 3.64, maximum width 1.04, length head .24, width head .54, interocular space .26, length pronotum .38, width pronotum .94, length scutellum .50, width scutellum .64, length corium 1.68, length clavus 1.30, length cuneus .54, width cuneus .26, length claval commissure .66, distance apex commissure-apex membrane 1.72, length metatibia 1.60; length antennal segments 1—.32, 2—1.10, 3—.80, 4—?; length labial segments 1—.34, 2—.36, 3—.30, 4—.40.

MALE GENITALIA: Figures 175–177.

BRACHYPTEROUS FEMALE: Basic coloration, body surface texture, and vestiture as in macropterous male (Fig. 32).

Head very similar in structure to male, eyes somewhat smaller; antennae inserted slightly above ventral margin of eyes, fossae removed from inner margin of eyes by distance equal to about diameter of antennal segment 2; pronotum only slightly inclined posteriorly, lateral margins sinuate, posterior margin deeply excavated medially; mesoscutum and scutellum nearly flat; hemelytra undifferentiated, reaching just posterior to middle of abdomen, lateral margins nearly straight, posterior margins evenly rounded; abdomen greatly enlarged in gravid females, pointed apically.

MEASUREMENTS: Total length 3.20, maximum width 1.12, width head .58, interocular space .28.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Zoutpansberg, 4500 ft., 5 mi. N. Louis Trichardt, 8 May 1968, T. Schuh, J. A. & S. Slater, M. Sweet (SANC).

PARATYPES: *Natal*—2 brachypterous ♀♀, 5 mi. N. Umkomaas, 17 Apr. 1968. *Transvaal*—1 macropterous ♂, 1 brachypterous ♀, Barberton, 3000 ft., 22–23 Mar. 1968; 1 macropterous ♂, Lyttelton, 27 Feb. 1968, UV light; 1 macropterous ♂, 20 mi. NE Machadodorp, Schoemannskloof, 4300 ft., 22 Mar. 1968; 1 macropterous ♂, Pretoria, 10.3.07 (Janse); 1 macropterous ♂, Pretoria, 17.I.1951 (Vari); 3 macropterous ♂♂, 1 macropterous ♀, 11 brachypterous ♀♀, same data as holotype; 2 macropterous ♂♂, South Africa, BM, 1926–40 (SANC, TM, BM[NH], JAS, RTS).

Hallodapus transvaalensis can be separated from all other described species of *Hallodapus* by its peculiar hemelytral fascia (Fig. 31). This is the only South African species of *Hallodapus* which possesses a stridulatory mechanism and the very long tibial spines.

H. transvaalensis is ground-living. The series of specimens from Louis Trichardt was taken from a dry grassy area along a roadside.

NOTES ON EXTRALIMITAL SPECIES

Hallodapus dispar (Odhiambo), new combination

Azizus dispar Odhiambo, 1959c, pp. 668–670.

This species was described in the genus *Azizus* from Uganda. The presence of well demarcated contrasting hemelytral maculae, the absence of the erect peg-like hairs which are characteristic of other *Azizus* species, the absence of extreme sexual dimorphism of the eyes, and the presence of a wing edge stridulatory mechanism, militate against placement of *dispar* in *Azizus*, but argue rather for placement in *Hallodapus*. Careful study of the *Hallodapus* complex of genera may reveal that *dispar* will need to be placed in a new genus.

Hallodapus poseidon (Kirkaldy)

Laemocoris poseidon Kirkaldy, 1902b, p. 315.

Poppius (1914a) synonymized *Allodapus aethiopicus* Reuter with *Laemocoris* (= *Hallodapus*) *poseidon* Kirkaldy. The holotype of *H. poseidon* from Addah (Ghana) is in the Helsinki Museum (Type No. 11866). Also what is probably the type of *H. aethiopicus*, from Pemba Island, is in the Helsinki Museum (Type No. 12071). The latter specimen is missing the head and pronotum but from what is available the specimen does not appear to be conspecific with *poseidon*. Confirmation of this, however, will have to await a revision of *Hallodapus*.

Hallodapus vittatus (Odhiambo), new combination

Trichophthalmocapsus vittatus Odhiambo, 1959c, pp. 661–664, 685.

This species was described in *Trichophthalmocapsus* but cannot be satisfactorily placed there because it does not have a wing edge stridulatory mechanism, lacks the very long spines on the tibiae, and has a nearly straight lateral corial margin. I am tentatively placing *vittatus* in *Hallodapus* even though it may deserve placement in a separate genus, but this cannot be determined without a revision of the *Hallodapus* complex of genera.

Laemocoris Reuter

Laemocoris Reuter, 1879, p. 183.

Laemocoris can be recognized by the possession of a *Hallodapus*-like facies, long erect hairs on the dorsum, a wing edge stridulatory

mechanism, strong sexual dimorphism, and a tumid scutellum which is usually spine-like in the males.

This genus is most diverse in the Mediterranean and Middle East, but it ranges through Africa and probably occurs in Southeast Asia (Carvalho, 1958a). *Laemocoris* presently includes about 11 described species. The fauna from the Middle East has been reviewed by Linnavuori (1964).

Only a single brachypterous female of an unidentified *Laemocoris* species is known from South Africa. It bears the following data and is placed in the J. A. Slater Collection: "S. Africa: Cape Prov., Cape Point Nat. Res., 22 Jan. 1968, J.A.&S. Slater, T. Schuh, M.H. Sweet."

Myombea China and Carvalho

Myombea China and Carvalho, 1951, pp. 1120–1123.

Myombea can be characterized by its similarity to *Formicopsella*. The head is strongly rounded and "necked" behind with the eyes removed from the anterior margin of the pronotum by a distance nearly equal to the diameter of an eye, the second antennal segment is flattened, the lateral margins of the hemelytra are distinctly sinuate, and the scutellum forms a fine, somewhat posteriorly directed spine. The pronotum is much more strongly narrowed and neck-like in *Myombea* than in *Formicopsella*, approaching the condition found in *Malgacheocoris* Carvalho from Madagascar. *Aspidacanthus* from Senegal and Turkestan also has a scutellar spine as in *Myombea*.

A single species is known from East and southern Africa.

Myombea bathycephala China and Carvalho

Myombea bathycephala China and Carvalho, 1951, pp. 1120–1123.

Myombea bathycephala was originally described from the Myombe River, Tanzania. A macropterous male bearing the following data, deposited in the British Museum (Natural History), is available from South Africa: "Port Shepstone, 5.97." China and Carvalho (1951) illustrated the male genitalia of this species.

Pangania Poppius

Pangania Poppius, 1914a, pp. 47–48.

Although ant mimetic in general appearance and behavior, *Pangania* does not show the great degree of morphological modification

of the head as found in *Skukuza*, *Formicopsella*, and *Myombea*. The tumid pronotum, sinuate lateral corial margin, and hemelytral coloration give *Pangania* its ant-like appearance. These features, combined with the very short, appressed pubescence found over nearly the entire body surface, the short, vertical head, the very short gula, the eyes almost touching the anterior pronotal margin, and the form of the phallotheca (Fig. 180), characterize the genus.

LIST OF SPECIES OF *Pangania*

bendera Odhiambo (*Pangania*), 1967, pp. 1676–1678. Mozambique.
chnous Odhiambo (*Systellonotopsis*), 1963, pp. 112–113. **New Combination.** Tanganyika.
fasciatipennis Poppius (*Pangania*), 1914a, p. 48. East Africa; South Africa.
venusta Odhiambo (*Pangania*), 1959c, pp. 657–659, 684–685. Tanzania.

Pangania fasciatipennis Poppius

Figures 39, 178–181

Pangania fasciatipennis Poppius, 1914a, p. 48.—Carvalho, Dutra, and Becker, 1960, p. 455.

Pangania fasciatipennis is the only species in the genus known from South Africa and therefore can be recognized by the characters given in the generic diagnosis. I collected this arboreal mirid in large numbers at Pienaarsriver Dam, near Pretoria, on *Acacia karroo* Hayne (Leguminosae); *Formicopsella regneri* was found on the same plants, but in somewhat smaller numbers than *fasciatipennis*. The mirids were living in association with two species of ants, *Anoplolepis custodiens* (F. Smith) and *Camponotus* sp., and resembled them very closely. No brachypterous specimens are known for *fasciatipennis*, whereas *regneri* females from South Africa are known only in the short winged form. The brachypterous specimens are superior ant mimics over those that are macropterous. E. Bedford (unpublished) notes that *Pangania fasciatipennis* "associates with the pugnacious ant *Anoplolepis custodiens* nymphs of all sizes and adults live peacefully with ants in holes in the crotches of orange trees."

MEASUREMENTS: Macropterous ♂—Total length 5.04, maximum width 1.56.

MALE GENITALIA: Figures 178–181.

I have designated as the lectotype of *fasciatipennis* a male speci-

men in the Helsinki Museum (Type No. 11858). It bears the labels "D.O. Afrika, Daressalam, Pangani u. hinterland, R. Regner L. G., jr. no. 10.30/09", "*Pangania fasciatipennis* n. gen. et sp. B. Poppius det.", and "LECTOTYPE *Pangania fasciatipennis* Poppius, det. R.T. Schuh."

Comparison of *P. fasciatipennis* with the holotypes of *P. venusta* Odhiambo and *P. bendera* Odhiambo indicates that these forms are very closely related and extremely difficult to distinguish from one another. I am regarding the status of *bendera* and *venusta* as questionable, but the validity of these species cannot be determined with certainity until further material is available (see also discussion under *P. chnous*).

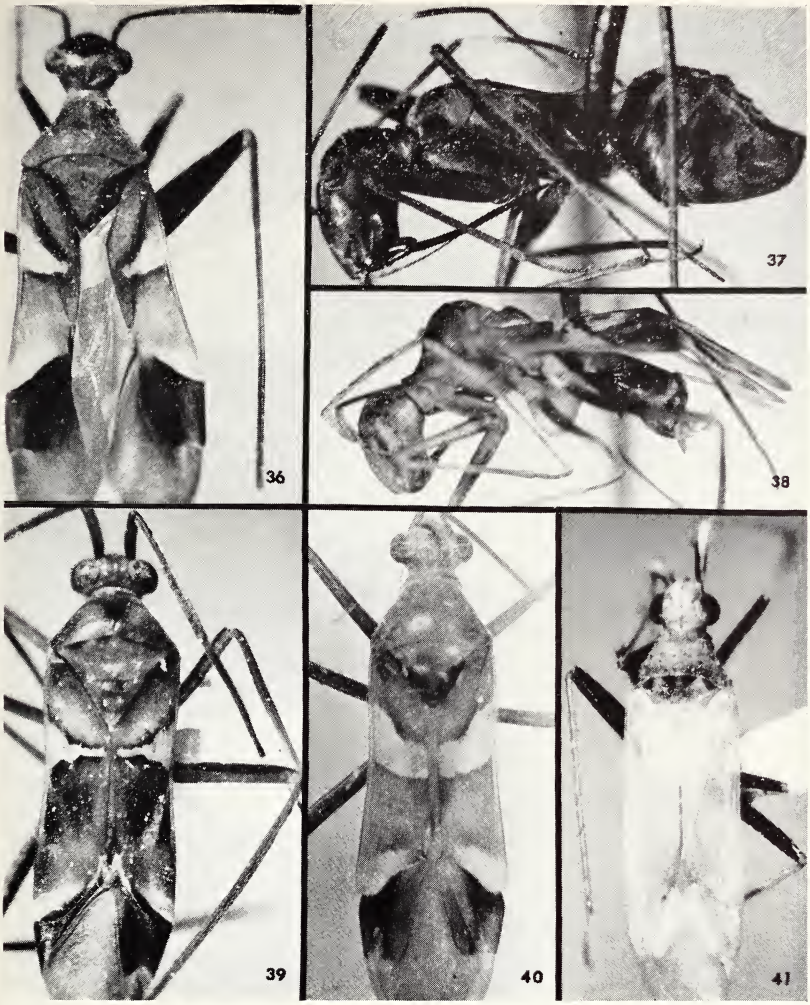
SPECIMENS EXAMINED: All specimens macropterous. *Cape Province*—1 ♂, Kimberley (Bro. Power); 1 ♂, Kimberley, 17–18 Jan. 1968, UV light; 1♂, Nooitgedacht, 23-10-1959, light trap (Krosing). *Natal*—1 ♀, Durban, 1902 (Muir); 2 ♀♀, Estcourt, 11-96; 1 ♀, Ngwabeni, Zululand, III.20-51 (Capener); 1 ♂, 3 ♀♀, Port Shepstone, 5.97; 1 ♀, Weenen, 14-3-97; 1 ♀, Weenen, XII. 1927 (Thomasset). *Transvaal*—1 ♀, Johannesburg, V-17-50 (Capener); 1 ♀, Johannesburg, Rivonia, XII.26.1951 (Capener); 1 ♀, Kruger Nat. Park, Skukuza, 29.IV.51 (Brinck and Rudebeck); 1 ♂, Skukuza, 23.III.1952 (Janse and Vari); 1 ♀, Letaba, 19-5-1947 (Bedford); 1 ♂, Lyttelton, 26 Feb. 1968, UV light; 8 nymphs (in alcohol), 15 mi. NE Machadodorp, 4500 ft. elevation, 26–27 Mar. 1968; 1 ♂, 1 ♀, Middlefontein near Nylstroom, XII-17-1953 (Capener); 2 ♂♂, 3 ♀♀, Pienaarspoort, 19.2.64 (Capener); 8 ♂♂, 28 ♀♀ (in alcohol—2 ♂♂, 13 ♀♀, 19 nymphs), Pienaarsriver Dam, 15 mi. NE Pretoria, 2 Nov. 1967 (Adults and nymphs on *Acacia karroo* Hayne); 1 ♀, Pretoria, 22-12-1951 (Capener); 16 ♂♂, 3 ♀♀, Rustenburg, XII-4-1950, XII-26-1951, III-22-1953, I-4-11-1957 (Capener); 1 ♀, Tzaneen, 11–16 Dec. 1963 (Capener); 1 ♀, Warmbaths, 4 Feb. 1964 (Capener). TANZANIA: 1 ♂, data as above (lectotype) (SANC, TM, BM[NH], HM, USNM, JAS, RTS).

NOTES ON EXTRALIMITAL SPECIES

Pangania chnous (Odhiambo), new combination

Systellonotopsis chnous Odhiambo, 1963, pp. 112–113.

Originally described in *Systellonotopsis*, this species is certainly very closely related to *Pangania fasciatipennis*. The most obvious difference between *chnous* and *fasciatipennis* is the coloration, *chnous*



FIGS. 36–41. Hallodapini. Fig. 36. *Skukuza slateri*, male, holotype. Fig. 37. *Skukuza slateri*, female (3 mi. E. Satara Camp, Kruger National Park, Transvaal). Fig. 38. *Formicopsella regneri*, male (Pienaarsriver Dam, Pretoria, Transvaal). Fig. 39. *Pangania fasciatipennis*, male (Pienaarsriver Dam, Pretoria, Transvaal). Fig. 40. *Systellonotus brincki*, male, holotype. Fig. 41. *Trichophorella australis*, male, holotype.

having the head, pronotum, and scutellum bright orange red and the hemelytra dark gray brown with a white transverse fascia, whereas in *fasciatipennis* the entire dorsum is basically light brown with a white hemelytral fascia. The form of the vesica in *chnous* and *fasciatipennis* is very similar, but apparently the phallotheca in *chnous* lacks the dorsal projection found in *fasciatipennis* (Odhiambo, 1963). On the basis of these characters I am transferring *chnous* to *Pangania*.

Skukuza, new genus

MACROPTEROUS MALE: Elongate, ant mimetic; entire body surface very finely granulose or pruinose, dull; head, pronotum, scutellum, and anterior half of hemelytra with scattered, erect, light colored hairs about the length of diameter of antennal segment 1; most of head, posterolateral margins of pronotum, lateral corial margins, and posterior half of corium with scattered, reclining, light hairs; all antennal segments with short, semiappressed, sericeous pubescence, segment 1 also with one or two erect, fine spines on interior surface; thoracic pleura and venter glabrous; abdominal venter with elongate reclining pubescence; all coxae with a few decumbent light hairs; all femora, tibiae, and tarsi with reclining hairs.

Head strongly declivent; eyes small in relation to total size of head, removed from anterior margin of pronotum by distance about equal to the width of an eye measured from above; head forming "neck" behind eyes, width at anterior margin of pronotum equal to interocular space; frons flattened; ratio of length of head to height of head about 3:5; gula long, nearly vertical; antennae inserted below ventral margin of eyes, fossae removed from eyes by distance about equal to diameter of antennal segment 1, with low, rounded carina between eye and antennal fossa; antennal segment 1 only slightly enlarged, segment 2 tapered, distal diameter slightly greater than diameter of segment 1, segments 3 and 4 subequal in diameter, about equal to proximal diameter of segment 2; labrum flattened laterally, crescentic; pronotum roughly triangular in dorsal aspect with flattened collar of width about equal to diameter of protibia; pronotum evenly and steeply inclined posteriorly, posterior lobe transversely convex; mesoscutum and scutellum separated by an indistinct transverse impression; scutellum flattened, weakly convex; lateral margins of hemelytra sinuate, narrowest at level of midpoint of claval commissure; cuneal incisure very shallow, cuneal fracture strongly angled anteromedially; membrane with two cells; abdomen constricted basally; all tibiae with light erect spines about

length of tibial diameter, mostly on ventral surfaces, and rows of tiny, closely spaced spines; tarsal claws moderately long, evenly curved, broad basally; parempodia hair-like, parallel; pulvilli small.

MALE GENITALIA: Figures 182–184.

BRACHYPTEROUS FEMALE: See *S. slateri* below.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Skukuza slateri*, new species.

This genus is named for Skukuza, a locality in the Kruger National Park, near which several specimens of the genus were collected.

Skukuza can be separated from other African genera by the neck-like structure of the head posteriorly, the eyes being well removed from the anterior margin of the pronotum, the scutellum lacking a spine, and the antennae being inserted below and removed from the ventral margin of the eyes. This genus appears to be most closely related to *Formicopsella* in general facies and also in the form of the male genitalia, which are typical of the Hallodapini.

Skukuza slateri, new species

Figures 36–37, 182–184

MACROPTEROUS MALE: Basic coloration dull gray brown; frons and all tibiae chocolate brown; antennae generally brown, median third of segment 2 somewhat lighter than remainder of segment; proximal third of antennal segment 3, transverse V-shaped macula at about midpoint of corium, and posterior margin of corium broadly white (Fig. 36).

Labium just surpassing mesocoxae; posterior margin of pronotum uniformly excavated across mesoscutum; metatarsal segments 2 and 3 subequal in length, metasarsal segment 1 slightly shorter than segment 2.

MEASUREMENTS: Total length 5.20, maximum width 1.48, length head .68, width head 1.00, interocular space .48, length pronotum .68, width pronotum 1.40, length scutellum .88, width scutellum 1.04, length corium 2.44, length clavus 1.80, length cuneus .88, width cuneus .40, length claval commissure 1.00, distance apex commissure-apex membrane 2.20, length metatibia 3.92; length antennal segments 1—.28, 2—1.92, 3—1.32, 4—?; length labial segments 1—.64, 2—.64, 3—.40, 4—.48.

MALE GENITALIA: Figures 182–184.

BRACHYPTEROUS FEMALE: Coloration, body surface texture, and vestiture as in male, except basic color slate gray.

Head very similar in structure to macropterous male, slightly larger in relation to total body size, eyes smaller relative to total

size of head, antennae somewhat further removed from eyes (by distance about equal to twice diameter of antennal segment 1); head slightly more conical in shape than in male and genal and gular regions larger; pronotal collar as in male, but pronotum arched longitudinally behind collar with posterior lobe nearly horizontal; pronotum transversely convex, posterior margin weakly concavely excavated across mesoscutum; scutellum nearly flat; hemelytra greatly reduced, undifferentiated, attaining posterior margin of abdominal tergite 2; posterior margins of hemelytra evenly rounded, upturned; legs very long, structure as in male; abdomen constricted basally, greatly enlarged medially, tapering to an acute apex.

MEASUREMENTS: Total length 5.12, maximum width 1.48, width head 1.16, interocular space .68.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate; sclerotized rings ovoid, lateral margins slightly upturned.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Kruger National Park, Letaba River at Letaba Camp, 1 May 1968, T. Schuh, J. A. & S. Slater, M. Sweet (SANC).

PARATYPES: *Transvaal*—4 macropterous ♂♂, same data as holotype; 2 macropterous ♂♂, 6 brachypterous ♀♀, 3 mi. E. Satara Camp, Nwanedzi River, 29 April 1968; 1 macropterous ♂, 2 brachypterous ♀♀, 9 mi. SSW Skukuza, 26 April 1968 (SANC, JAS, RTS).

This species is named for Dr. James A. Slater, of the University of Connecticut, who introduced me to the fauna of South Africa, and who has continued to stimulate my interest in the Miridae of the region.

As the only known species of the genus occurring in South Africa, *slateri* can be recognized by the complex of characters given in the generic discussion (see also discussion under *S. zeugma* below).

All known localities for *Skukuza slateri* are in the low veld of the northeastern Transvaal. I took specimens at three different localities, all of which were very dry, open areas with scattered grasses and forbs, the total vegetative cover probably never exceeding 50 percent of the substrate surface area. The sites were heavily grazed so that the vegetation was almost mat-like.

Skukuza slateri is remarkably ant-like in habitus and behavior. It is so elusive that collecting only a very few specimens can be a great accomplishment; species of the ant-mimetic rhyparochromine lygaeid genus *Poeantius* are some of the few ground living bugs that are as agile as *Skukuza*. No ant association was obvious at any of

the collection sites. *Skukuza* was taken in the same habitat with *Poeantius* sp.

NOTES ON EXTRALIMITAL SPECIES

Skukuza zeugma (Odhiambo), new combination

Formicopsella zeugma Odhiambo, 1959c, pp. 652–655, 684–685.

Described in *Formicopsella*, this species is much more closely related to *Skukuza slateri* than it is to *F. regneri*. The figures of the head of *zeugma* given by Odhiambo (1959c) are deceptive, in that they show the antennae as being inserted dorsad of the ventral margin of the eyes. The antennae are in fact inserted somewhat below the ventral margin of the eyes, very much as in *S. slateri*. The holotype of *zeugma*, from which Odhiambo's (1959c) drawings were made, is card mounted and has the head flexed upward and anteriorly, giving a false impression of the antennal insertion. The basic structure of the head is very similar in *zeugma* and *slateri*, with the frons being flattened, whereas in *Formicopsella* the frons is very strongly rounded. The vestiture of *zeugma* consists of a few erect hairs and a rather dense covering of decumbent, weakly shining hairs, and is very much like that of *slateri*, although in the latter species the decumbent hairs are sparsely placed. The anterior fascia of the hemelytra is broad, complete, and nearly parallel sided in *zeugma*, whereas it forms a triangular macula on each hemelytron in *slateri*. Both species have a similar dull gray coloration.

Systellonotopsis Poppius

Systellonotopsis Poppius, 1914a, pp. 43–44.

Systellonotopsis is probably most closely related to *Pangania*. It differs in having long erect hairs on the dorsum, whereas in *Pangania* there are only short decumbent hairs. Only two species are presently placed in the genus, although Odhiambo (1959b; 1963) has described species in the genus that I feel are more closely related to other genera.

LIST OF SPECIES OF *Systellonotopsis*

bifasciatus Poppius (*Systellonotopsis*), 1914a, p. 44. Botswana; South West Africa.

* *chnous* Odhiambo (*Systellonotopsis*), see *Pangania chnous* (Odhiambo) **New Combination.**

pandus Odhiambo (*Systellonotopsis*), 1963, pp. 111–112. Tanganyika.

* *pumilis* Odhiambo (*Systellonotopsis*), see *Trichophthalmocapsus pumilis* (Odhiambo) **New Combination.**

Systellonotopsis bifasciatus Poppius

Systellonotopsis bifasciatus Poppius, 1914a, p. 44.

Systellonotopsis bifasciatus most closely resembles *Pangania fasciatipennis* in southern Africa, but can be separated from it by the presence of erect hairs on the dorsum. All known specimens are females and therefore the structure of the male genitalia is not known.

Described from a single female from "Bechuanaland," additional specimens of *bifasciatus* were not recorded in the literature subsequent to the original description until Carvalho et al. (1960), recorded a specimen from Royal Natal National Park, Natal; comparison of this specimen with the holotype of *bifasciatus* indicates, however, that it is not in fact *S. bifasciatus*, but *Systellonotus brincki*, which is described as new below. The holotype of *S. bifasciatus* was noted by Poppius as being deposited in the Berlin-Humboldt Museum; in fact it is in the Helsinki Museum (Type No. 11859).

Comparison of a female specimen from Abachaus, Damaraland, South West Africa, deposited in the Transvaal Museum, with the holotype of *S. bifasciatus*, indicates that the two are conspecific. Both of these specimens have short, decumbent hairs on the dorsum, which were not mentioned in the original description, as well as the erect hairs pointed out by Poppius. The total length of the Damaraland specimen is 4.40 mm.; the maximum width is 1.24 mm.

Systellonotus Fieber

Systellonotus Fieber, 1858, p. 326.

Systellonotus contains approximately 14 species. Up to the present time the genus has been known only from the Palearctic, primarily from the Mediterranean and North Africa. A single species is described below from South Africa.

Systellonotus brincki, new species
Figures 40, 185–188

Systellonotopsis bifasciatus Carvalho, Dutra, and Becker, 1960 (*nec* Poppius), p. 456.

MACROPTEROUS MALE: Basic coloration dull, rather light reddish brown; distal two-thirds of antennal segment 3, complete broad

transverse fasica at level of middle of claval commissure, apex of corium broadly, and ostiolar peritreme white; cuneus castaneous; membrane light smoky brown with white bloom.

Elongate; entire body smooth, dull, weakly pruinose; cell of membrane and base of cuneus shining; dorsum with decumbent and semierect, moderately long, light hairs; antennal segment 1 with inconspicuous, decumbent light hairs, and a few erect, light, slender spines, segments 2, 3, and 4 with dense, short, decumbent, light vestiture; eyes with some very short hairs; labium with a few moderately long, erect hairs basally and some very short hairs; femora with decumbent light hairs and a few semierect light hairs; tibiae with reclining light hairs and scattered, semierect, light spines about as long as tibial diameter; abdomen with reclining light hairs and scattered, long, erect, light hairs.

Head strongly deflexed, frons nearly vertical; eyes large, protuberant, strongly granular, removed from anterior margin of pronotum by distance about equal to diameter of antennal segment 2; vertex nearly flat, not elevated above level of pronotal collar; head constricted slightly behind eyes; anterior margins of eyes very weakly sinuate; antennae inserted somewhat below middle of anterior margin of eyes, fossae contiguous with eyes; antennal segment 1 slightly enlarged, weakly bowed; antennal segment 2 nearly cylindrical, slightly narrowed proximally, about equal in diameter to segment 1, segments 3 and 4 of slightly smaller diameter than segment 2; eyes occupying slightly over half of height of head; clypeus prominent; bucculae narrow; gula moderately long, inclined about 45°; labium just surpassing metacoxae; pronotum elevated posteriorly, weakly tumid; lateral margins nearly straight; pronotum rather strongly narrowed anteriorly, collar flat, about as wide as diameter of antennal segment 1, calli poorly defined; posterior margin of pronotum concavely excavated across mesoscutum, convexly rounded laterally; mesoscutum steeply inclined anteriorly; scutellum convex; lateral margins of hemelytra distinctly sinuate, widest just anterior to apex of corium; base of cuneus recessed mesiad of lateral corial margin by distance about equal to diameter of antennal segment 2; membrane with 2 cells; posterior margins of cells evenly rounded; abdomen very slender, reaching to apex of cuneus; legs long; femora weakly bowed; all tibiae with longitudinal rows of tiny, closely-spaced spines; metatarsal segment 1 about one-fourth length of segment 2, segments 2 and 3 subequal in length; claws long, gently curved, slightly broadened basally; parempodia hair-like, parallel; pulvilli minute.

MEASUREMENTS: Total length 5.12, maximum width 1.52, length head .40, width head .88, interocular space .30, length pronotum .64, width pronotum 1.24, length scutellum 1.00, length corium 2.60, length clavus 2.00, length cuneus .72, width cuneus .36, length claval commissure 1.28, distance apex commissure-apex membrane 2.64, length metatibia 3.80; length antennal segments 1—.64, 2—1.80, 3—1.46, 4—?; length labial segments 1—.60, 2—.60, 3—.54, 4—.52.

MALE GENITALIA: Figures 185–188.

Females unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Orange Free State*, Bultfontein, 8.1.07 (TM).

PARATYPES: 1 macropterous ♂, same data as holotype. *Natal*—1 macropterous ♂, Natal National Park, The Hostel, 3.IV.51 (Brinck and Rudebeck); 1 macropterous ♂, U. So. Afri., N. Y. 107793, X-27-49-18552, *Erica bergiana* (TM, LU, USNM, RTS).

This species is named for Dr. Per Brinck of the Lund University Zoological Institute.

Systellonotus brincki most closely resembles *Pangania fasciatipennis* and *Systellonotopsis bifasciatus* in South Africa, but differs in that the abdomen is long and slender, the gula is moderately long, and the eyes occupy only about two-thirds the height of the head; *brincki* additionally differs from *fasciatipennis* in that the dorsum has erect hairs and the phallotheca lacks the dorsal projection. *S. brincki* also resembles *Carinogulus* to some extent in dorsal aspect but lacks the carinate gula.

Additional specimens from South Africa probably representing new species of *Systellonotus* include a macropterous male from Grootfontein, Middleburg, Cape Province, deposited in the South African National Collection of Insects, a macropterous male from Namakunde, South West Africa, deposited in the South African Museum, and a macropterous male from Mafa, South West Africa, also deposited in the South African Museum. These specimens appear to represent two species but are badly mutilated and therefore I have not considered it advisable to describe them at the present time.

Trichophorella Reuter

Trichophorella Reuter, 1905b, p. 20.

Trichophorella is characterized by its pinkish coloration, elongate body form, nearly parallel sided hemelytra, globose head, strongly granular almost hemispherical eyes, and a few erect, black

setiform hairs on the dorsum. This genus is probably most closely related to *Marmorodapus* Schmitz, and somewhat less closely related to other members of the *Aeolocoris* group.

LIST OF SPECIES OF *Trichophorella*

australis, new species. South Africa: Transvaal.
rubella Odhiambo (*Trichophorella*), 1959c, pp. 678–680. Uganda.
sordidipennis Reuter (*Trichophorella*), 1905b, p. 21. "Assinie, Afrique oc."

Trichophorella australis, new species

Figures 41, 189–192

MACROPTEROUS MALE: Elongate, parallel sided; general coloration of dorsum cream with pinkish tinge; head and pronotal calli slightly orangish; pronotal collar, posterior lobe of pronotum and mesoscutum suffused with brown; antennal segment 1 cream dorsally, mahogany ventrally and laterally on proximal half; antennal segments 2 and 3 cream, segment 4 deep red; labium yellowish, segment one red on distal half; head below eyes and antennal bases red; thoracic pleura red to mahogany; abdomen cream medioventrally, mahogany lateroventrally and on posterior third; all coxae, trochanters, tibiae, and tarsi cream; all tibiae with a red stripe dorsally; all femora mahogany; bases of some hairs on hemelytra and inner margin of cuneus with reddish suffusion; membrane almost white.

Body surface smooth, dull; head and pronotum with decumbent sericeous hairs; hemelytra with decumbent golden hairs; antennae with very short, appressed pubescence, segment 1 with numerous, erect, white, peg-like hairs about as long as diameter of segment 2, segment 2 with a peg-like hair proximally; pronotum and hemelytra with a few, short, black, erect, spine-like hairs; legs generally with short, decumbent hairs; metafemora with a few, fine, black spines dorsally and some long erect hairs ventrally.

Head globose as viewed from above; eyes large, nearly hemispherical as viewed from above, occupying nearly entire sides of head posterior to antennal bases, contiguous with anterior margin of pronotum, granular; vertex weakly longitudinally sulcate; frons weakly transversely rugose, strongly convex; antennae inserted at middle of anterior margin of eyes, segment 1 enlarged, segment 2 about three-fourths diameter of segment 1, segment 3 slightly smaller in diameter than segment 2, segment 4 slightly smaller in diameter than segment 3; clypeus compressed laterally; labium just surpass-

ing metacoxae; pronotum with lateral margins nearly straight, posterior margin deeply excavated across mesoscutum, collar about width of diameter of antennal segment 3, calli indistinct; mesoscutum and scutellum nearly flat, separated by a weak transverse impression; hemelytra nearly parallel sided; cuneus slightly recessed mesiad of lateral corial margin; abdomen almost reaching apex of cuneus; tibiae with scattered light spines of length about equal to tibial diameter; metatarsal segments 2 and 3 subequal in length, segment 1 about half length of segment 2; claws long, evenly curved; parempodia hair-like, parallel; pulvilli minute.

MEASUREMENTS: Total length 4.80, maximum width 1.33, length head .46, width head .78, interocular space .28, length pronotum .44, width pronotum 1.12, length scutellum .84, width scutellum .88, length corium 2.44, length clavus 1.80, length cuneus .76, width cuneus .28, length claval commissure 1.04, distance apex commissure-apex membrane 2.04, length metatibia 2.76; length antennal segments 1—.68, 2—1.88, 3—1.22, 4—.88; length labial segments 1—.58, 2—.50, 3—.52, 4—.48.

MALE GENITALIA: Figures 189–192.

MACROPTEROUS FEMALE: Very similar to male except eyes much smaller and vertex relatively wider.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Lyttelton, 29 Feb. 1968, J. A. & S. Slater, UV light (SANC).

PARATYPES: *Transvaal*—1 macropterous ♂, same data as holotype; 2 macropterous ♂♂, *idem*, except 20 Feb. 1968; 1 macropterous ♂, Rustenburg, 7–17 Nov. 1967 (Capener); 1 macropterous ♂, Pretoria, 12.III.1952 (Vari); 1 macropterous ♀, Pretoria, 27. III.1956 (Vari); 1 macropterous ♀, Johannesburg, V-17-1950 (Capener); 1 macropterous ♂, 1 macropterous ♀, Reitfontein, 30. 11.04 (SANC, TM, JAS, RTS).

This species is named for its occurrence in southern Africa.

The most distinctive difference between *T. australis* and the other two species of the genus is that in *australis* the cuneus is light and nearly unicolorous with the remainder of the hemelytra, whereas in *sordidipennis* Reuter and *rubella* Odhiambo the cuneus is dark red or brown and strongly contrasting with the remainder of the hemelytra. Also in *australis* antennal segment 1 is about one-third the length of segment 2 and half the length of segment 3, proportions quite different from those given by Poppius (1914a) for *sordidipennis* and by Odhiambo (1959c) for *rubbella*. I have examined the holotype of *sordidipennis* from "Assinie, Afrique oc." deposited

in the Helsinki Museum (Type No. 12072), but have not been able to confirm the accuracy of Poppius' data on the antennal proportions because the head is missing from this female specimen.

No field information is available for this species (or for the genus as a whole); nearly all available specimens were taken at lights.

Trichophthalmocapsus Poppius

Trichophthalmocapsus Poppius, 1914a, pp. 46–47.—Odhiambo, 1959c, p. 664.

The characters most useful for diagnosing *Trichophthalmocapsus* are: 1) eyes in males extremely large, occupying almost the entire sides of the head, the eyes of the females much smaller, the vertex relatively much wider, and the genae exposed; 2) posterior tibiae usually enlarged, spindle-shaped, with very long slender spines, and usually lacking short appressed vestiture; 3) hemelytra with noticeably sinuate lateral margins, widest at a point just anterior to the cuneal incisure; 4) lateral corial margins and inner surface of metafemora modified to form a stridulatory mechanism; and 5) vesica S-shaped. The genus is most closely related to *Boopidella* Reuter by the extremely large eyes and to *Laemocoris* and *Hallodapus* (in part) by the stridulatory mechanism, and to all 3 of these genera by the general facies. Odhiambo (1959c) used the size of the eyes to separate *T. hirsutus* Odhiambo, which was described from a female, from *T. vittatus* Odhiambo and *T. pilosus* Poppius, both of which were described from males; this character is not valid, however, when both sexes are present, because the eyes are much smaller in the females than in the males, as was correctly pointed out by China (1932).

All species of *Trichophthalmocapsus*, *Laemocoris*, and some species of *Hallodapus* have a wing edge stridulatory mechanism. The lateral corial margin is finely serrate and forms the stridulitrum; the inner surface of the metafemora is "pebbled" or strongly granular and forms the stridulatory plectrum. Although the corial serrations are very often extremely minute and difficult or impossible to see, the femoral modifications are readily visible in all species that are known to possess the stridulatory mechanism.

LIST OF SPECIES OF *Trichophthalmocapsus*

australis, new species. South Africa: Transvaal, Natal.
* *chariensis* Odhiambo (*Trichophthalmocapsus*), see *Hallodapus albofasciatus* (Motschulsky) **New Synonymy.**
hessei, new species. South West Africa.

hirsutus Odhiambo (*Trichophthalmocapsus*), 1959c, pp. 660–661, 664, 685. Tanzania.

jamesi China (*Trichophthalmocapsus*), 1932, pp. 594–597. Kenya.

pilosus Poppius (*Trichophthalmocapsus*), 1914a, p. 47. Tanzania.

pumilis Odhiambo (*Systellonotopsis*), 1959c, pp. 655–657, 684–685. **New Combination.** Ethiopia; Uganda.

* *vittatus* Odhiambo (*Trichophthalmocapsus*), see *Hallodapus vittatus* (Odhiambo) **New Combination.**

Trichophthalmocapsus australis, new species

Figures 33, 194–196

Trichophthalmocapsus jamesi Carvalho, Dutra, and Becker, 1960 (*nec* China), pp. 456–457.

MACROPTEROUS MALE: Basic coloration brownish black; rounded macula just anterior to midpoint of corium, posterior margin of corium, mesocoxae and metacoxae, and all trochanters white; juga and lora reddish; antennal segment 1 and all tarsi light brown; antennal segment 2 (segments 3 and 4 missing in holotype) and remainder of legs castaneous; membrane smoky brown.

Dorsum, except cuneus, smooth and dull or weakly pruinose; cuneus and legs weakly shining; dorsum with short, decumbent, sericeous hairs and long, semierect, weakly shining hairs; antennae with very short appressed pubescence and some erect hairs about as long as 1¼ times diameter of antennal segment 2; eyes with a few short hairs; venter with scattered light hairs; femora with long, erect, light hairs.

Head vertical, short; eyes very large, granular, protuberant, occupying nearly entire sides of head, reaching to bucculae; head slightly convex behind eyes; vertex narrow, depressed between eyes, posterior margin ecarinate, concave; antennae inserted just below middle of sinuate anterior margins of eyes; antennal segment 1 slightly enlarged, segment 2 of slightly smaller diameter than segment 1; gula obsolete; bucculae small; labium just surpassing metacoxae; pronotum with collar about as wide as diameter of antennal segment 1, calli distinct, rather widely separated, lateral margins nearly straight, posterior margin forming a low concave angle across scutellum; mesoscutum inclined anteriorly; scutellum convex; lateral corial margins weakly sinuate, very finely serrate (stridulitrum); cuneal incisure shallow, fracture strongly angled anteromedially; membrane with one visible cell; abdomen just attaining apex of corium; profemora and metafemora and tibiae of more or less con-

ventional form; metafemora weakly bowed, inner and posterior surfaces glabrous, with numerous, tiny, short ridges arranged linearly (stridulatory plectrum); metatibiae thickened, spindle-shaped; all tibiae with semierect light spines of length ranging from less than tibial diameter to nearly three times tibial diameter, and with rows of tiny, closely spaced black spines; metatarsal segments 1 and 2 subequal in length, segment 3 slightly longer than segment 2.

MEASUREMENTS: Total length 3.52, maximum width 1.20, length head .26, width head .72, interocular space .16, length pronotum .34, width pronotum 1.00, length scutellum .66, width scutellum .70, length corium 1.76, length clavus 1.32, length cuneus .70, width cuneus .30, length claval commissure .74, distance apex commissure-apex membrane 1.50, length metatibia 1.86; length antennal segments 1—.36, 2—1.06, 3—?, 4—?; length labial segments 1—.34, 2—.36, 3—.34, 4—.44.

MALE GENITALIA: Figures 194–196.

MACROPTEROUS FEMALE: Similar to male, except eyes much smaller, vertex relatively wider, and gena exposed below eyes.

MEASUREMENTS: Total length 3.40, maximum width 1.12, width head .66, interocular space .34.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Kruger Nat. Park, Punda Milia Camp, 7 May 1968, Slater, Schuh, Sweet, at light (SANC).

PARATYPES: *Transvaal*—1 macropterous ♀, Kruger National Park, Letaba Camp, 6.V.51, at light in evening (Brinck and Rudebeck); 1 macropterous ♂, Rustenburg, XII-4-1950 (Capener) (LU, JAS).

ADDITIONAL SPECIMENS: *Natal*—1 macropterous ♀, Weenen, ii.1924 (Thomasset) (BM[NH]).

This species is named for its occurrence in southern Africa.

See discussion under *T. hessei*.

Trichophthalmocapsus hessei, new species

Figures 34–35, 193

Trichophthalmocapsus pilosus Carvalho, Dutra, and Becker, 1960 (*nec* Poppius), pp. 456–457.

MACROPTEROUS MALE: Basic coloration dark brown; transverse hourglass-shaped fascia on corium at level of apex of scutellum, posterior margin of corium narrowly, all coxae and trochanters, and ostiolar peritreme white; membrane smoky brown; distal two-thirds of antennal segments 3 tan (segment 4 missing in holotype).

Head and anterior lobe of pronotum and venter polished, shining; remainder of dorsum dull, weakly pruinose; dorsum with long, semierect, light hairs; antennal segment 1 with a long, thin, semierect spine on interior surface; antennal segments 2 and 3 with very short, appressed, light pubescence (segment 4 missing in holotype); eyes with a few very short hairs; abdominal venter with elongate, reclining hairs; femora with short decumbent hairs; protibiae and mesotibiae with short, spine-like hairs of length less than tibial diameter; metatibiae with semierect spines of length twice tibial diameter.

This species is similar in structure to *T. australis* except as follows: lateral corial margins without visible serrations (at 150×); inner surface of metafemora pebbled; metatibiae not spindle-shaped, cylindrical; metatarsal segment 1 slightly shorter than segment 2, segment 2 slightly shorter than segment 3.

MEASUREMENTS: Total length approx. 3.50, maximum width 1.20, length head .26, width head .72, interocular space .16, length pronotum .34, width pronotum 1.00, length scutellum .66, width scutellum .70, length corium 1.76, length clavus 1.32, length cuneus .66, width cuneus .30, length claval commissure .74, distance apex commissure-apex membrane 1.50, length metatibia 1.86; length antennal segments 1—.36, 2—1.06, 3—?, 4—?; length labial segments 1—.34, 2—.36, 3—.34, 4—.44.

MALE GENITALIA: Figure 193.

MACROPTEROUS FEMALE: Differing from male as in *T. australis*.

MEASUREMENTS: Total length 3.52, maximum width 1.28, width head .70, interocular space .36.

HOLOTYPE: Macropterous ♂, SOUTH WEST AFRICA: Kaokoveld, Ohopoho, 4.VI.51, No. 325, at light in evening, Expedition 1950–1951, Brinck-Rudebeck (LU).

PARATYPES: SOUTH WEST AFRICA—2 macropterous ♀♀, Warmbad, Kaokoveld, Mus. Expd., Feb. 1925 (SAM).

This species is named for Dr. A. J. Hesse, Curator of Insects, South African Museum, Cape Town, who has added greatly to our knowledge of the insect fauna of South and South West Africa.

Trichophthalmocapsus hessei is probably most closely related to *T. pilosus* but differs in having antennal segment 1 dark, whereas it is white in *pilosus*, and in lacking the short decumbent hairs on the dorsum. *T. hessei* can be separated from *T. australis* in that the stridulitrum is not visible on the lateral corial margin and the dorsum lacks short decumbent hairs; the stridulitrum is very obvious in *australis* and the dorsum has both long and short hairs.

NOTES ON EXTRALIMITAL SPECIES

Trichophthalmocapsus pilosus Poppius

Trichophthalmocapsus pilosus Poppius, 1914a, p. 47.

Poppius (1914a) in his original description of *T. pilosus*, indicated that the holotype was deposited in the Berlin-Humboldt Museum. It is actually in the Helsinki Museum (Type No. 11870).

Trichophthalmocapsus pumilis (Odhiambo), new combination

Systellonotopsis pumilis Odhiambo, 1959c, pp. 655–657, 685.

Examination of a male paratype of *Systellonotopsis pumilis* in the British Museum (Natural History) indicates that this is in fact a species of *Trichophthalmocapsus*. The eyes of *pumilis* are very large, the metafemora have very long, glassy spines, and the stridulatory device is present.

NOTES ON EXTRALIMITAL GENERA

Aeolocoris Reuter

Aeolocoris Reuter, 1903, p. 17.

Aeolocoris presently contains three species from North and East Africa. It is most closely related to *Azizus* and *Acrorrhinium*.

Aeolocoris alboconspersus Reuter

Aeolocoris alboconspersus Reuter, 1903, p. 17

Reuter (1903) described this species from specimens from Obock, Djbouti, and Arabia Meridionalis (Aden). I am designating as the lectotype, a female specimen in the Paris Museum. It bears the following labels: "Museum Paris, DJIBOUTI, H. Coutiere 1897"; "*Aeolocoris alboconspersus* Reut. n. g. et sp. sp. typ."; and "LECTOTYPE *Aeolocoris alboconspersus* Reuter, det. R. T. Schuh." Wagner (1970b) stated that a specimen in the Helsinki Museum from Obock, bearing the label "*Aeolocoris alboconspersus* Reut. typ." was the holotype, but this certainly is incorrect because Reuter (1903) stated that he examined more than one specimen but did not designate a holotype.

Boopidella Reuter

Boopidella Reuter, 1907b, p. 25.

Boopidella appears to be most closely related to *Trichophthalmocapsus* by its large eyes, but differs from that genus in lacking

the long erect hairs on the dorsum, having the tibiae mutic, and lacking the stridulatory device. A single species of *Boopidella* is known from East Africa.

Boopidella fasciata Reuter

Boopidella fasciata Reuter, 1907b, p. 25.

Boopidella fasicata was described from four male specimens from Pemba Island (Tanzania). I am designating a specimen in the Helsinki Museum (Type No. 10270) bearing the labels "Pemba" and "*Boopidella fasciata* Reut. Typ." as the lectotype and adding the label "LECTOTYPE *Boopidella fasciata* Reuter, det. R. T. Schuh."

Diocoris Kirkaldy

Diocoris Kirkaldy, 1902c, p. 246.
Systellonotidea Poppius, 1914a, p. 29. **New Synonymy.**

Diocoris exhibits sexual dimorphism in the form of the pronotum. The males have the collar depressed and demarcated from the remainder of the pronotum; the females have the collar evenly arched with the remainder of the pronotum and separated from it by only a finely impressed line. This difference was recognized by Poppius (1914a) as of generic significance, and he therefore placed *Diocoris agalestus* Kirkaldy and *Systellonotidea triangulifer* Poppius in separate genera. Poppius however had only a female of *agalestus* and a male of *triangulifer*. Now that the different pronotal structures can be verifed as a sexually dimorphic character, it is apparent that *Systellonotidea* is congeneric with *Diocoris* based on the structure of the head, the type of hemelytral fascia, and the structure of the male genitalia.

Odhiambo (1959c) recognized the genus *Gampsodema* Odhiambo as distinct from *Diocoris* on the basis of its strongly flattened metafemora. This structural feature also occurs in some species of *Diocoris*, although not to the pronounced degree found in *Gampsodema spissata* Odhiambo, and it may be found that the two genera will have to be considered as synonymous.

Diocoris presently includes five species from East and West Africa.

Diocoris agalestus Kirkaldy

Diocoris agalestus Kirkaldy, 1902c, p. 246.

A single specimen of *Diocoris agalestus* Kirkaldy, labeled "Guinee, Addah (Reitter)" is in the Helsinki Museum, and may be the

holotype of this species (personal communication, Martin Meinander, Helsinki Museum).

LEUCOPHOROPTERINI, new tribe

Karoocapsus, new genus

MACROPTEROUS MALE: Elongate, relatively large, nearly parallel sided; brown or brownish black, usually with strongly contrasting, large, yellowish hemelytral maculae; body surface smooth, dull or weakly shining; dorsum with reclining light and/or dark setiform hairs and also appressed, scale-like, sericeous hairs, particularly on the head, pronotum, scutellum adjacent to the claval suture, and on the mesepisterna and metepisterna and sometimes on the abdomen; antennae with short, dark, reclining vestiture.

Head declivent, concave behind; eyes moderately large, protuberant, not reaching gula ventrally; vertex nearly as wide as anterior margin of pronotum, flat or slightly depressed, posterior margin usually carinate; frons weakly convex, transversely rugose; antennae inserted just above ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 moderately enlarged, segment 2 usually cylindrical, of slightly smaller diameter than segment 1, segments 3 and 4 about two-thirds diameter of segment 2; labium reaching at least to metacoxae; pronotum with anterior margin finely carinate, upturned, lateral and posterior margins nearly straight or slightly concave; mesoscutum separated from weakly convex scutellum by distinct transverse impression; lateral corial margins nearly straight; cuneal incisure shallow or obsolete, cuneal fracture angled slightly anteromedially; membrane with two cells; legs long; tibiae with scattered, semierect, black spines about as long as tibial diameter and rows of tiny, closely spaced black spines; tarsal claws long, slender, gently curved; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 197–219. Vesica U-shaped, weakly twisted, gonopore apical; phallotheca L-shaped; left clasper trough-like; right clasper lanceolate.

BRACHYPTEROUS FEMALE: See discussion under *K. pulchrus*.

FEMALE GENITALIA: Unknown.

TYPE SPECIES: *Karoocapsus middleburgensis*, new species.

This genus is named for its predominant occurrence in the Little and Great Karoo and other arid areas of South Africa. I have followed Acocks (1953) in the spelling of Karoo, although it is commonly spelled Karroo.

Karoocapsus can be separated from other South African Phylinae

by the following combination of characters: 1) parempodia hair-like, parallel; 2) claws long, slender; 3) head declivent, concave behind; 4) dorsum with reclining setiform hairs and appressed scale-like sericeous hairs; 5) hemelytra usually dark brown with strongly contrasting yellowish maculae; and 6) anterior margin of pronotum carinate, upturned. The genus is most closely related to *Leucophoroptera* Poppius from Australia. Only *Lasiolabopella* in South Africa has scale-like hairs (these are very easily removed in *Karoocapsus*), although several genera have wooly sericeous hairs on the dorsum. Most members of the Hallodapini have light hemelytral maculae, but none have scale-like hairs and all have a flattened pronotal collar very much different from the carinate anterior pronotal margin of *Karoocapsus*.

Karoocapsus can be divided into several species groups based on the coloration pattern. These divisions are very helpful in the preliminary identification of species, and are used in the following key. The male genitalia, however, are most useful in separating apparently closely related species (e.g. *flavomaculatus*, *middelburgensis*, and *trifasciatus*), and often show much different relationships between species than those suggested by coloration.

The type of coloration pattern found in *Karoocapsus* is not uncommon in ant-mimic Miridae, and in genera such as *Hallodapus* contributes to the ant-mimic habitus when combined with appropriate behavior, even though dead specimens are not particularly ant-like. Both sexes of *Karoocapsus* are probably ant mimetic, although the females are probably superior mimics because of their morphological specialization relative to the males.

Most of the known specimens of *Karoocapsus* are from light traps. Five of the eight described species are from a single locality, Grootfontein, Middelburg, Cape Province. All of these species were collected during October, although some were taken during other months as well. No ecological data are available for any species of *Karoocapsus*, but their is a high probability that they are ground living as are most phyline ant-mimics.

KEY TO SPECIES OF *Karoocapsus*

Macropterous specimens

1. Hemelytra uniformly light brown translucent ..... *brunneus* (Fig. 43)
   Hemelytra with yellowish quadrate or elongate maculae, more or less strongly contrasting with dark brown background coloration 2
2. Hemelytra with broad white or yellowish transverse fasica on basal half of corium; posterior half of corium dark brown, without light markings; basal third of cuneus white or yellow 3

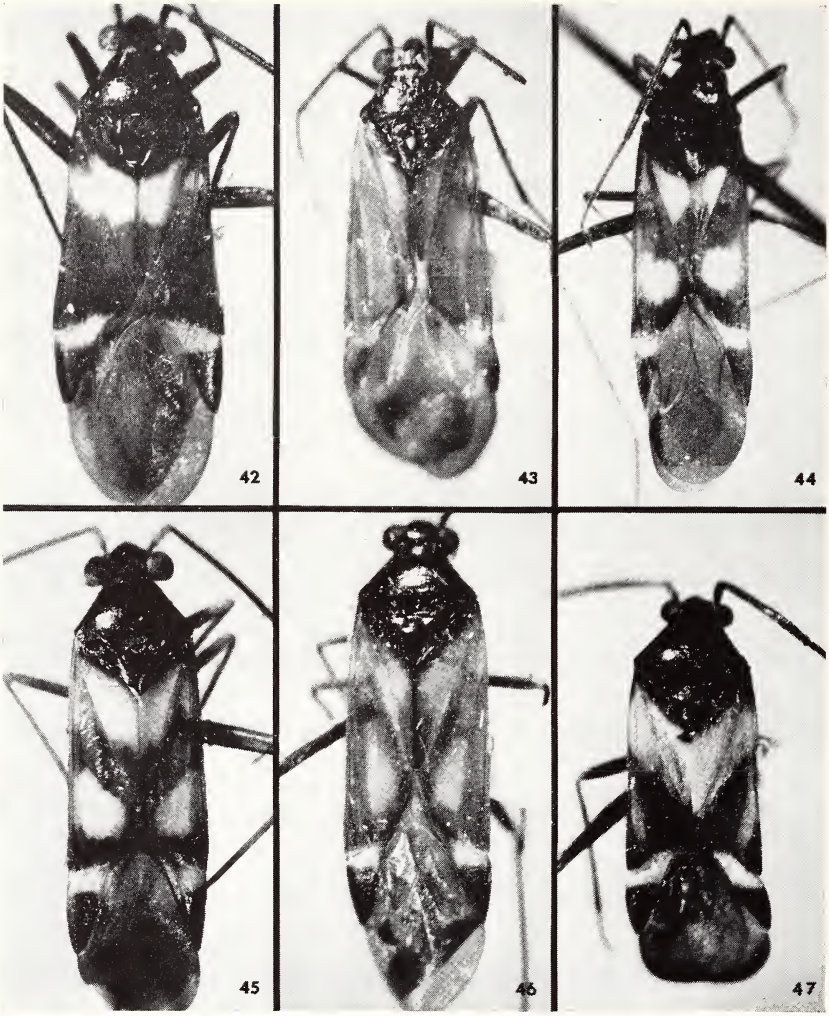
Hemelytra with white or yellow maculae on anterior half of clavus and posterior half of corium; basal third of cuneus white or yellow 4

3. Clavus adjacent to claval commissure entirely light colored ..... *occidentalis* (Fig. 47)
   Clavus light colored adjacent to anterior two-thirds of claval commissure, dark brown adjacent to posterior third of claval commissure ..... *bifasciatus* (Fig. 42)
4. Large, elongate species, length 4.56 mm. to 4.86 mm., maximum width 1.28 mm. to 1.56 mm.; head and pronotum brown to dark brown, not noticeably shining; labium long, reaching or surpassing mesocoxae 5
   Medium sized, stout-bodied species, length 4.32 mm., maximum width 1.40 mm.; head and pronotum black, shining; labium short, slightly surpassing procoxae ..... *pulchrus* (Fig. 48)
5. Hemelytral maculae strongly contrasting with background coloration; yellowish macula on posterior half of corium either rounded or quadrate, occupying endocorium and exocorium 6
   Hemelytral maculae weakly contrasting with background coloration; whitish macula on posterior half of corium elongate, confined to endocorium ..... *obscurus* (Fig. 46)
6. Yellowish macula on posterior half of corium more or less round, not parallel to costal vein laterally (Figs. 44 and 49) 7
   Yellowish macula on posterior half of corium distinctly trapezoidal, paralleling costal vein laterally; length 4.88 mm.; male genitalia Figs. 203–205 ..... *middelburgensis* (Fig. 45)
7. Slender species, length 4.56 mm., maximum width 1.28 mm.; corium adjacent to claval fascia brown as hemelytral background coloration; male genitalia Figs. 206–207 ..... *flavomaculatus* (Fig. 44)
   Robust species, length 4.72 mm., maximum width 1.56 mm.; corium adjacent to claval fascia light, contrasting with dark hemelytral background coloration; male genitalia Figs. 217–219 ..... *trifasciatus* (Fig. 49)

Karoocapsus bifasciatus, new species
Figures 42, 197–199

MACROPTEROUS MALE: Basic coloration dark brown or mahogany to nearly black; broad fascia on anterior half of corium and clavus and basal third of cuneus white or yellow white (Fig. 42); antennal segment 4 yellow white; membrane smoky brown.

Corium and clavus dull, remainder of dorsum weakly shining; setiform hairs on dorsum black on dark background areas, light on light background areas; posterior margin of white corial fascia, clavus, and corium adjacent to apical half of claval suture, mesepi-



FIGS. 42–47. Leucophoropterini. Fig. 42. *Karoocapsus bifasciatus*, male (Grootfontein, Middelburg, Cape Province). Fig. 43. *Karoocapsus brunneus*, male, holotype. Fig. 44. *Karoocapsus flavomaculatus*, male, holotype. Fig. 45. *Karoocapsus middelburgensis*, male, holotype. Fig. 46. *Karoocapsus obscurus*, male, holotype. Fig. 47. *Karoocapsus occidentalis*, male, holotype.

sterna and metepisterna, and posterior margin of abdominal sternite 4 with sericeous, scale-like hairs.

Vertex flat; antennal segment 1 with a few erect black spines about as long as tibial diameter, segment 2 about equal in diameter to segment 1, tapering to about two-thirds greatest diameter on proximal fourth, segments 3 and 4 about half diameter of segment 2; labium not quite reaching posterior margin of mesocoxae; posterior margin of pronotum weakly concave; calli obsolete; hemelytra broadest at apex of corium; abdomen reaching to apex of cuneus; metatarsal segments 2 and 3 subequal in length, segment 1 about two-fifths length of segment 2.

MEASUREMENTS: Total length 4.96, maximum width 1.40, length head .40, width head .96, interocular space .40, length pronotum .60, width pronotum 1.36, length scutellum .68, width scutellum .96, length corium 2.24, length clavus 1.60, length cuneus .92, width cuneus .35, length claval commissure .88, distance apex commissure-apex membrane 2.56, length metatibia 3.04; length antennal segments 1—.36, 2—1.60, 3—?, 4—?; length labial segments 1—.46, 2—.48, 3—.38, 4—.46.

MALE GENITALIA: Figures 197–199.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: *Cape Province*—6 macropterous ♂♂, same data as holotype; 1 macropterous ♂, Bushmanland, Henries, Lightfoot, October 1917. SOUTH WEST AFRICA—1 macropterous ♂, Bullspoort, 20.4.49 (Strey) (SANC, SAM, JAS, RTS).

This species is named for the two conspicuous light fasciae on the hemelytra.

Karoocapsus bifasciatus is most closely allied to *K. occidentalis*, in that it does not possess light colored maculae on the posterior half of the corium. The two species can be easily separated from one another in that *bifasciatus* has the clavus adjacent to the posterior third of the claval commissure dark and *occidentalis* has the clavus light along the entire length of the commissure. The male genitalia (Figs. 197–199, 211–213) are also distinctive for the two species.

Karoocapsus brunneus, new species

Figures 43, 200–202

MACROPTEROUS MALE: Basic coloration light brown; pronotum, scutellum, mesepisterna and metepisterna, apex of labium, all tarsi, and genital segment dark brown; abdomen greenish.

FIGS. 48–50. *Leucophoropterini*. Fig. 48. *Karoocapsus pulchrus*, male (Rooinek Pass, Cape Province). Fig. 49. *Karoocapsus trifasciatus*, male, holotype. Fig. 50. *Tytthus parviceps*, male (Lyttelton, Pretoria, Transvaal).

Dorsum weakly shining, setiform hairs dark brown; head, pronotum, scutellum, and pleural region of prothorax rather densely covered with scale-like, sericeous hairs; antennal segment 1 with a few erect black spines on interior surface.

Vertex flat; antennal segment 2 about three-fourths diameter of segment 1, of nearly uniform diameter, segments 3 and 4 slightly greater than one-half diameter of segment 2; labium reaching metacoxae at trochanteral joint; anterior, lateral, and posterior pronotal margins weakly concave; calli indistinct; metatarsal segments 2 and 3 subequal in length, segment 1 about two-fifths length of segment 2.

MEASUREMENTS: Total length 4.64, maximum width 1.44, length head .28, width head .88, interocular space .32, length pronotum .40, width pronotum 1.66, length scutellum .72, width scutellum .88, length corium 2.40, length clavus 1.60, length cuneus .92, width cuneus .36, length claval commissure .92, distance apex commissure-apex membrane 2.48, length metatibia 2.36; length antennal segments 1—.38, 2—1.28, 3—1.06, 4—.34; length labial segments 1—.38, 2—.38, 3—.26, 4—.40.

MALE GENITALIA: Figures 200–202.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: 4 macropterous ♂♂, same data as holotype (SANC, RTS).

This species is named for its uniform brown coloration.

Karoocapsus brunneus is unique among the known species of the genus in that it has uniformly dull brown hemelytra without yellow maculae.

Karoocapsus flavomaculatus, new species

Figures 44, 206–207

MACROPTEROUS MALE: Basic coloration blackish brown; hemelytra brown with large yellowish maculae on clavus, posterior half of corium, and basal third of cuneus (Figure 44); tibiae and tarsi light brown; membrane smoky gray brown.

Setiform hairs on dorsum dark on dark background areas, light on light background areas; mesepisterna and metepisterna with scale-like sericeous hairs.

Posterior margin of vertex not carinate and rather poorly defined from cervical region; vertex weakly convex; antennal segment 2 about equal in diameter to segment 1, segments 3 and 4 about half diameter of segment 2; labium just surpassing posterior margin of mesosternum; pronotum with anterior margin weakly sinuate, posterior margin nearly straight; calli obscure; hemelytra widest at apex of corium; abdomen reaching middle of cuneus; metatarsal segment 2 slightly longer than segment 3, segment 1 about one-third length of segment 2.

MEASUREMENTS: Total length 4.56, maximum width 1.28, length head .40, width head .80, interocular space .32, length pronotum .52, width pronotum 1.08, length scutellum .60, width scutellum .80, length corium 2.24, length clavus 1.40, length cuneus .84, width cuneus .36, length claval commissure .88, distance apex commissure-apex membrane 2.40, length metatibia 2.72; length antennal segments 1—.38, 2—1.50, 3—1.00, 4—.22; length labial segments 1—.40, 2—.40, 3—.36, 4—.54.

MALE GENITALIA: Figures 206–207.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, near Doornbosch, S.A.M., 9:1961 (SAM).

This species is named for its possession of yellow hemelytral maculae.

Karoocapsus flavomaculatus is most easily confused with *K. trifasciatus*, but can be separated from it by the absence of a sub-

apical spine on the vesica (see also discussion under *K. middelburgensis*).

Karoocapsus middelburgensis, new species
Figures 45, 203–205

MACROPTEROUS MALE: Basic coloration dark brown or brownish black; head below antennal bases and anterior to eyes, antennal segment 1, all femora, and all tibiae light brown; anterior half of cuneus and adjacent corium, posterior half of corium, and basal third of cuneus with yellowish maculae (Fig. 45); membrane dark smoky gray brown.

Setiform hairs on dorsum dark on dark background areas and light on light background areas; scutellum and mesoscutum along transverse impression, extreme base of corium, corium adjacent to posterior half of claval suture, cuneus basally, and mesepisterna and metepisterna with scale-like sericeous hairs.

Vertex slightly depressed; antennal segment 1 with one or two slender, erect, black spines on interior surface, segment 2 of slightly greater diameter distally than proximally, greatest diameter slightly less than that of segment 1, segments 3 and 4 about two-thirds diameter of segment 2; labium reaching to trochanteral joint of metacoxae; pronotum with posterior margin weakly concave; calli indistinct; hemelytra widest at midpoint of cuneus; abdomen just surpassing midpoint of cuneus; metatarsal segments 2 and 3 subequal in length, segment 1 about one-third length of segment 2.

MEASUREMENTS: Total length 4.88, maximum width 1.56, length head .30, width head .96, interocular space .36, length pronotum .44, width pronotum 1.18, length scutellum .76, width scutellum .96, length corium 2.44, length clavus 1.80, length cuneus .88, width cuneus .40, length claval commissure 1.00, distance apex commissure-apex membrane 2.60, length metatibia 2.96; length antennal segments 1—.32, 2—1.58, 3—1.00, 4—.54; length labial segments 1—.44, 2—.36, 3—.40, 4—.46.

MALE GENITALIA: Figures 203–205

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: *Cape Province*—7 macropterous ♂♂, Grootfontein, Middelburg, 3.XII.1965 (Schoombee); 1 macropterous ♂, *idem*, 18.3-65 (Johannsmeier); 3 macropterous ♂♂, *idem*, Mei 1965 (Johannsmeier); 1 macropterous ♂, *idem*, 15.X.65 (Schoombee) (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: *Cape Province*—2 macropterous ♂♂, Oudtshoorn, Zebra, Mus. Exp., Oct. 1951 (SAM).

This species is named for Middelburg, Cape Province, the type locality of this and four other species of *Karoocapsus*.

Karoocapsus middelburgensis appears to be most closely related to *trifasciatus*, *flavomaculatus*, *pulchrus*, and *obscurus*. It can be separated from *pulchrus* by its much larger size, from *obscurus* by strongly contrasting light maculae, and from *flavomaculatus* and *trifasciatus* by the maculae on the posterior half of the corium reaching to the costal vein. Also the shape of the phallotheca easily separates *middelburgensis* from *trifasciatus*, and the lack of the subapical spine on the vesica from *flavomaculatus*.

Karoocapsus obscurus, new species

Figures 46, 208–210

MACROPTEROUS MALE: Hemelytra generally medium brown, remainder of body, antennae, coxae, trochanters, proximal third of all femora, and labium nearly black; clavus and posterior half of endocorium with obscure white maculae (Fig. 46); basal third of cuneus white; membrane smoky brown.

Setiform hairs on dorsum brown; scutellum and pleural areas of pronotum, and mesepisterna and metepisterna (more densely) covered with scale-like sericeous hairs.

Vertex nearly flat, posterior margin carinate laterally; antennal segment 2 of slightly smaller diameter than segment 1, segment 3 about one-half diameter of segment 2 (segment 4 missing in holotype); labium reaching trochanteral joint of mesocoxae; all pronotal margins nearly straight; calli indistinct; abdomen reaching middle of cuneus; metatarsal segment 1 about one-third length of segment 2, about one-half length of segment 3.

MEASUREMENTS: Total length 4.72, maximum width 1.72, length head .28, width head .84, interocular space .34, length pronotum .40, width pronotum 1.20, length scutellum .80, width scutellum .96, length corium 2.56, length clavus 1.76, length cuneus 1.00, width cuneus .40, length claval commissure .96, distance apex commissure-apex membrane 2.76, length metatibia 2.76; length antennal segments 1—.34, 2—1.60, 3—.98, 4—?; length labial segments 1—.44, 2—.42, 3—.30, 4—.46.

MALE GENITALIA: Figures 208–210.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPE: 1 macropterous ♂, same data as holotype (RTS).

This species is named for the indistinct nature of the hemelytral markings.

Karoocapsus obscurus is most easily searated from other members of the genus by the rather weakly contrasting and diffuse light markings of the hemelytra; all other species except *brunneus* have strongly contrasting, rather well defined markings. The vesica is similar to that of *flavomaculatus.*

Karoocapsus occidentalis, new species

Figures 47, 211–213

MACROPTEROUS MALE: Basic coloration brownish black; antennal segment 1, profemora distally, all tibiae, and elongate streak adjacent to costal vein on posterior half of corium brown; complete broad transverse fascia on anterior half of corium, entire clavus, and basal two-fifths of cuneus white (Fig. 47); membrane dark smoky brown.

Setiform hairs on dorsum about as long as tibial diameter, light on light background areas, dark on dark background areas; pleural region of pronotum and mesepisterna and metepisterna with scale-like, sericeous hairs.

Vertex slightly depressed, posterior margin with low, broad, rounded carina medially; antennal segment 1 with slender erect spine on interior surface, segment 2 spindle-shaped, greatest diameter equal to that of segment 1, segments 3 and 4 slightly smaller in diameter than segment 2; labium reaching between mesocoxae and metacoxae; anterior margin of pronotum slightly depressed medially, with anterior margin almost obscured by "overhanging" region anterior to weakly defined calli; posterior margin of pronotum shallowly concave; hemelytra broadest at apex of corium; abdomen just surpassing apex of cuneus; metatarsal segments 2 and 3 subequal in length, segment 1 about two-fifths length of segment 2.

MEASUREMENTS: Total length approx. 4.50, maximum width 1.48, length head .30, width head .80, interocular space .36, length pronotum .52, width pronotum 1.28, length scutellum .72, width scutellum .88, length corium 2.20, length clavus 1.64, length cuneus .80, width cuneus .40, length claval commissure .84, distance apex commissure-apex membrane 2.10, length metatibia 2.60; length antennal segments 1—.28, 2—1.30, 3—.76, 4—?; length labial segments 1—.40, 2—.40, 3—.23, 4—.44.

MALE GENITALIA: Figures 211–213.

HOLOTYPE: Macropterous ♂, SOUTH WEST AFRICA: Hoffnung, 1,850 m., 26.i.1934, K. Jordan (BM[NH]).

PARATYPES: SOUTH WEST AFRICA—4 macropterous ♂♂, Kaross, Mus. Expd., Feb. 1925; 1 macropterous ♂, Windhoek, 19.1.1934 (Jordan) (SAM, BM[NH], RTS).

This species is named for its occurrence in western South Africa.

See discussion under *bifasciatus*.

Karoocapsus pulchrus, new species

Figures 48, 214–216

MACROPTEROUS MALE: Stout bodied; basic coloration brownish black or black; antennal segment 1 yellow brown; clavus, posterior half of corium and basal third of cuneus with large yellow gold maculae (Fig. 48); membrane light smoky brown.

Dorsum polished, with black setiform hairs; corium, clavus adjacent to claval suture, and mesepisterna and metepisterna with scale-like sericeous hairs.

Vertex weakly convex, posterior margin with fine carina; antennal segment 1 with slender, erect, black spine on interior surface, segment 2 about equal to diameter of segment 1 over most of length, tapering to about two-thirds maximum diameter on proximal fifth, segments 3 and 4 about one-half diameter of segment 2; labium just attaining base of mesocoxae; posterior margin of pronotum straight; calli indistinct; lateral corial margins weakly sinuate, widest at apex; lateral cuneal margin convex; abdomen just attaining apex of cuneus; metatarsal segments 2 and 3 subequal in length, segment 1 about two-fifths length of segment 2.

MEASUREMENTS: Total length 4.32, maximum width 1.40, length head .44, width head 1.00, interocular space .48, length pronotum .68, width pronotum 1.32, length scutellum .60, width scutellum .80, length corium 1.96, length clavus 1.48, length cuneus .72, width cuneus .32, length claval commissure .80, distance apex commissure-apex membrane 1.80, length metatibia 2.64; length antennal segments 1—.30, 2—1.12, 3—.74, 4—.46; length labial segments 1—.36, 2—.36, 3—.26, 4—.30.

MALE GENITALIA: Figures 214–216.

BRACHYPTEROUS FEMALE: See discussion below.

FEMALE GENITALIA: Not examined.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Rooineck Pass, Mus. Expd., Oct. 1952 (SAM).

PARATYPES: 3 macropterous ♂♂, 1 brachyterous ♀, same data as holotype (SAM, RTS).

This species is named for its bright coloration.

The small size and stocky appearance in conjunction with the

shining black head and pronotum will separate *pulchrus* from other species of *Karoocapsus*. The yellow gold maculae occupy a relatively greater portion of the hemelytra than in *flavomaculatus*, *middelburgensis*, and *trifasciatus*, all of which have similar coloration.

A teneral specimen of *pulchrus* is available and suggests the structure assumed by all females of *Karoocapsus*. It differs from the male as follows: eyes smaller than in male, vertex relatively wider, frons more strongly convex; antennae inserted just below ventral margin of eyes, fossae removed from eyes by distance equal to diameter of segment one; pronotum nearly quadrangular, strongly swollen; hemelytra greatly reduced, undifferentiated, posterior margins broadly rounded, apex attaining abdominal sternite 4.

Additional single females from Citrusdal, Cape Province, deposited in the South African Museum, and 5 mi. N. Fouriesburg, Orange Free State, deposited in the J. A. Slater Collection, resemble the female of *pulchrus* in basic structure, but cannot be identified positively as members of *Karoocapsus* at the present time because they are not associated with male specimens.

Karoocapsus trifasciatus, new species

Figures 49, 217–219

MACROPTEROUS MALE: Basic coloration brownish black; clavus and corium basally, posterior half of corium, and basal two-fifths of cuneus with large yellowish maculae (Fig. 49); membrane smoky brown.

Dorsum with dark, reclining setiform hairs and decumbent weakly shining hairs, the latter dark on dark background areas and light on light background areas; corium adjacent to claval commissure, pleural region of prothorax, mesepisterna and metepisterna, and abdominal sternite 4 with scale-like sericeous hairs.

Vertex flat, posterior margin with a weak carina; antennal segment 2 about equal in diameter to segment 1, segment 3 about two-thirds diameter of segment 2 (segment 4 missing in holotype); labium reaching between mesocoxae and metacoxae; posterior margin of pronotum shallowly concave; calli indistinct; hemelytra widest at apex of corium; abdomen not quite reaching apex of cuneus; metatarsal segments 2 and 3 subequal in length, segment 1 about one-third length of segment 2.

MEASUREMENTS: Total length 4.72, maximum width 1.56, length head .32, width head .92, interocular space .36, length pronotum .48, width pronotum 1.24, length scutellum .80, width scutellum 1.00, length corium 2.44, length clavus 1.88, length cuneus

.96, width cuneus .40, length claval commissure .96, distance apex commissure-apex membrane 2.44, length metatibia 3.00; length antennal segments 1—.30, 2—1.58, 3—1.00, 4—.62; length labial segments 1—.44, 2—.56, 3—.32, 4—.36.

MALE GENITALIA: Figures 217–219.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, 15.X.65, E. Schoobee (SANC).

PARATYPES: *Cape Province*—2 macropterous ♂♂, same data as holotype; 3 macropterous ♂♂, Grootfontein, Middelburg, October (Johannsmeier); 1 macropterous ♂, Deelfontein, 22 Oct. 1902; 2 macropterous ♂♂, *idem*, 25 Oct. 1902; 1 macropterous ♂, Uniondale District, Oct. 1952 (SANC, BM[NH], JAS, RTS).

This species is named for the three light maculae on the hemelytra.

See discussions under *middelburgensis* and *flavomaculatus*.

Tytthus Fieber

Tytthus Fieber, 1864, p. 82.

Although previously placed in the Phylini (Carvalho and Southwood, 1955), I am placing *Tytthus* in the Leucophoropterini on the basis of the following characters: 1) the parempodia are hair-like and parallel; 2) the vesica is U-shaped, not twisted, the gonopore is undeveloped; 3) the male genitalia are small relative to the total size of abdomen; 4) the right clasper is similar to *Karoocapsus*; and 5) the posterior wall is a simple sclerotized plate. The head is convex behind in *Tytthus*, whereas it is concave in most members of the tribe. *Tytthus* is not ant mimetic but does have a light-dark color pattern, which does not exist in most Phylini, and therefore suggests additional evidence for placement in the Leucophoropterini.

Tytthus includes 13 species. It is the only genus in the Leucophoropterini that occurs in the Western Hemisphere and the Palearctic.

Tytthus parviceps (Reuter)

Figure 50

Cyrtorhinus parviceps Reuter, 1890, p. 258.

Cyrtorhinus melanops Carvalho, Dutra, and Becker, 1960 (*nec* Reuter), pp. 459–460.

Tytthus parviceps can be recognized by the characters given in the generic discussion as well as by its basic facies (Fig. 50).

This species is widely distributed in the Ethiopian Region and

also occurs in the southern Palearctic, Florida, and the neotropics (Carvalho and Southwood, 1955).

Carvalho et al. (1960) incorrectly recorded specimens of this species from 10 miles north of Matatiele as *Cyrtorhinus melanops* Reuter.

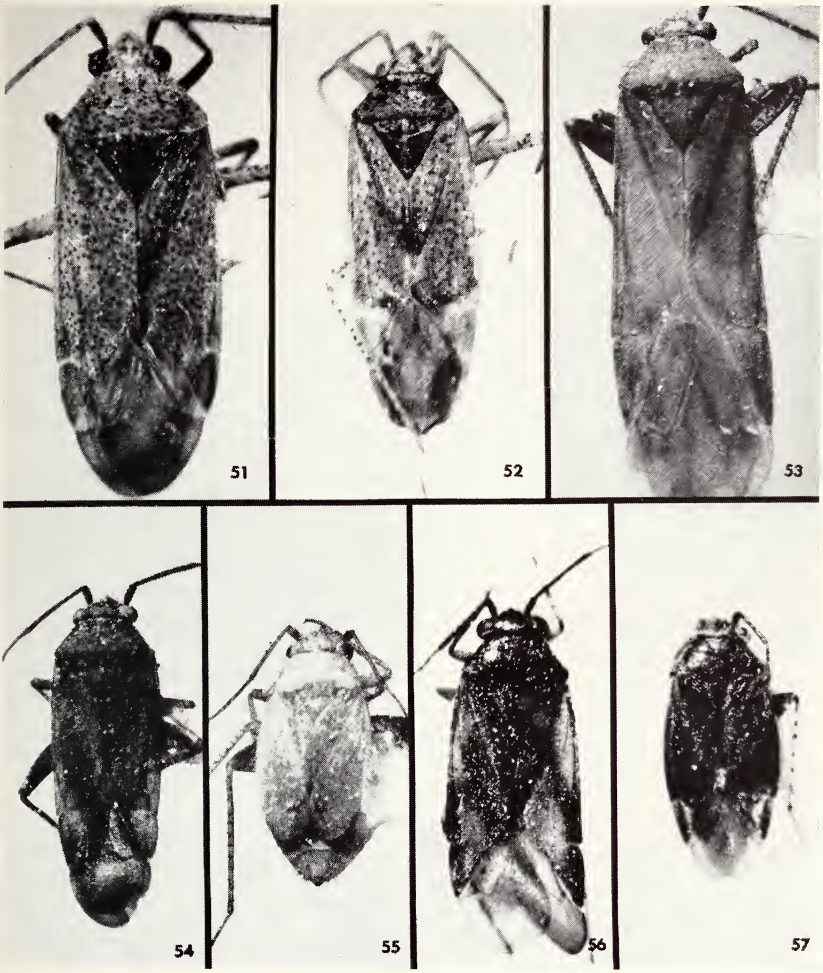
SPECIMENS EXAMINED: All specimens macropterous. *Cape Province*—1 ♂, 1♀, 10 mi. N. Matatiele, V.III.51 (Brinck and Rudebeck); 1 ♂, Rondvlei near Knysna, 8 Feb. 1968. *Natal*—1 ♂, Port Shepstone, 5.97. *Transvaal*—1 ♀, Lyttelton, 12 Jan. 1968, UV light; 4 ♂♂, 1 ♀, *idem*, 29 Feb. 1968; 1 ♀, Tzaneen, 11–16 Dec. 1963 (Capener); 2 ♂♂, 3 ♀♀, Zomerkomst, Politzi, 20-3-65 (Johannsmeier). SOUTH WEST AFRICA—3 ♂♂, 4 ♀♀, Cayimeis, Mar. 1925 (SANC, SAM, LU, BM[NH], JAS, RTS).

TRIBE PHYLINI

Austropsallus, new genus

MACROPTEROUS MALE: Large, stout bodied, elongate or very elongate; coloration often mottled, usually with dark spots at the bases of setiform hairs on dorsum and femora; body surface smooth, dull; dorsum with curved, reclining, or semierect, setiform hairs (sometimes very long), and decumbent, wooly, sericeous pubescence; eyes conspicuously hairy; antennal segment 1 with decumbent pubescence and one or more erect, fine, black spines on interior or dorsal surface; antennal segments 2, 3, and 4 with rather dense, semierect or reclining, light or dark vestiture of length up to 2½ times the diameter of segment of occurrence; thoracic pleura with wooly hairs as on dorsum; abdominal venter with reclining light hairs; tibiae usually with long dark spines with dark bases.

Head deflexed, clypeus prominent; eyes granular, moderately large, protuberant, reaching almost to gula; vertex sometimes with very low, rounded carina on posterior margin; antennae inserted slightly below middle of anterior margin of eyes, fossae contiguous with eyes; antennal segment 1 rather long, moderately enlarged, segment 2 about two-thirds diameter of segment 1, length 1¼ to nearly two times width of head across eyes, segments 3 and 4 subequal in diameter, about two-thirds diameter of segment 2, combined length roughly equal to length of segment 2; gula short, nearly horizontal; labium long, nearly attaining or surpassing mesocoxae; pronotum with anterior margin sinuate, finely carinate, upturned, lateral and posterior margins nearly straight; calli indistinct; pronotum inclined posteriorly; mesoscutum about one-third length of scutellum; mesoscutum and scutellum flattened, separated by dis-



FIGS. 51–57. Phylini. Fig. 51. *Austropsallus drakensbergensis*, male, holotype. Fig. 52. *Austropsallus helichrysi*, male, holotype. Fig. 53. *Austropsallus saniensis*, male, holotype. Fig. 54. *Austropsallus senecionus*, male, holotype. Fig. 55. *Austropsallus senecionus*, female (Sani Pass, 9400 ft., Lesotho). Fig. 56. *Capecapsus tradouwensis*, male, holotype. Fig. 57. *Capecapsus tradouwensis*, female (Doorn River, Cape Province).

tinct, transverse impression; lateral corial margins nearly straight; cuneal incisure shallow, fracture slightly angled anteromedially; membrane with two cells; abdomen reaching to about middle of cuneus; legs moderately long; only metatibiae with rows of tiny, closely spaced spines; metatarsal segment 1 about one-half length of segment 2, segments 2 and 3 subequal in length; claws moderately long, curved, broad basally; parempodia hair-like, parallel; pulvilli small.

MALE GENITALIA: Figures 220–234. Similar in structure to *Coatonocapsus*, *Capecapsus*, and *Odhiamboella*; left clasper in all species similar (Fig. 222), most highly modified in *A. middelburgensis* (Fig. 225); right clapser lanceolate; phallotheca L-shaped, usually elongate apically (Fig. 221); vesica with two attenuated apical spiculi, usually bent in characteristic manner, somtimes forming complete coil (Fig. 226).

MACROPTEROUS FEMALE: Eyes slightly smaller and vertex relatively wider than in males; females of *A. senecionus* brachypterous (see species description).

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Austropsallus drakensbergensis*, new species.

This genus is named for its southern distribution in Africa and for its resemblance to the genus *Psallus*.

Austropsallus is probably most closely related to *Coatonocapsus*. It can be recognized by the generally long, erect, setiform hairs on the dorsum and antennae, the mottled and often spotted coloration, the uniform surface texture and coloration of the head, and the form of the male genitalia.

Single male specimens probably representing additional new species from those described below are known from Zoutpansberg, 5 mi. N. Louis Trichardt, Transvaal (deposited in the J. A. Slater Collection), and Sani Pass, 9400 ft., Lesotho (also in the J. A. Slater Collection).

KEY TO SPECIES OF *Austropsallus*

Macropterous specimens

1. Antennal segment 2 with erect, dark hairs about 2½ times as long as diameter of segment; antennal segment 1, proximal half of segment 2, and entire dorsum with dark spots at bases of hairs ..... *drakensbergensis* (Fig. 51)

   Antennal segment 2 with or without long, erect, dark hairs, never with dark spots; dorsum with or without dark spots 2

2. Very long, slender species, total length 5.44 mm., greatest width 1.72

mm.; antennal segment 2 with long, erect, dark hairs; dorsum sparsely covered with long, semierect, dark hairs with very small, dark bases; general coloration dingy green or light olive ..... *saniensis* (Fig. 53)

Species either small (5.00 mm. or less) or if over 5.00 mm., width relative to length much greater than in *saniensis;* vestiture and coloration variable 3

3. Small species, length 3.52 mm.; dorsum nearly unicolorous blackish brown; entire body and appendages with long, heavy, black, setiform hairs ..... *senecionus* (Fig. 54)

Species larger than above, length over 4.50 mm.; body and appendages with moderately long, light colored hairs 4

4. Dorsum with round, brown spots at bases of setiform hairs; tibiae with very long slender black spines with dark bases; length under 5.00 mm. ..... *helichrysi* (Fig. 52)

Dorsum either without spots or with spots only on clavus and posterior half of corium; length over 5.00 mm 5

5. Membrane brown, including cells ..... *middelburgensis*

Membrane white with light brown cells ..... *albonotum*

Austropsallus albonotum, new species

Figures 226–227

MACROPTEROUS MALE: Basic coloration greenish white; head mottled; anterior third of pronotum, mesoscutum, mesothoracic and metathoracic pleura, bases of procoxae, mesocoxae and metacoxae entirely, single row of spots on anterior surface of profemora and mesofemora, two rows of spots on anterior surface of metafemora, and irregularly placed spots on posterior surfaces of all femora brown; posterior half of corium and entire clavus with thickly placed, round, reddish spots; membrane generally white, cells reddish brown; antennae light brown, segment 1 with narrow brown band proximally; femora, tibiae, and tarsi nearly white; tibial spines obscurely dark at bases.

Setiform hairs on dorsum light on light background areas, dark on dark background areas; hairs on antennae and femora light.

Labium just surpassing metacoxae.

MEASUREMENTS: Total length 5.28, maximum width 1.88, length head .36, width head .92, interocular space .48, length pronotum .60, width pronotum 1.60, length scutellum .84, width scutellum 1.12, length corium 2.72, length clavus 2.00, length cuneus 1.00, width cuneus .44, length claval commissure 1.12, distance apex commissure-apex membrane 2.72, length metatibia 2.76; length antennal segments 1—.32, 2—1.44, 3—?, 4—?; length labial segments 1—.52, 2—.58, 3—.38, 4—.56.

MALE GENITALIA: Figures 226–227.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: 10 macropterous ♂♂, same data as holotype; 1 macropterous ♂, *idem*, 15.X.65 (Schoombee). *Transvaal*—2 macropterous ♂♂, Zomerkomst, Politzi, 20.3.65 (Johannsmeier) (SANC, JAS, RTS).

This species is named for its very light dorsal coloration.

Austropsallus albonotum is probably most closely related to *A. middelburgensis*. It can be recognized by the generally light dorsal coloration with the posterior half of the corium and the entire cuneus reddish (spotted) and with the membrane white and the cells light brown.

Austropsallus drakensbergensis, new species

Figures 51, 220–222

MACROPTEROUS MALE: Basic coloration light reddish brown (see discussion); dorsum, antennal segment 1, proximal half of antennal segment 2, all femora, and all tibiae with numerous round brown spots; mesosternum and tarsal segment 3 black; thoracic pleura and most of abdomen yellow orange; membrane smoky brown, veins yellow orange.

Dorsum dull, antennae with a few, erect, very long brown hairs; femora and tibiae with black spines.

Labium just surpassing metacoxae.

MEASUREMENTS: Total length 4.64, maximum width 1.80, length head .28, width head .92, interocular space .40, length pronotum .82, width pronotum 1.60, length scutellum .80, width scutellum 1.04, length corium 2.52, length clavus 2.00, length cuneus .88, width cuneus .44, length claval commissure 1.00, distance apex commissure-apex membrane 2.20, length metatibia 2.48; length antennal segments 1—.36, 2—1.44, 3—.84, 4—.40; length labial segments 1—.60, 2—.60, 3—.30, 4—.50.

MALE GENITALIA: Figures 220–222.

MACROPTEROUS FEMALE: See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Oliviershoek Pass Summit, 5400 ft. el., 25 mi. S. Harrismith, 4 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Syncolostemon macranthus* [Guerke] Ashby) (SANC).

PARATYPES: 28 macrop. ♂♂, 16 macrop. ♀♀, same data as holotype (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: All specimens macropterous. *Natal*—5 ♂♂, 1 ♀, 65 nymphs (in alcohol), same data as holotype; 1 ♂, 1 ♀, Natal Nat. Park, iii.1932 (Mackie); 1 ♂, 1 ♀, Port Shepstone, 5.97; 3 ♂♂, 3 ♀♀, V. Reenen. *Transvaal*—2 ♀♀, 5 nymphs (in alcohol), 13 mi. S. Barberton, 5300 ft. el., 24 Mar. 1968 (Adults and nymphs on *Hemizygia albiflora* [N.E. Br.] Ashby); 49 ♂♂, 25 ♀♀ (2 ♂♂, 52 nymphs—in alcohol), Mariepskop near Klaserie, 6300 ft., 30 Nov. 1967 (Adults and nymphs on *Hemizygia albiflora* [N.E. Br.] Ashby) (SANC, TM, BM[NH], HM, USNM, JAS, RTS).

This species is named for its general occurrence on the Drakensberg Escarpment.

Austropsallus drakensbergensis is probably most closely related to *A. helichrysi*. It can be recognized by the uniform covering of brown spots on the dorsum and the long hairs on the antennae with dark spots at the bases on segment 1 and the proximal half of segment 2. Most specimens are rusty orange in coloration, but the series from Mariepskop is dark purplish brown, and has therefore not been included in the paratype series even though the structural features, including the male genitalia, agree closely with the specimens treated as paratypes.

Known host plants are *Syncolostemon macranthus* (Guerke) (Labiatae) and *Hemizygia albiflora* (N.E. Br.) Ashby (Labiatae). The general coloration of the bugs usually agrees rather closely with the coloration of the flowers of the host plant.

Austropsallus helichrysi, new species

Figures 52, 232–234

MACROPTEROUS MALE: Basic coloration light grayish green or yellow green; dorsum, femora, and tibiae covered with round brown spots; posterior margin of vertex and mesoscutum orange; scutellum and thoracic pleura brown; ostiolar peritreme white; all tarsal segments 3 black; abdomen very dark brown.

Dorsum dull; setiform hairs slender, dark; hairs on antennae and femora light; femora and tibiae with black spines.

Labium reaching almost to middle of abdomen.

MEASUREMENTS: Total length 4.52, maximum width 1.40, length head .30, width head .76, interocular space .36, length pronotum .44, width pronotum 1.20, length scutellum .64, width scutellum .80, length corium 2.12, length clavus 1.56, length cuneus .68, width cuneus .28, length claval commissure .88, distance apex commissure-apex membrane 1.88, length metatibia 2.00; length

antennal segments 1—.30, 2—1.06, 3—.66, 4—.32; length labial segments 1—.52, 2—.60, 3—.34, 4—.54.

MALE GENITALIA: Figures 232–234.

MACROPTEROUS FEMALE: See generic discussion.

HOLOTYPE: Macropterous ♂, LESOTHO: Sani Pass, 8000 ft., 10 Mar. 1968, J. Munting, S. Slater, T. Schuh, M. Sweet (Adults on *Helichrysum cooperi* [Harv.]) (SANC).

PARATYPES: 27 macropterous ♂♂, 29 macropterous ♀♀, same data as holotype (SANC, BM[NH], HM, USNM, SAM, JAS, RTS).

This species is named for the host genus, *Helichrysum*.

Austropsallus helichrysum is similar to *drakensbergensis*, but is smaller, basically greenish, and lacks dark spots on antennal segments 1 and 2.

The type locality is a subalpine region on the Drakensberg Escarpment in which the host plant, *Helichrysum cooperi* Harv. (Compositae), was growing is association with *Chrysocoma tenuifolium* Berg., *Geranium pulchrum* N.E. Br., and *Papaver aculeatum* Thunb.

Austropsallus middelburgensis, new species

Figures 223–225

MACROPTEROUS MALE: Head and anterior third of pronotum cream; posterior two-thirds of pronotum grayish; mesoscutum orange; scutellum, corium, clavus, and lateral margin of cuneus light orangish brown to brown; cuneus anteriorly on mesial margin white, red between white area and brown lateral margin; membrane brown, veins nearly white; antennae, legs, and labium very light brown or cream; coxae generally brown; mesothoracic and metathoracic pleura and most of abdominal venter very dark brown; venter of abdomen sublaterally and apical half of genital capsule yellow orange; profemora and mesofemora with a few, metafemora with many, brown spots; tibial spines light brown, with or without obscure dark bases.

Dorsum dull; setiform hairs on dorsum and appendages light.

Labium just surpassing mesocoxae.

MEASUREMENTS: Total length 5.60, maximum width 2.00, length head .52, width head 1.12, interocular space .42, length pronotum .56, width pronotum 1.68, length scutellum .96, width scutellum 1.68, length corium 3.04, length clavus 2.20, length cuneus 1.08, width cuneus .48, length claval commissure 1.20, distance apex commissure-apex membrane 2.80, length metatibia 2.88; length antennal segments 1—.44, 2—1.52, 3—?, 4—?; length labial segments 1—.56, 2—.62, 3—.34, 4—.54.

MALE GENITALIA: Figures 223–225.

MACROPTEROUS FEMALE: See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: 10 macropterous ♂♂, 1 macropterous ♀, same data as holotype (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: *Cape Province*—2 macropterous ♂♂, 2 macropterous ♀♀, Camps Bay, Cape Peninsula, Sept. 1920 (Turner) (BM[NH]).

Austropsallus middelburgensis has light antennal hairs as do *albonotum* and *helichrysi*, whereas in the remaining three species the antennal hairs are black. *A. middelburgensis* can be separated from *albonotum* by the generally brown membrane, and from *helichrysi* by its much larger size and lack of dark spots at the bases of the hairs on the dorsum.

The four specimens from Camps Bay, Cape Peninsula, have nearly identical male genitalia with the Middelburg series, but are much redder in dorsal coloration, and therefore are not included as paratypes.

Austropsallus saniensis, new species

Figures 53, 229–231

MACROPTEROUS MALE: Very elongate; basic coloration light olive to yellowish; posterior margin of vertex, mesoscutum; posteromesial margin of cuneus, and veins of membrane weakly orange; mesosternum, labial segment 4, all tarsal segments 3, bases of black hairs on dorsum and femora, and bases of spines on tibiae black.

Dorsum smooth, dull; setiform and wooly hairs on dorsum rather widely spaced; femora with some setiform black hairs.

Labium just surpassing apex of mesocoxae.

MEASUREMENTS: Total length 5.44, maximum width 1.72, length head .28, width head .84, interocular space .44, length pronotum .48, width pronotum 1.35, length scutellum .96, length corium 2.72, length clavus 1.84, length cuneus 1.08, width cuneus .32, length claval commissure 1.08, distance apex commissure-apex membrane 3.08, length metatibia 2.40; length antennal segments 1—.36, 2—1.24, 3—.84, 4—?; length labial segments 1—.46, 2—.44, 3—.26, 4—.34.

MALE GENITALIA: Figures 229–231.

Female unknown.

HOLOTYPE: Macropterous ♂, LESOTHO: Sani Pass, 10 Mar. 1968, 9400 ft., T. Schuh, M. Sweet, S. Slater, J. Munting (SANC).

This species is named for the type locality, the summit of the Sani Pass, Lesotho.

Austropsallus saniensis is the only known species in the genus with extremely long hemelytra and with scattered setiform hairs with tiny black spots at their bases on an otherwise rather uniformly colored dorsum (see also discussion under *A. senecionus*).

The type locality is an alpine region at the summit of the Sani Pass. At the time of my visit the area was badly overgrazed. The vegetation consisted mostly of grasses and very low-growing composites including species of *Helichrysum*, *Senecio*, and *Eumorphia.*

Austropsallus senecionus, new species

Figures 54, 55, 228

MACROPTEROUS MALE: Basic coloration dull brown or blackish brown, very weakly suffused with green; femora heavily spotted with black; tibiae with black spots at bases of most spines; all tarsal segments 3 black; membrane dark smoky brown.

Setiform hairs on dorsum rather closely placed, without dark bases; antennae with many, very long, erect, black hairs; femora with rather dense reclining dark hairs and numerous reclining or semierect black setiform hairs, particularly on dorsal surface.

Labium just surpassing mesocoxae.

MEASUREMENTS: Total length 3.52, maximum width 1.20, length head .22, width head .70, interocular space .58, length pronotum .40, width pronotum 1.12, length scutellum .52, width scutellum .72, length corium 1.72, length clavus 1.20, length cuneus .64, width cuneus .28, length claval commissure .60, distance apex commissure-apex membrane 1.76, length metatibiae 1.72; length antennal segments 1—.24, 2—.82, 3—.50, 4—.34; length labial segments 1—.36, 2—.38, 3—.20, 4—.30.

MALE GENITALIA: Figure 228.

BRACHYPTEROUS FEMALE: Hemelytra reduced, apex of abdomen exposed; general coloration light green or yellow green; antennal segment 2 dark; antennal segments 3 and 4, labial segment 4, all tarsal segments 3, and extreme base and apex of ovipositor black; tibiae and femora without distinct black spots, bases of spines only very obscurely dark.

Body surface and vestiture as in male; long black setiform hairs of dorsum, black tibial spines, and black hairs on antennae giving very spiny appearance.

Eyes relatively small, weakly protuberant; vertex convex, pos-

terior margin nearly straight, ecarinate; frons strongly convex; antennae inserted at level of ventral margin of eyes, fossae slightly removed from anterior margins of eyes; labium just surpassing metacoxae; pronotum almost flat, anterior and lateral margins nearly straight, posterior margin weakly sinuate; mesoscutum and scutellum flat; cuneus and membrane greatly reduced, membrane not projecting posteriorly past apex of cuneus; lateral margins of hemelytra including cuneus evenly convexly rounded, nearly conforming to lateral abdominal margins; apical 2 abdominal segments almost completely exposed; legs relatively short.

MEASUREMENTS: Total length 2.76, maximum width 1.28, width head .72, interocular space .42.

FEMALE GENITALIA: See generic discussion.

HOLOTYPE: Macropterous ♂, LESOTHO: Sani Pass, 10 Mar. 1968, 9400 ft., T. Schuh, M. Sweet, S. Slater, J. Munting (Adults and nymphs on *Senecio achilleaefolius* DC.) (SANC).

PARATYPES: 6 macropterous ♂♂, 1 macropterous ♀, 24 brachypterous ♀♀, same data as holotype (SANC, JAS, RTS).

This species is named for the host genus, *Senecio*.

The smallest and most slender bodied species in the genus, *A. senecionus* most closely resembles *saniensis* in coloration and form of the dorsal vestiture, especially in that *senecionus* lacks spots at the bases of the setiform hairs and *saniensis* has only very small spots. The two species can be easily separated because *senecionus* is small and does not have the long hemelytra relative to the total body length as found in *saniensis*. *A. senecionus* is at present the only species in the genus for which brachypterous females are known, but females of this species are also known in the macropterous form. The females of *senecionus* are reminiscent of *Ellenia obscuricornis* in general shape and coloration, but the pretarsal structures are much different, and the females of *senecionus* are usually brachypterous whereas no brachypterous specimens of *Ellenia* are known (see also discussion under *Coatonocapsus*).

The host plant of this species is *Senecio achilleaefolius* DC. (Compositae) (see discussion under *A. saniensis*).

Brachycranella Reuter

Brachycranella Reuter, 1905c, p. 19.—Wagner, 1965, p. 83.

Only a single species, from South West Africa, is currently placed in *Brachycranella*. Wagner (1965) discussed the relationship of *Brachycranella* to *Atomoscelis* and other allied genera in the Pale-

arctic. Reuter (1905c) related *Brachycranella* to *Tuponia* Reuter. Poppius (1914a) keyed the genus out with *Leptoxanthus* at the end of his key to the Phylinae, considering both genera to lack "arolia".

Brachycranella viridipunctata (Stål)

Capsus (*Eurymerocoris*) *viridipunctata* Stål, 1858, p. 317.
Brachycranella viridipunctata: Carvalho, Dutra, and Becker, 1960, pp. 451–452.

The identity and relationships of *Brachycranella viridipunctata* must await examination of the holotype which is probably in the Stockholm Museum. The type locality of the species, "Territorium fluvii Svakop", is at about 22–23° S. latitude in South West Africa. Carvalho et al. (1960) recorded this species from Ladismith, Cape Province.

Capecapsus, new genus

MACROPTEROUS MALE: Elongate, parallel sided; head between and below antennae, including clypeus, juga, and lora, black, highly polished, shining; entire body smooth; dorsum with moderately dense, reclining, dark, setiform hairs and decumbent, flattened, wooly, sericeous hairs; antennal segment 1 with decumbent dark hairs and an erect, dark spine on interior surface; antennal segments 2, 3, and 4 with dense vestiture of decumbent short hairs and longer reclining hairs about the length of diameter of antennal segment 2; thoracic pleura and most of abdominal venter with decumbent, wooly, sericeous hairs similar to those on dorsum; femora with decumbent hairs; tibiae and tarsi with inconspicuous decumbent hairs; tibiae with semierect black spines about the length of tibial diameter.

Head declivous; clypeus just visible from above; eyes moderately large, protuberant, contiguous with anterior margin of pronotum, reaching almost to gula ventrally, anterior margins weakly sinuate; antennae inserted just above ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 moderately enlarged, segment 2 increasing very slightly in diameter distally to diameter nearly equal to that of segment 1; antennal segments 3 and 4 subequal in diameter, about three-fourths diameter of segment 2; bucculae small; gula obsolete; pronotum broad, flattened; scutellum weakly convex; hemelytra nearly parallel sided; cuneal incisure distinct; membrane with 2 cells; only metatibiae with longitudinal rows of tiny, closely spaced spines; tarsal claws moderately long, gently curved; parempodia weakly fleshy, convergent apically, reaching just past midpoint of claw; pulvilli minute.

MALE GENITALIA: Figures 235–237. Vesica similar in structure to *Coatonocapsus* and *Odhiamboella*, with complete coil and single attenuated apical spine; gonopore subapical, well developed; claspers and phallotheca typical of the Phylini.

BRACHYPTEROUS FEMALE: See *C. tradouwensis*.

FEMALE GENITALIA: Not examined.

TYPE SPECIES: *Capecapsus tradouwensis*, new species.

This genus is named for its occurrence in the Cape Province of South Africa.

Capecapsus appears to be most closely related to *Coatonocapsus*, based on its general facies, polished frons below the antennae, sexual wing dimorphism, and the form of the male genitalia; the fleshy convergent parempodia and unicolorous dorsum will separate *Capecapsus* from *Coatonocapsus*. The polished frons relates *Capecapsus* to *Ellenia* which also has fleshy convergent parempodia; the relationship between the two genera does not appear to be particularly close on the basis of the male genitalia, however. *Capecapsus* is also similar to *Odhiamboella* in general facies and structure of the vesica, but the type of vestiture is very different.

Capecapsus tradouwensis, new species
Figures 56, 57, 235–237

MACROPTEROUS MALE: Basic coloration dark brown; membrane smoky brown; all femora distally, and tibiae, yellowish, with numerous brown spots.

Posterior margin of vertex nearly straight with distinct carina; labium just surpassing procoxae; pronotum depressed on either side of midline behind weak calli, anterior margin weakly sinuate, lateral margins shallowly concave, posterior margin nearly straight; cuneal fracture slightly angled anteromedially; abdomen reaching to about middle of cuneus; metatarsal segment 1 slightly less than one-half length of segment 2, segments 2 and 3 subequal in length.

MEASUREMENTS: Total length 3.72, maximum width 1.36, length head .24, width head .80, interocular space 3.72, length pronotum .44, width pronotum 1.16, length scutellum .52, width scutellum .72, length corium 1.80, length clavus 1.40, length cuneus .80, width cuneus .36, length claval commissure .80, distance apex commissure-apex membrane 1.72, length metatibia 1.56; length antennal segments 1—.24, 2—.76, 3—.34, 4—.26; length labial segments 1—.26, 2, 3, and 4—.40.

MALE GENITALIA: Figures 235–237.

BRACHYPTEROUS FEMALE: Ovoid, stout bodied; general coloration, surface texture and pubescence as in macropterous male.

Eyes slightly smaller than in male, vertex relatively wider; posterior margin of vertex sinuate; pronotal calli slightly raised, widely separated medially; scutellum nearly flat; hemelytra broadly rounded laterally, short, just surpassing apex of abdomen.

MEASUREMENTS: Total length 3.40, maximum width 1.28, width head .74, interocular space .40.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Tradouw Pass, Swellendam Dist., Mus. Expd., Nov. 1925 (SAM).

PARATYPES: *Cape Province*—3 macropterous ♂♂, same data as holotype; 1 macropterous ♂, 48 mi. E. Barrydale, XI-31-1966 (Rozen); 2 macropterous ♂♂, 4 brachypterous ♀♀, Doorn River, XI.1931 (Ogilvie) (SAM, AMNH, RTS).

This species is named for the Tradouw Pass.

As the only species in the genus, *C. tradouwensis* can be separated from other South African Phylinae by the characters given in the generic discussion and by the structure of the male genitalia.

Coatonocapsus, new genus

MACROPTEROUS MALE: Relatively small; elongate, nearly parallel sided; coloration sombre, mottled or spotted; body surface smooth, dull; head below level of dorsal margin of antennal fossae (including clypeus, lora, and juga) highly polished (usually black); dorsum with reclining or erect dark setiform hairs and decumbent, wooly, sericeous hairs; eyes with very short hairs; antennae with dense, reclining light vestiture about as long as diameter of antennal segment 1 and usually with some longer, fine, semierect hairs; antennal segment 1 with slender, erect, black spine on interior surface; thoracic pleura and abdomen lateroventrally with wooly hairs as on dorsum; abdomen medially and posteriorly with reclining light hairs; femora with reclining hairs and some fine spines; tibiae and tarsi with fine reclining hairs and some reclining or semierect black spines about as long as 1½ times tibial diameter.

Head declivous; eyes moderately large, protuberant, weakly granular, nearly confluent with anterior margin of pronotum; vertex weakly convex, posterior margin nearly straight, ecarinate; frons convex, transversely rugose; anterior margins of eyes weakly emarginate; antennae inserted at just below level of ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 moderately enlarged, segment 2 tapering slightly proximally or nearly cylin-

drical, greatest diameter slightly less than diameter of segment 1, segments 3 and 4 about two-thirds diameter of segment 2; bucculae very slightly enlarged; gula about as long as diameter of antennal segment 1, inclined; apex of labium reaching or surpassing base of mesocoxae; pronotum flattened, only slightly inclined posteriorly; calli weak, rather widely separated medially; pronotum with anterior margin finely carinate, upturned, weakly sinuate, lateral margins nearly straight, weakly convergent anteriorly, posterior margin straight or shallowly excavated across flat mesoscutum; mesoscutum one-quarter to one-third length of flat scutellum, separated from the latter by shallow, transverse impression; lateral corial margins weakly convexly rounded; cuneal incisure shallow or obsolete, fracture slightly angled anteromedially; membrane with 2 cells; abdomen reaching to about middle of cuneus; legs moderately long; only metatibiae with longitudinal rows of tiny, closely-spaced spines; metatarsal segment 1 about one-third length of segment 2, segment 3 about three-fourths length of segment 2; claws very long, slender, weakly curved, only slightly broadened basally; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 238–244. Vesica similar in structure to *Odhiamboella* and *Capecapsus,* with a single coil and apically with one or two attenuated spines subtended by well developed gonopore; structure of claspers and phallotheca relatively constant, but left clasper in *C. transvaalensis* with a thorn-like projection dorsally.

BRACHYPTEROUS FEMALE: See *Coatonocapsus sweeti.*

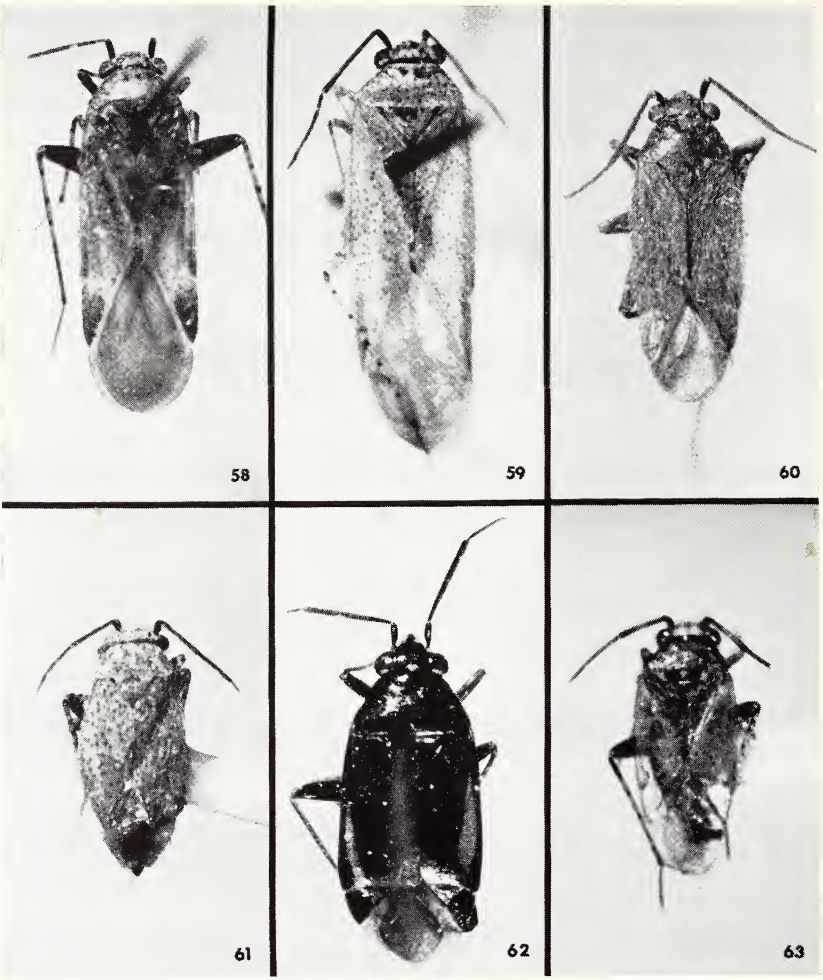
FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Coatonocapsus sweeti*, new species.

This genus is named in honor of Dr. W. G. H. Coaton, Head, Systematic Entomology, Plant Protection Research Institute, Pretoria, whose encyclopedic knowledge of South Africa helped make much of the field work for this project a success.

Coatonocapsus rather closely resembles certain species of *Austropsallus*, particularly *A. senecionus*, by virtue of the black setiform hairs on the dorsum, the spotted femora and tibiae, and the general body form. *Coatonocapsus* differs from *Austropsallus* by having only short to moderately long reclining hairs on the antennae, by having the clypeus, juga, and lora shining black, and by having the vesica characteristically curved (Fig. 238) (see also discussions under *Austropsallus* and *Capecapsus*).

A male specimen, probably representing a new species of *Coatonocapsus* in addition to those described below, is known from Grootfontein, Middelburg, Cape Province (deposited in South African



FIGS. 58–63. Phylini. Fig. 58. *Coatonocapsus johannsmeieri*, male, holotype. Fig. 59. *Coatonocapsus pallidus*, male, holotype. Fig. 60. *Coatonocapsus sweeti*, male, holotype. Fig. 61. *Coatonocapsus sweeti*, female (Sani Pass, 9400 ft., Lesotho). Fig. 62. *Denticulophallus adenandrae*, male, holotype. Fig. 63. *Ellenia obscuricornis*, male (Sani Pass, 9400 ft., Lesotho).

National Collection of Insects). Also known is a female from Cape Town, deposited in the South African Museum, which somewhat resembles *C. pallidus*; this specimen is brachypterous.

KEY TO SPECIES OF *Coatonocapsus*

Macropterous males

1. Basic coloration light yellow green; setiform hairs on dorsum with small brown spots at bases; labium reaching between procoxae and mesocoxae ..... *pallidus* (Fig. 59)
   Coloration brown or nearly black; dorsum heavily spotted with dark brown or black; labium surpassing mesocoxae 2
2. Large species, length 4.80 mm ..... *transvaalensis*
   Smaller species, length under 4.00 mm 3
3. Head, pronotum, scutellum, and antennae black or nearly so; lateral corial margins weakly convex ..... *sweeti* (Fig. 60)
   Head, pronotum, and scutellum brown, mottled with black; antennal segment 2 brown; lateral corial margins straight ..... *johannsmeieri* (Fig. 58)

Coatonocapsus johannsmeieri, new species

Figures 58, 241

MACROPTEROUS MALE: Basic coloration dull brown mottled with dark brown and black; transverse rugosities of frons, vertex around eyes and on posterior margin, pronotal calli, mesoscutum (except lateral margins), and midline of scutellum black; all setiform hairs with brown spots at bases; antennal segment 1 and all tarsi dark brown; clypeus, apex of juga, lora, and labium dark brown, shining; mesothoracic and metathoracic pleura, mesosternum, and abdomen dark brown (appearing pruinose); femora and tibiae yellow brown, femora heavily spotted with black; tibiae with black spots at bases of spines.

Labium just reaching metacoxae at trochanteral joint; posterior margin of pronotum shallowly excavated.

MEASUREMENTS: Total length 3.80, maximum width 1.28, length head .20, width head .76, interocular space .40, length pronotum .36, width pronotum 1.04, length scutellum .60, width scutellum .72, length corium 1.88, length clavus 1.28, length cuneus .76, width cuneus .24, length claval commissure .72, distance apex commissure-apex membrane 1.92, length metatibia 1.68; length antennal segments 1—.28, 2—.90, 3—?, 4—?; length labial segments 1—.36, 2—.28, 3—.32, 4—.30.

MALE GENITALIA: Figure 241.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: 3 macropterous ♂♂, same data as holotype (SANC, RTS).

This species is named for the collector, M. Johannsmeier.

Coatonocapsus johannsmeieri is similar in coloration to *transvaalensis* but is much smaller and has the hemelytra shorter relative to the total length of the body. It is much lighter and more elongate than *sweeti*, and much darker than *pallidus*.

Coatonocapsus pallidus, new species

Figures 59, 242

MACROPTEROUS MALE: Basic coloration light yellow green; head with an orangish tinge; all setiform hairs on dorsum with small, round, brown spots at bases; vertex mottled with brown; clypeus, apex of juga and lora, antennae, labium, coxae, mesoscutum, abdomen (basal half greenish), and tarsi brown; femora with many small, round, brown spots; tibiae with dark brown spots at bases of spines.

Labium reaching between procoxae and mesocoxae; posterior margin of pronotum straight.

MEASUREMENTS: Total length 4.40, maximum width 1.44, length head .24, width head .80, interocular space .40, length pronotum .48, width pronotum 1.20, length scutellum .44, width scutellum .72, length corium 2.04, length clavus 1.44, length cuneus 1.00, width cuneus .32, length claval commissure 1.00, distance apex commissure-apex membrane 2.20, length metatibia 1.92; length antennal segments 1—.30, 2—.98, 3—.66, 4—.30; length labial segments 1—.30, 2—.28, 3—.12, 4—.20.

MALE GENITALIA: Figure 242.

BRACHYPTEROUS FEMALE: Coloration, body surface texture, and vestiture as in male; abdomen yellow green; ovipositor brown.

Structurally very similar to female of *C. sweeti*.

FEMALE GENITALIA: See generic discussion.

MEASUREMENTS: Total length 3.08, maximum width 1.32, width head .78, interocular space .40.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, East of Pakhuis Pass, Mus. Expd., Sept. 1947 (SAM).

PARATYPES: *Cape Province*—1 macropterous ♂, 4 brachypterous ♀♀, Doorn River, XI.1931 (Mackie); 12 brachypterous ♀♀, Michells Pass, Ceres Div., Oct. 1934; 1 macropterous ♂, R. Sonder

End, Oudebosch, 1500 ft., Nov.–Dec. 1928 (Barnard); 1 brachypterous ♀, Swartbergen, Nov. 1935 (SAM, BM[NH], RTS).

This species is named for its light coloration.

Coatonocapsus pallidus can be separated from other members of the genus by its light green coloration, small brown spots on the dorsum, and short labium.

Coatonocapsus sweeti, new species

Figures 60, 61, 243, 244

MACROPTEROUS MALE: Basic coloration dull black; hemelytra dull dark brown, with diffuse black spots at bases of setiform hairs; posterior margin of vertex and lateral margins of mesoscutum orange; ostiolar peritreme, margin of pleural region of prothorax, and margin of bucculae dull white; labium, femora, and tibiae generally brown; labium infuscate apically; femora heavily spotted with black, tibiae with black bands formed by black bases of spines.

Labium just surpassing mesocoxae; posterior margin of pronotum shallowly excavated.

MEASUREMENTS: Total length 3.20, maximum width 1.20, length head .28, width head .76, interocular space .40, length pronotum .40, width pronotum 1.00, length scutellum .48, width scutellum .60, length corium 1.60, length clavus 1.20, length cuneus .52, width cuneus .25, length claval commissure .76, distance apex commissure-apex membrane 1.36, length metatibia 1.68, length antennal segments 1—.32, 2—.88, 3—.50, 4—.28; length labial segments 1—.36, 2—.34, 3—.20, 4—.26.

MALE GENITALIA: Figures 243, 244.

BRACHYPTEROUS FEMALE: Small, stout bodied, ovoid; hemelytra just covering abdomen; general coloration dull yellow green; dorsum with numerous round black spots at bases of setiform hairs; antennae, clypeus, apex of juga, lora, and labium black; coxae and tarsi nearly black; femora and tibiae dull yellowish with heavy black spots.

Body surface and vestiture as in macropterous male.

Head broad; width across eyes nearly equal to width of posterior margin of pronotum; vertex broad, convex, posterior margin nearly straight, ecarinate; eyes smaller than in male, protuberant, leaving genae exposed ventrally; antennal fossae slightly removed from margins of eyes; apex of labium reaching to base of ovipositor; pronotum with anterior margin nearly straight, lateral margins nearly parallel, posterior margin very shallowly excavated; lateral corial margins convex; cuneus and membrane forming broadly rounded posterior margin of hemelytra; membrane greatly reduced.

MEASUREMENTS: Total length 2.60, maximum width 1.12, width head .72, interocular space .40.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

HOLOTYPE: Macropterous ♂, LESOTHO: Sani Pass, 10 Mar. 1968, 9400 ft., T. Schuh, M. Sweet, S. Slater, J. Munting (Adults and nymphs on *Eumorphia sericea* Wood and Evans) (SANC).

PARATYPES: 39 macropterous ♂♂, 44 brachypterous ♀♀, same data as holotype (SANC, TM, SAM, BM[NH], HM, JAS, RTS, USNM).

ADDITIONAL SPECIMENS: 15 nymphs (in alcohol), same data as holotype (RTS).

This species is named for Dr. Merrill H. Sweet, who first discovered it in the field and established the identity of the host plant.

Coatonocapsus sweeti is the smallest known species in the genus. It is nearly black, whereas all other species are distinctly brown or green. *C. sweeti* appears to be most closely related to *johannsmeieri*.

This species is known only from the type locality on *Eumorphia sericea* Wood and Evans (Compositae) (see also discussion under *Austropsallus saniensis*).

Coatonocapsus transvaalensis, new species

Figures 238–240

MACROPTEROUS MALE: Basic coloration brown; dorsum with large dark brown spots at bases of setiform hairs; head weakly orange; antennal segments 1, 3, and 4, clypeus, apex of juga, lora, mesothoracic and metathoracic pleura and sterna, and abdominal venter dark brown; antennal segment 2, labium basally, coxae, pleural region of prothorax, and prothoracic sternum light brown; coxae mottled with dark brown, labium black apically; femora and tibiae light yellow brown; femora heavily spotted with black; tibiae with narrow bands formed by black bases of spines.

Labium just surpassing mesocoxae; posterior margin of pronotum nearly straight.

MEASUREMENTS: Total length 4.80, maximum width 1.68, length head .24, width head .88, interocular space .40, length pronotum .44, width pronotum 1.28, length scutellum .72, width scutellum .92, length corium 2.56, length clavus 1.66, length cuneus 1.04, width cuneus .40, length claval commissure 1.00, distance apex commissure-apex membrane 2.08, length metatibia 2.32; length antennal segments 1—.32, 2—1.16, 3—.84, 4—.36; length labial segments 1—.40, 2—.40, 3—.24, 4—.40.

MALE GENITALIA: Figures 238–240.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Zomerkomst, Politzi, 20.3.65, M. Johannsmeier (SANC).

PARATYPES: 2 macropterous ♂♂, same data as holotype (SANC, RTS).

This species is named for its occurrence in the Transvaal.

Coatonocapsus transvaalensis is the largest known species in the genus, and in size could only be confused with *pallidus* which is light green whereas *transvaalensis* is mottled brown. *C. transvaalensis* has very long hemelytra relative to the total length of the body and also has a relatively long second antennal segment.

Denticulophallus, new genus

MACROPTEROUS MALE: Body thickset, elliptical; dorsum polished, shining, with heavy, semierect, black setiform hairs about as long as metatibial diameter; pronotum weakly transversely rugose; antennal segment 1 with decumbent black hairs and a few erect, slender, black spines, segment 2 with semierect black hairs about as long as diameter of segment 3, segments 3 and 4 with fine, decumbent, black hairs; all femora, tibiae, and tarsi with short, reclining, heavy, black hairs.

Head declivous; clypeus prominent as viewed from above; eyes contiguous with anterior margin of pronotum, occupying sides of head ventrally to gula; antennae inserted at level of ventral margin of eyes, fossae slightly removed from anterior margins of eyes; antennal segment 1 slightly enlarged, segment 2 narrowed proximally, increasing in diameter distally to about diameter of segment 1, segments 3 and 4 slightly smaller than proximal diameter of segment 2; bucculae well developed; pronotum nearly flat longitudinally, slightly inclined posteriorly; mesoscutum and scutellum nearly flat; lateral margin of corium weakly convex; cuneus and membrane strongly deflexed; cuneal incisure shallow; membrane with two cells, all tibiae with black semierect spines about as long as tibial diameter, without rows of tiny closely-spaced spines; claws broadened basally; parempodia hair-like, parallel; pulvilli large, fleshy, flattened, just reaching apex of claws and free from claws except at base.

MALE GENITALIA: Figure 245–247. Vesica U-shaped, twisted, apex with several attenuated spines and recurved teeth, gonopore subapical; phallotheca and claspers typical of Phylini.

MACROPTEROUS FEMALE: Structure very similar to male.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Denticulophallus adenandrae*, new species.

This genus is named for the structure of the vesica of the type species.

Denticulophallus appears to be most closely related to *Macrotylus*, at least in the structure of the pulvilli and the general body form, including the prominent clypeus. It is, however, very distinct by virtue of the shining black body, the heavy, black, setiform hairs on the dorsum, and the peculiar structure of the vesica.

Denticulophallus adenandrae, new species

Figures 62, 245–247

MACROPTEROUS MALE: Generally black, shining; all coxae, all tibiae distally, and antennal segment 4 distally, brown.

Hemelytral surface slightly irregular, less highly polished than remainder of body; eyes with scattered short hairs.

Vertex weakly convex, posterior margin ecarinate; labium just surpassing mesocoxae at trochanteral joint; all pronotal margins nearly straight; calli poorly defined; cuneal fracture angled anteromedially; inner apical margin of large cell of membrane broadly rounded; abdomen just surpassing apex of cuneus in male (nearly reaching apex of membrane in female); metatarsal segments 1 and 2 subequal in length, segment 3 about 1½ times length of segment 2.

MEASUREMENTS: Total length 3.48, maximum width 1.48, length head .32, width head .80, interocular space .36, length pronotum .56, width pronotum 1.24, length scutellum .56, width scutellum .84, length corium 1.76, length clavus 1.32, length cuneus .60, width cuneus .28, length claval commissure .68, distance apex commissure-apex membrane 1.40, length metatibia 1.82; length antennal segments 1—.24, 2—.92, 3—.54, 4—.34; length labial segments 1—.52, 2—.52, 3—.32, 4—.32.

MALE GENITALIA: Figures 245–247.

MACROPTEROUS FEMALE: Very similar to macropterous male.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Vergelegen, Somerset West, 8/11/1964, F. W. and S. K. Gess (on flowers of *Adenandra umbellata* Willd. (Rutaceae)) (SAM).

PARATYPES: 3 macropterous ♂♂, 5 macropterous ♀♀, same data as holotype (SAM, JAS, RTS).

ADDITIONAL SPECIMENS: *Cape Province*—1 macropterous ♂, Ceres, Nov. 1920 (Turner) (BM[NH]).

This species is named for the host genus, *Adenandra*.

See generic discussion.

Most known specimens of *Denticulophallus adenandrae* were taken on *Adenandra umbellata* Willd. (Rutaceae). The host genus is endemic to the Southwest Cape (Phillips, 1951).

Ellenia Reuter

Ellenia Reuter, 1910a, p. 168.

Carvalho (1952a) placed *Ellenia* in the Orthotylini. The structure of the pretarsus and male and female genitalia, however, militate for placement in the Phylini.

Ellenia is most closely related to *Psallus*, but can be separated from it by the presence of a longitudinal keel on the male genital capsule and its highly polished, shining black clypeus, juga, and lora. The parempodia are similar in structure to those described by Wagner (1961) for *Chinacapsus* Wagner, being only slightly thickened and convergent apically rather than strongly flattened and recurved as in the Orthotylinae and Pilophorini.

MALE GENITALIA: Figures 248–250. Vesica short, S-shaped, strongly twisted; left clasper and phallotheca characteristic of Phylinae.

Ellenia was originally described from South America with a single included species. The genus at present also includes approximately ten species from Africa and one from Formosa.

The genus *Melanotrichiella* Poppius was synonymized with *Ellenia* by Carvalho (1952a), but this action is almost certainly incorrect. I have examined what is probably the only available specimen of the genus, the holotype female of *M. annulicornis* Poppius, which is deposited in the Helsinki Museum (Type No. 11891). It differs from *Ellenia* by having the head entirely unicolorous and of uniform surface texture, having antennal segment 2 about one-third longer than the width of the head, and having antennal segment 3 about three-fourths as long as segment 2. The legs are missing from the holotype of *annulicornis*, so the parempodia cannot be examined. The ratio of the lengths of antennal segments 2 and 3 is very much different than that found in most Phylini, including *Ellenia*, and suggests a relationship to the Orthotylini. Confirmation of this will have to await the availability of more specimens so that the parempodia and the male and female genitalia can be examined.

Carvalho (1948) redescribed *Ellenia cuneata* (Stål) with a dorsal view illustration and figures of the male genitalia. Apparently he figured the vesica of a mirid other than *cuneata* because the drawing definitely represents the phallus of an orthotyline and not that of *cuneata*, even though the figures of the claspers seem to be correct.

Ellenia obscuricornis (Poppius)
Figures 63, 248–250

Marshalliella obscuricornis Poppius, 1914a, p. 76.
Psallus tenebrosus Odhiambo, 1959b, pp. 516–518, 541. **New Synonymy.**
Psallus labeculus Odhiambo, 1959b, pp. 518–521, 541. **New Synonymy.**
Ellenia obscuricornis Carvalho, Dutra, and Becker, 1960, pp. 460–461.

Ellenia obscuricornis (Poppius) is one of the most common and widespread members of the Phylinae in South Africa and is the only species in the genus known from the region. It can be recognized by the characters given in the generic discussion and by its generally light green coloration (see also below) with dark spots at the bases of the setiform hairs (and on the femora and tibiae) and the structure of the male genitalia.

MEASUREMENTS: Macropterous ♂ (Sani Pass, 9400 ft.)—Total length 2.88, maximum width 1.24; macropterous ♀ (*idem*)—Total length 3.36, greatest width 1.32.

MALE GENITALIA: Figures 248–250.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

The range of variation in this species in South Africa is extreme. The males are usually much darker than the females, particularly the pronotum, mesoscutum, scutellum, and the thoracic and abdominal pleura. In some specimens the antennae are totally black. The long series from Lesotho, Sani Pass, at 8000 and 9400 feet, are particularly dark, the latter locality having uniformly darker specimens than the former. Also, two extremely dark specimens are known from Mariepskop, near Klaserie, Transvaal; these individuals key out in Poppius' key (1914a) to *Marshalliella kilimana* Poppius on the basis of the black antennae, but are actually only very dark specimens of *obscuricornis*. The specimens from the Oliphants River at Citrusdal are all very light green.

A single female specimen of *E. obscuricornis* is present in the Helsinki Museum and three males and one female are present in the British Museum (Natural History). All bear the labels "S. Rhodesia, Chirinda, 12.VII.1911, Swynnerton," and therefore must represent the cotype series examined by Poppius (1914a). I have selected a male in the British Museum as the lectotype and labeled it "LECTOTYPE *Marshalliella obscuricornis* Poppius, det. R. T. Schuh."

Psallus labeculus Odhiambo and *Psallus tenebrosus* Odhiambo (Odhiambo, 1959b) both have a keel on the male genital capsule as found in *Ellenia* and have the vesica identical with specimens of

E. obscuricornis from South Africa. The type specimens of both of these species resemble *obscuricornis* very closely, including the shining black area on the front of the head. They fit well within the range of variation of *obscuricornis* and I am therefore synonymizing them.

Host plant information on *obscuricornis* is incomplete, but the species may be restricted to the Compositae and possibly to the genus *Senecio*.

SPECIMENS EXAMINED: All specimens macropterous. LESOTHO —17 ♂♂, 31 ♀♀, 14 nymphs, Sani Pass, 9400 ft., 10 Mar. 1968 (Adults and nymphs on *Senecio burchelli* D.C.); 14 ♂♂, 22 ♀♀, 8 nymphs, *idem*, 8000 ft.; 2 ♀♀, Mamathes, 5 mi. ENE Teyateyaneng, 28.III.51, at light (Brinck and Rudebeck); 4 ♀♀, Quthing, 17.III.51 (Brinck and Rudebeck). SOUTH AFRICA: *Cape Province*—17 ♂♂, 68 ♀♀, 4 nymphs, Citrusdal, Oliphants River, 29 Jan. 1968 (Adults and nymphs on *Senecio angustifolius* [Thunb.] Willd.); 4 ♂♂, 4 ♀♀, Calvinia (Ogilvie); 2 ♂♂, Doorn River, XI. 1931 (Mackie); 1 ♂, 5 ♀♀, 2 mi. S. Goukamma, Knysna, 8 Feb. 1968; 1 ♂, Base Michells Pass, 6 mi. SW Ceres, 27 Jan. 1968; 2 ♂♂, 2 ♀♀, Schoemannspoort, 10 mi. N of Oudtshoorn, 18 Nov. 1967 (Sweet); 1 ♂, Swellendam, at light, 14 Nov. 1967 (Sweet). *Natal*—1 ♂, Bergville, 17.I.1964 (Paliatseas); 1 ♂, Cathedral Peak, 2–3.IV.1954 (Vari); 1 ♀, Drakensberg, Cathedral Peak, ca. 6000 ft., 2.IV.1954, at light (Balfour-Browne); 1 ♂, Giants Castle Park, 5800 ft., 5 Mar. 1968, UV light trap; 1 ♀, Greytown, X.1931 (Ogilvie); 1 ♂, 3 ♀♀, Hilton; 1 ♀, Mont-aux-Sources, 4–6.IV.1954 (Vari); 2 ♀♀, *idem*, 8500–10,500 ft., 26,ii.1929 (Scott); 3 ♀♀, Natal National Park, iii.1932 (Mackie); 1 ♀, Port Shepstone, 5.97; 5 ♂♂, 1 ♀, Royal Natal National Park, Tendele Camp, 5 March 1968, UV light trap; 5 ♂♂, 26 ♀♀, Sea Park, Durban, VII-1950 (Capener); 4 ♂♂, 4 ♀♀, Weenen, XII.1923-V.1924 (Thomasset); 1 ♂, 1 ♀, *idem*, IX.X.1928; 1 ♀, Umbilo, Durban, 5.9.26 (Bevis). *Orange Free State*—1 ♀, Ficksburg, ii.iii.1932 (Mackie); 1 ♂, 23 ♀♀, 10 mi. Petrus Steyn to Reitz, 27.12.1967 (Munting); 3 ♀♀, H. Smith. *Transvaal*—9 ♂♂, 13 ♀♀, Lyttelton, Pretoria, 18 Dec. 1967–29 Feb. 1968, UV light; 1 ♂, 1 ♀, Malelane, 24.III. 1952 (Janse and Vari); 6 ♀♀, Hartebeespoort Dam, 20 mi. W Pretoria, 30 October 1967; 1 ♀, Johannesburg, XII.26.1951 (Capener); 1 ♂, 1 ♀, Mariepskop near Klaserie, 6300 ft., 30 Nov. 1967; 1 ♀, Sycamore, 28 Apr. 1926 (Horn); 1 ♀, Claudiushoop, 11 mi. N Dendron, 17.12.65 (Johannsmeier) (SANC, TM, SAM, BM[NH], HM, USNM, JAS, RTS).

Eminoculus, new genus

MACROPTEROUS MALE: Small, stout bodied; entire body surface highly polished, shining; dorsum rugulose or rugose; vestiture variable.

Head vertical, very broad, eyes stylate; frons convex; head viewed anteriorly V-shaped below eyes; juga bulging; bucculae expanded; gula obsolete; antennae inserted below ventral margin of eyes at about level of dorsal margin of clypeus; antennal segment 1 moderately enlarged, segment 2 tapering slightly proximally, distal diameter nearly equal to diameter of segment 1, segments 3 and 4 about equal to proximal diameter of segment 2; pronotum nearly flat longitudinally, weakly convex transversely, with flattened collar about as wide as diameter of antennal segment 1, lateral margins very slightly concave, posterior margin weakly concave across scutellum; calli well defined, separated medially; mesoscutum broadly exposed, inclined anteriorly; scutellum nearly flat; clavi inclined medially to scutellum, forming low ridge along claval commissure; cells of membrane with evenly rounded posterior margin; legs rather short, posterior femora noticeably bowed; tibiae with scattered thin spines on ventral surface, lacking rows of tiny closely-spaced spines; tarsal claws broad basally; parempodia hair-like, parallel; pulvilli relatively large, attached to most of ventral surface of claws.

MALE GENITALIA: Figures 251–253. Phylini-type; structure of vesica, phallotheca, and claspers not showing particularly close relationship to other known genera.

BRACHYPTEROUS FEMALE: See *Eminoculus drosanthemi.*

FEMALE GENITALIA: Figure 254. Posterior wall a simple sclerotized plate; sclerotized rings moderately infolded laterally.

TYPE SPECIES: *Eminoculus drosanthemi*, new species.

This genus is named for its stylate eyes.

Eminoculus is unique among the South African Miridae by virtue of its stylate eyes (which are reminiscent of those of *Pachytomella* Reuter in the Halticini) and peculiar coleopteroid females. The only other described phyline genera with stylate eyes are *Lasiolabops* Poppius and *Lasiolabopella*, in which the eyes are not nearly so conspicuously stalked as in *Eminoculus*. *Eminoculus* is the only known member of the Phylini with a well developed flat pronotal collar. This structure suggests a relationship to the Hallodapini, but other characters, including the form of the male genitalia and the structure of the pulvilli do not support such a relationship.

Eminoculus drosanthemi, new species
Figures 64–65, 251–254

MACROPTEROUS MALE: Basic coloration shining black; antennal segment 1, proximal three-fourths of antennal segment 2, dorsal surface of all femora distally, all tibiae, all tarsal segments 1 and 2, ventral margin of prothoracic pleuron, ventral margin of mesepimeron, and posterior margin of metepisternum cream or light brown; distal quarter of antennal segment 2 and segments 3 and 4 entirely brown; membrane smoky brown.

Coxae generally pruinose; body covered with decumbent, short, light hairs; antennae with short decumbent vestiture, segment 1 with one or two slender, erect spines on interior surface; vertex, pronotum, and genal region dorsad of bucculae with long, erect, fine hairs; abdominal venter with long, reclining hairs; posterior half of pronotum rugulose, contrasting with smooth calli.

Vertex slightly depressed, posterior margin carinate, concave; posterior margin of eyes slightly anterior to transverse midline of pronotum; labium reaching to trochanteral joint of mesocoxae; lateral corial margins weakly convex; cuneal incisure shallow; metatarsal segment 3 slightly longer than segment 2, segment 2 slightly longer than segment 1.

MEASUREMENTS: Total length 2.28, maximum width 1.04, length head .12, width head 1.08, interocular space .56, length pronotum .48, width pronotum 1.00, length scutellum .40, width scutellum .60, length corium 1.14, length clavus .95, length cuneus .39, width cuneus .26, length claval commissure .52, distance apex commissure-apex membrane 1.10, length metatibia 1.30; length antennal segments 1—.30, 2—.70, 3—.38, 4—.28; length labial segments 1—.28, 2, 3, and 4—.54.

MALE GENITALIA: Figures 251–253.

BRACHYPTEROUS FEMALE: Coleopteroid; general coloration, surface texture, and pubescence as in macropterous male.

Head similar in structure to male; vertex not depressed, posterior margin more strongly concave and not as finely carinate as in male; frons more strongly produced than in males; pronotum nearly horizontal longitudinally, posterior margin forming shallow inverted "V"; hemelytra reduced, undifferentiated, coleopteroid, posterior margins forming an inverted "V", posterolateral angles broadly rounded; apex of abdomen exposed.

MEASUREMENTS: Total length 2.32, maximum width 1.36, width head 1.20, interocular space .66.

FEMALE GENITALIA: Figure 254.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Meintjies Kop, Pretoria, 22 Oct. 1967, J. A. & S. Slater (Adults and nymphs on *Drosanthemum floribundum* [Harv.] Schwart.) (SANC).

PARATYPES: *Transvaal*—3 macropterous ♂♂, 5 brachypterous ♀♀, Pretoria, 6.9.66 (duPlessis); 4 macropterous ♂♂, 14 brachypterous ♀♀, Pretoria, 24 October 1967 (Adults and nymphs on *Drosanthemum floribundum* [Harv.] Schwart.); 1 brachypterous ♀, Pretoria, National Botanical Gardens, 28 Dec. 1967 (SANC, JAS, RTS).

This species is named for the host, *Drosanthemum floribundum* (Harv.) Schwart. (Aizoaceae).

Eminoculus drosanthemi can be separated from all other members of the Phylinae by its conspicuously stylate eyes, shining black rugulose dorsum with inconspicuous pubescence, and very small size. *E. hirsutus* is similar to *drosanthemi* in the structure of the head, but can be separated from it by the very wide pronotal collar, pronounced calli, and long erect pubescence.

This species was found on its mat-like host by lifting up a section of the plant and examining closely the lower stems.

Three additional brachypterous female specimens from the Cape Province bear the following data: Calvinia, XI.1931 (deposited in British Museum [Natural History]; Moordenaars Karoo, Lammerfontein, Oct. 1952 (deposited in South African Museum); and, Knysna Head, 1 Feb. 1968 (deposited in J. A. Slater Collection). These specimens differ in the structure of the head, surface texture of the pronotum, and type of pubescence from the Pretoria specimens, and are therefore not included in the paratype series.

Eminoculus hirsutus, new species

Figure 66

MACROPTEROUS MALE: Head, pronotum, and scutellum shining black; corium, clavus, cuneus, antennae, entire venter, labium, femora (except tibial joint), and all tarsal segments 3 dull black; ventral margin of mesepimeron and metepimeron, all femora distally, all tibiae, and tarsal segments 1 and 2 tan or light brown; membrane dark smoky brown; all coxae mostly pruinose.

Head, pronotum, and scutellum rugulose; hemelytra faintly rugulose; remainder of body dull, finely granulose; frons, vertex, head below eyes and above bucculae, pronotum, scutellum, and basal region of hemelytra with long, sericeous, erect or semierect hairs;

FIGS. 64–69. Phylini. Fig. 64. *Eminoculus drosanthemi*, male, holotype. Fig. 65. *Eminoculus drosanthemi*, female (Pretoria, Transvaal). Fig. 66. *Eminoculus hirsutus*, male, holotype. Fig. 67. *Lamprosthenarus* near *sjostedti*, male (Bridal Veil Falls, Sabie, Transvaal). Fig. 68. *Lasiolabopella capeneri*, female (Tzaneen, Transvaal). Fig. 69. *Lepidocapsus rubrum*, male, holotype.

hemelytra with numerous, venter of thorax and abdomen with less numerous, decumbent, light hairs; antennae with dense decumbent vestiture, segment 1 with several fine black spines on interior surface; femora with a few, long, erect hairs, particularly on the ventral surfaces.

Head short, transverse, eyes on long stalks projecting laterally

beyond anterolateral margins of pronotum by distance on each side about equal to three-fourths width of the anterior margin of the pronotum; eyes nearly spherical; posterior margin of vertex forming fine, rounded carina medially, grading into cylindrical eye stalks laterally; vertex depressed on either side of midline anterior to posterior margin; labium just surpassing procoxae; pronotum with anterior margin nearly straight, lateral and posterior margins sinuate; pronotum with very deep, wide, transverse impression medially; calli elevated, pronounced, largely confluent; cuneal incisure shallow, fracture angled anteromedially; tibiae with semierect, black spines; metatarsal segment 1 about one-third length of segment 2, segment 3 about two-thirds length of segment 2; metafemora weakly bowed.

MEASUREMENTS: Total length 3.72, maximum width 1.36, length head .16, width head 1.32, interocular space .74, length pronotum .62, width pronotum 1.20, length scutellum .56, width scutellum .68, length corium 1.64, length clavus 1.18, length cuneus .68, width cuneus .34, length claval commissure .68, distance apex commisure-apex membrane 1.54, length metatibia 1.94; length antennal segments 1—.50, 2—1.06, 3—.52, 4—?; length labial segments 1—.30, 2—.26, 3—.12, 4—.12.

MALE GENITALIA: Not examined.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Oudtshoorn, Zebra, Mus. Expd., Oct. 1951 (SAM).

This species is named for its conspicuous long vestiture.

See discussion under *E. drosanthemi*.

Lamprosthenarus Poppius

Lamprosthenarus Poppius, 1914a, p. 91.

Lamprosthenarus can be separated from other African genera of Phylinae by the following combination of characters: parempodia hair-like and parallel; head extremely short and concave behind, posterior margin of vertex finely carinate; dorsum heavily punctured; and, entire body shining black and metallic. *Agrametra* Buchanan-White and *Neoambonea* have a similar combination of characters, but the former is endemic to St. Helena, and the latter has fleshy, apically convergent, recurved parempodia and belongs to the Pilophorini.

MALE GENITALIA: Figures 255–257. Vesica structurally very similar to *Coatonocapsus*, with two attenuated apical spines.

Lamprosthenarus near **sjostedti** Poppius
Figures 67, 255–257

Comparison of specimens of *Lamprosthenarus* from South Africa with the type female of *L. sjostedti* from Mt. Kilimanjaro, deposited in the Stockholm Museum, reveals that they are very similar, appearing to differ only in size. *Lamprosthenarus* near *sjostedti* can be recognized in South Africa by the characters given above for the genus.

MEASUREMENTS: Macropterous ♂—Total length 2.76, maximum width 1.40.

MALE GENITALIA: Figures 255–257.

Specimens of *sjostedti* from Bridal Veil Falls, near Sabie, were swept from a field containing sedges, grasses, and many ruderal plant species.

SPECIMENS EXAMINED: *Natal*—1 macropterous ♀, Giants Castle Park, 5800 ft., 6 Mar. 1968. *Transvaal*—2 macropterous ♂♂, Bridal Veil Falls, Sabie, 29 Nov. 1967 (RTS).

Lasiolabopella, new genus

MACROPTEROUS FEMALE: Dorsum smooth, dull; body covered with black and sericeous, scale-like, appressed hairs; antennae and legs with very fine, short, decumbent, inconspicuous hairs.

Small, body flattened; eyes substylate, strongly protuberant, weakly granular; head nearly as broad as posterior margin of pronotum; posterior margin of vertex (including eyes) concave, reaching posteriorly around anterior angles of pronotum; frons triangular from above, strongly produced anteriorly, attaining distal end of antennal segment 1; eyes reaching almost to gula, leaving small genal area exposed; antennae inserted slightly above ventral margin of eyes, fossae contiguous with sinuate anterior margins of eyes; antennal segment 1 slightly enlarged, with single fine spine on dorsal surface, segment 2 gradually enlarged distally to about 1½ times proximal diameter, distally about same diameter as segment 1, segments 3 and 4 about equal to proximal diameter of segment 2; gula short, about as long as diameter of antennal segment 1; anterior margin of pronotum finely carinate, upturned; calli distinctly raised, flattened, confluent medially; pronotum nearly horizontal; mesoscutum narrowly exposed, scutellum and mesoscutum flat; lateral corial margins weakly convex; cuneal fracture angled anteromedially; membrane with two cells; legs short; all tibiae with rows of tiny, closely-spaced spines, without longer spines; tarsal claws relatively

short, rather strongly and smoothly curved, broad basally; parempodia hair-like, parallel; pulvilli minute.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

MACROPTEROUS MALE: Very similar to female.

MALE GENITALIA: Figures 258–260. Typical of Phylini, showing no particularly close relationship to other known genera.

TYPE SPECIES: *Lasiolabopella capeneri*, new species.

This genus is named for its resemblance to *Lasiolabops* Poppius.

Lasiolabopella can be recognized by its very small size, flattened body, substylate eyes, and covering of black and sericeous scale-like hairs. *Eminoculus*, the only genus in South Africa with a similar head structure, is shining black and lacks scale-like hairs. *Lasiolabops*, from East and West Africa, differs from *Lasiolabopella* by being much larger, not having a flattened body, and having a much shorter head.

Lasiolabopella capeneri, new species

Figures 68, 258–260

MACROPTEROUS FEMALE: Head, anterior three-fourths of pronotum, scutellum, clavus adjacent to scutellum, corium (except as noted below), cuneus, membrane except veins, mesothoracic and metathoracic pleura and sterna (except ostiolar peritreme), abdomen, all coxae, all femora (apices sometimes light), and labium dark brown; posterior fourth of pronotum, most of clavus, extreme base and apex of corium, veins of membrane, and prosternum white; antennae, tibiae, tarsi (and sometimes femora distally), and ostiolar peritreme very light yellow white.

Scutellum and anterior two-thirds of clavus densely covered with appressed, scale-like, sericeous hairs; posterior third of pronotum, anterior two-thirds of corium, and clavus with a few black, scale-like hairs; posterior third of cuneus densely covered with black, scale-like hairs; abdominal venter thickly covered with generally black-appearing scale-like hairs; eyes with very short hairs.

Posterior margin of vertex with low rounded carina medially; labium just attaining trochanteral joint of mesocoxae; pronotum with anterior margins sinuate, lateral margins straight, posterior margin shallowly excavated; cuneal incisure shallow; abdomen almost attaining apex of cuneus; metatarsal segment 1 about one-half length of segment 2, segments 2 and 3 subequal in length.

MEASUREMENTS: Total length 3.20, maximum width 1.20, length head .44, width head .88, interocular space .44, length pronotum .44, width pronotum 1.00, length scutellum .40, width scu-

tellum .60, length corium 1.60, length clavus 1.16, length cuneus .52, width cuneus .36, length claval commissure .62, distance apex commissure-apex membrane 1.20, length metatibia 1.36; length antenal segments 1—.18, 2—.78, 3—.58, 4—.24; length labial segments 1—.32, 2—.36, 3—.36, 4—.30.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

MACROPTEROUS MALE: Very similar to female.

MALE GENITALIA: Figures 258–260.

HOLOTYPE: Macropterous ♀, SOUTH AFRICA: *Transvaal*, Tzaneen, 11–16 Dec. 1963, A. L. Capener (Host plant *Terminalia sericea*) (SANC).

PARATYPES: *Transvaal*—1 macropterous ♀, 10 mi. N. Acornhoek, 29 Nov. 1967, at light; 1 macropterous ♂, 5 macropterous ♀♀, Middelfontein nr. Nylstroom, XII-17-1953 (Capener); 4 macropterous ♀♀, same data as holotype; 1 macropterous ♀, 6 mi. N. Warmbaths, 7 Dec. 1967 (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: SOUTH WEST AFRICA—1 macropterous ♂, 1 macropterous ♀, Abachaus, XI.1949 (Hobohm) (TM).

This species is named for Mr. A. L. Capener.

See generic discussion.

The specimens from Abachaus, South West Africa, have the male genitalia identical with those from the Transvaal, but are lighter in color and have therefore not been included in the paratypic series.

The only known host record for *capeneri* is *Terminalia sericea* Burch. (Combretaceae).

Lepidocapsus Poppius

Lepidocapsus Poppius, 1914a, pp. 103–104.

Lepidocapsus can be recognized by the following combination of characters: the parempodia are hair-like and parallel; the pulvilli are large and fused to the entire ventral surface of the claws; antennal segment 2 is very thick, fusiform, and about 2½ times diameter of segments 3 and 4; and, the dorsum is densely covered with reclining, heavy, setiform hairs and decumbent wooly sericeous hairs. No other phyline from South Africa has the greatly enlarged second antennal segment. *Rakula* Odhiambo and *Atractotomus* Fieber from tropical Africa have an enlarged second antennal segment but both lack the wooly sericeous hairs on the dorsum.

MALE GENITALIA: Figures 261–263. Vesica with two attenuated spines apically, possibly showing a relationship to *Coatonocapsus*.

Poppius (1914a) noted that the holotype of *Lepidocapsus crassicornis* Poppius was deposited in the Berlin-Humboldt Museum. In fact it is in the Helsinki Museum (Type No. 12257).

Lepidocapsus presently includes two species from Malawi and South Africa.

Lepidocapsus rubrum, new species

Figures 69, 261–263

MACROPTEROUS FEMALE: Small, robust, basic coloration bright red; antennal segments 1 and 2 and all tarsal segments 3 black; antennal segments 3 and 4, all tibiae, and all tarsal segments 1 and 2 yellow; membrane light smoky gray, veins of small cell red, veins of large cell unicolorous with membrane; venter including coxae slightly darker than dorsum.

Entire body smooth, weakly shining; dorsum with dense, semierect, long, light colored hairs (about as long as tibial diameter), and decumbent, sericeous, wooly hairs; thoracic pleura with wooly hairs; abdominal venter with reclining fine golden hairs; antennal segments 1 and 2 with dense, reclining, short, black vestiture, segments 3 and 4 with semierect, light colored hairs about as long as diameter of segment 3; femora with fine reclining light colored hairs; gular region below eyes with several very long, light colored hairs; eyes with short hairs visible at about 25×.

Head deflexed; eyes rather small as viewed from above, contiguous with anterior margin of pronotum; vertex convex, posterior margin ecarinate; antennae inserted slightly above ventral margin of eyes; antennal segment 1 somewhat conical in shape, largest distally, segment 2 greatly enlarged, fusiform, about 1½ times diameter of segment 1, segments 3 and 4 about one-third diameter of segment 2; labium just reaching trochanteral joint of metacoxae; pronotum with anterior, lateral, and posterior margins nearly straight; cuneal incisure shallow; tibiae with a few semierect dark spines, about length of tibial diameter, with dark bases; only metatibiae with rows of tiny, closely-spaced, dark spines; metatarsal segments 1 and 2 subequal in length, segment 3 slightly longer than segment 2.

MEASUREMENTS: Total length approximately 2.65, maximum width 1.24, length head .22, width head .64, interocular space .36, length pronotum .40, width pronotum 1.04, length scutellum .44, width scutellum .60, length corium 1.36, length clavus 1.12, length cuneus .40, width cuneus .44, length claval commissure .56, distance apex commissure-apex membrane approximately .96, length meta-

tibia 1.30; length antennal segments 1—.16, 2—.64, 3—.34, 4—.22; length labial segments 1—.28, 2—.28, 3—.24, 4—.28.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

MACROPTEROUS MALE: Very similar to female except eyes slightly larger and vertex relatively narrower.

MALE GENITALIA: Figures 261–263.

HOLOTYPE: Macropterous ♀, SOUTH AFRICA: *Cape Province*, Ceres, 25 Jan. 1968, J. A. & S. Slater, T. Schuh, M. Sweet, UV light (SANC).

PARATYPES: *Cape Province*—7 macropterous ♂♂, 10 macropterous ♀♀, Michell's Pass Summit SW of Ceres, 25 Jan. 1968 (Adults and nymphs on *Erica exurgens* Andr.) (SANC, HM, JAS, RTS).

This species is named for its bright red coloration.

Lepidocapsus rubrum differs from *L. crassicornis* by being smaller and bright red; *crassicornis* is dull orange.

The host of this species, *Erica exurgens* Andr. (Ericaceae), has bright red flowers very similar to the color of *rubrum*.

An additional specimen of *Lepidocapsus*, possibly representing a new species, is known from Blouberg, Motlakeng, 5–6000 ft., Transvaal (deposited in the Transvaal Museum). It is slightly larger than *rubrum* and is dull red.

Leptoxanthus Reuter

Leptoxanthus Reuter, 1905d, p. 8.

Leptoxanthus includes only a single species from South West Africa. The genus was related to *Tuponia* by Reuter (1905d); Poppius (1914a) keyed out *Leptoxanthus* with *Brachycranella* in the last couplet of his key to the Phylinae, considering both genera to lack "arolia" (see also discussion under *L. flaveolus*).

Leptoxanthus flaveolus Reuter

Leptoxanthus flaveolus Reuter, 1905d, p. 8.

Leptoxanthus flaveolus was described by Reuter (1905d) from a female collected by Wahlberg at "Svakop." This locality is almost certainly the Svakop River in South West Africa, which is at about 22–23° S. latitude. I have not been able to locate the holotype of *flaveolus* in the Helsinki Museum (personal communication, Martin Meinander, Helsinki Museum). Until this specimen can be found the exact identity and relationships of *Leptoxanthus* cannot be determined.

Macrotylus Fieber

Macrotylus Fieber, 1858, p. 325.

Macrotylus can be recognized in South Africa by the strongly anteriorly projecting clypeus, the long, free pulvilli, and the absence of heavy setiform hairs on the dorsum. *Denticulophallus* is the only other genus from the region with pulvilli that are nearly as long as the claw and free from it over most of their length. The size and coloration of *Macrotylus* are quite variable.

Macrotylus is widely distributed in the Nearctic and Palearctic, but has not been previously recorded from the Ethiopian Region.

Ten male specimens from Claudiushoop, 11 mi. N. Dendron, Transvaal, deposited in the South African National Collection of Insects, probably represent a new genus allied to *Macrotylus*. They have the pretarsal structures very similar to *Macrotylus*, but the head is more strongly declivent. All are in very poor condition and therefore cannot be described at this time.

Macrotylus hemizygiae, new species

Figures 266–268

MACROPTEROUS MALE: Basic coloration very light yellow green or yellow brown; head, anterior half of pronotum, and midline of scutellum tinged with greenish; scutellum mostly light brown; femora (particularly metafemora) covered with small, round, brown spots at bases of hairs.

Entire body smooth, dull; pronotum sparsely, scutellum, clavus, corium, and cuneus rather densely, covered with moderately long, fine, decumbent, black hairs; entire dorsum and thoracic pleura densely covered with decumbent, wooly, sericeous hairs; antennae with short, reclining, dark vestiture; antennal segment 1 with several erect, slender, black spines; eyes with very short hairs; abdominal venter with moderately long, reclining, light hairs; all femora with decumbent dark hairs, ventral margins with a few, erect, long, fine, light hairs; tibiae with semierect, dark spines about as long as tibial diameter.

Head strongly produced anteriorly; juga and clypeus prominent; vertex and frons convex; eyes granular, protuberant, appearing nearly hemispherical as viewed from above, occupying nearly entire sides of head posterior to antennal bases; segment 1 moderately enlarged, segment 2 nearly cylindrical, slightly greater in diameter distally than proximally, about one-half diameter of segment 1, segments 3 and 4 of slightly smaller diameter than segment 2; lora forming a low angle with longitudinal axis of body; bucculae slightly ex-

panded; gula horizontal, about as long as width of eye viewed from side; labium just surpassing metacoxae; posterior margin of pronotum weakly sinuate, calli indistinct; pronotum slightly inclined posteriorly; mesoscutum and scutellum nearly flat; hemelytra weakly convex laterally; cuneal incisure obsolete; cuneal fracture slightly angled anteromedially; membrane with two cells, metatibiae with longitudinal rows of tiny, closely spaced spines; metatarsal segment 1 about one-half length of segment 3, segment 3 about two-thirds length of segment 2; pretarsal structures as described under *M. niger*.

MEASUREMENTS: Total length approx. 3.92, maximum width 1.48, length head .40, width head .68, width vertex .36, length pronotum .52, width pronotum 1.16, length scutellum .48, width scutellum .68, length corium 1.88, length clavus 1.36, length cuneus .64, width cuneus .40, length claval commissure .84, distance apex commissure-apex membrane approx. 1.65, length metatibia 2.20; length antennal segments 1—.26, 2—1.26, 3—.88, 4—.42; length labial segments 1—.44, 2—.42, 3—.30, 4—.42.

MALE GENITALIA: Figures 266–268.

MACROPTEROUS FEMALE: Very similar to male.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Kruger Nat. Park, Oliphants River near Oliphants Camp, 30 Apr. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Hemizygia thorncrofti* [N.E. Br.] Ashby) (SANC).

PARATYPES: *Transvaal*—7 macropterous ♂♂, 13 macropterous ♀♀, same data as holotype (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: *Transvaal*—1 macropterous ♂, 1 macropterous ♀, 2 nymphs (in alcohol), same data as holotype; 2 macropterous ♂♂, 1 macropterous ♀, 4 nymphs (in alcohol), Kruger Nat. Park, Letaba River near Oliphants Camp, 30 Apr. 1968 (RTS).

This species is named for the host genus, *Hemizygia*.

Macrotylus hemizygiae can be separated from *M. niger*, the only other species of *Macrotylus* occurring in South Africa, by its light coloration and decumbent wooly pubescence.

The host, *Hemizygiae thorncrofti* (N.E. Br.) Ashby (Labiatae), was growing on a rocky slope on the banks of the Letaba River.

Macrotylus niger, new species

Figures 70, 264, 265

MACROPTEROUS MALE: Basic coloration black; membrane smoky brown, dark; veins of membrane, and mesial margin of cuneus narrowly, white.

Dorsum smooth, dull or very weakly shining, with reclining, moderately long, light hairs; eyes with short hairs; antennae with decumbent, short, dense, light hairs; thoracic pleura with a few hairs as on dorsum; abdominal venter with reclining, weakly shining hairs; femora with inconspicuous decumbent hairs; tibiae and tarsi with reclining dark hairs and tibiae with scattered, semierect, black spines about as long as tibial diameter.

Head only slightly declivous, clypeus prominent; vertex and frons convex; eyes small as viewed from above, protuberant, occupying nearly entire sides of head behind antennal bases; antennae inserted just below middle of anterior margins of eyes, fossae contiguous with eyes; antennal segment 1 moderately enlarged, segment 2 nearly cylindrical, about three-fourths diameter of segment 2; bucculae slightly expanded; gula short, length about equal to diameter of antennal segment 2; labium slightly surpassing metacoxae; posterior margin of pronotum nearly straight; hemelytra nearly parallel sided; cuneal incisure shallow; membrane with two cells; abdomen almost attaining apex of corium; metafemora flattened, moderately enlarged; all tibiae with rows of tiny, closely spaced spines; metatarsal segment 1 about one-half length of segment 2, segments 2 and 3 subequal in length; tarsal claws strongly curved, very strongly broadened basally; parempodia hair-like, parallel; pulvilli greatly enlarged, fleshy, flattened, free, reaching almost to apex of claw.

MEASUREMENTS: Total length 2.80, maximum width 1.08, length head .22, width head .52, interocular space .26, length pronotum .40, width pronotum .94, length scutellum .40, width scutellum .60, length corium 1.38, length clavus 1.04, length cuneus .46, width cuneus .22, length claval commissure .56, distance apex commissure-apex membrane 1.26, length metatibia 1.56; length antennal segments 1—.18, 2—.74, 3—.58, 4—.24; length labial segments 1—.30, 2—.32, 3—.26, 4—.24.

MALE GENITALIA: Figures 264, 265.

MACROPTEROUS FEMALE: Very similar to male.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Oliviershoek Pass Summit, 5400 ft. elevation, 25 mi. S. Harrismith, 4 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet, (SANC).

PARATYPES: *Natal*—2 macropterous ♂♂, 2 macropterous ♀♀, V. Reenen. *Transvaal*—1 macropterous ♂, Moketsi, 31.1.63 (Paliatseas); 2 macropterous ♀♀, Mac Mac, Graskop, 17.1.63 (Paliatseas); 1 macropterous ♂, New Chum Falls, nr. Vaalhoek, 17 Jan. 1963 (Capener) (SANC, BM[NH], RTS).

This species is named for its black coloration.

Macrotylus niger can be distinguished from other South African Phylinae by virtue of its very long pulvilli, small size, protuberant clypeus, and black coloration.

Natalophylus, new genus

MACROPTEROUS MALE: Moderately large, elongate, with long appendages; facies *Phylus*-like; body generally smooth, shining; head, pronotum, scutellum, clavus, corium, and cuneus with erect, golden hairs about twice as long as tibial diameter; antennal segment 1 with some decumbent hairs and a thin, erect, dark spine on dorsal surface, segments 2, 3, and 4 with some semierect fine hairs about as long as diameter of segment on which they occur; thoracic pleura glabrous; abdominal venter with fine decumbent hairs; femora with inconspicuous decumbent hairs; tibiae and tarsi with reclining light hairs; all femora with a few, very fine, long, erect hairs on ventral surfaces; metafemora with some long, fine, erect or semierect, spine-like hairs on dorsal surfaces.

Head deflexed; eyes moderately large, protuberant, confluent with anterior pronotal margin, broadly emarginate anteriorly, reaching ventrally almost to gula; antennae inserted slightly above ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 moderately enlarged, segment 2 cylindrical, about two-thirds diameter of segment 1, segments 3 and 4 subequal in diameter, slightly more than one-half diameter of segment 2; clypeus prominent as viewed laterally, not visible from above; bucculae narrow; gula short; labium just surpassing procoxae; pronotum broad, not strongly narrowed anteriorly, anterior margin finely carinate, upturned; pronotum flattened longitudinally, only slightly inclined posteriorly; mesoscutum separated from scutellum by shallow transverse impression; hemelytra nearly straight and parallel sided; cuneal incisure shallow; membrane with two cells; tibiae with scattered, semierect, dark spines about 1½ times length of tibial diameter; only metatibiae with longitudinal row of tiny, closely spaced spines; tarsal claws moderately long, broad basally, evenly curved; parempodia slightly over one-half length of claws, weakly fleshy, convergent apically; pulvilli minute.

MALE GENITALIA: Figures 269–272. Structure of vesica and phallotheca of phyline pattern, but showing no relationship to other known genera.

MACROPTEROUS FEMALE: Eyes slightly smaller and vertex relatively wider than in male.

FEMALE GENITALIA: Not examined.

TYPE SPECIES: *Natalophylus heteromorphae*, new species.

This genus is named for its occurrence in Natal and its great similarity in appearance to *Phylus* Hahn from Europe.

Natalophylus resembles *Phylus* very closely superficially but differs in the following characters: the head is much more strongly deflexed; the gula is much shorter; the labium is much shorter, only slightly surpassing the procoxae; and, the tibial spines are dark with dark bases. Also the vesica and phallotheca of *Natalophylus* are structurally very dissimilar to those of *Phylus* (see Wagner and Weber, 1964).

Natalophylus can be recognized by its very long antennae, long, light colored legs, short labium, single type of dorsal pubescence, and weakly fleshy, apically convergent parempodia.

Natalophylus heteromorphae, new species

Figures 71, 269–272

MACROPTEROUS MALE: Brownish black, including antennae; labium and legs, including coxae, bright yellow; base of labium, metacoxae proximally, small round spots on femora, bases of tibial spines, and all tarsal segments 3 brownish black.

Eyes with very short hairs.

Vertex nearly flat, posterior margin straight, very weakly carinate; pronotum with anterior margin weakly sinuate, lateral margins nearly straight, posterior margin broadly excavated, scutellum weakly convex; cuneal fracture slightly angled anteromedially; abdomen not quite attaining apex of cuneus; metatarsal segment 1 about one-half length of segment 2, segment 2 slightly longer than segment 3.

MEASUREMENTS: Total length 4.16, maximum width 1.68, length head .24, width head .80, interocular space .40, length pronotum .48, width pronotum 1.16, length scutellum .76, width scutellum .84, length corium 2.12, length clavus 1.68, length cuneus .68, width cuneus .28, length claval commissure .88, distance apex commissure-apex membrane 1.76, length metatibia 2.56; length antennal segments 1—.36, 2—1.84, 3—1.00, 4—.80; length labial segments 1—.26, 2—.26, 3—.14, 4—.20.

MALE GENITALIA: Figures 269–272.

MACROPTEROUS FEMALE: Eyes slightly smaller and vertex relatively wider than in male.

FEMALE GENITALIA: Not examined.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Oliviershoek Pass Summit, 5400 ft. elevation, 25 mi. S. Harrismith, 4 Mar.

1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Heteromorpha trifoliata* [Wendl.] Eckl. & Zeyh.) (SANC).

PARATYPES: 3 macropterous ♂♂, 8 macropterous ♀♀, same data as holotype (SANC, JAS, RTS).

This species is named for the host genus, *Heteromorpha.*

See generic discussion for separation from other members of the Phylinae.

This species is known only from the type locality on *Heteromorpha trifoliata* (Wendl.) Eckl. & Zeyh. (Umbelliferae). The host genus is African, containing six species, three of which occur in South Africa (Phillips, 1951).

Odhiamboella, new genus

MACROPTEROUS MALE: Elongate; body dull or weakly shining, generally with reclining, golden, setiform hairs; antennal segment 1 with one or two slender, erect spines, segments 2, 3, and 4 with short, dense, reclining vestiture; tibiae with semierect black spines; genae with long erect hairs; eyes with very short hairs.

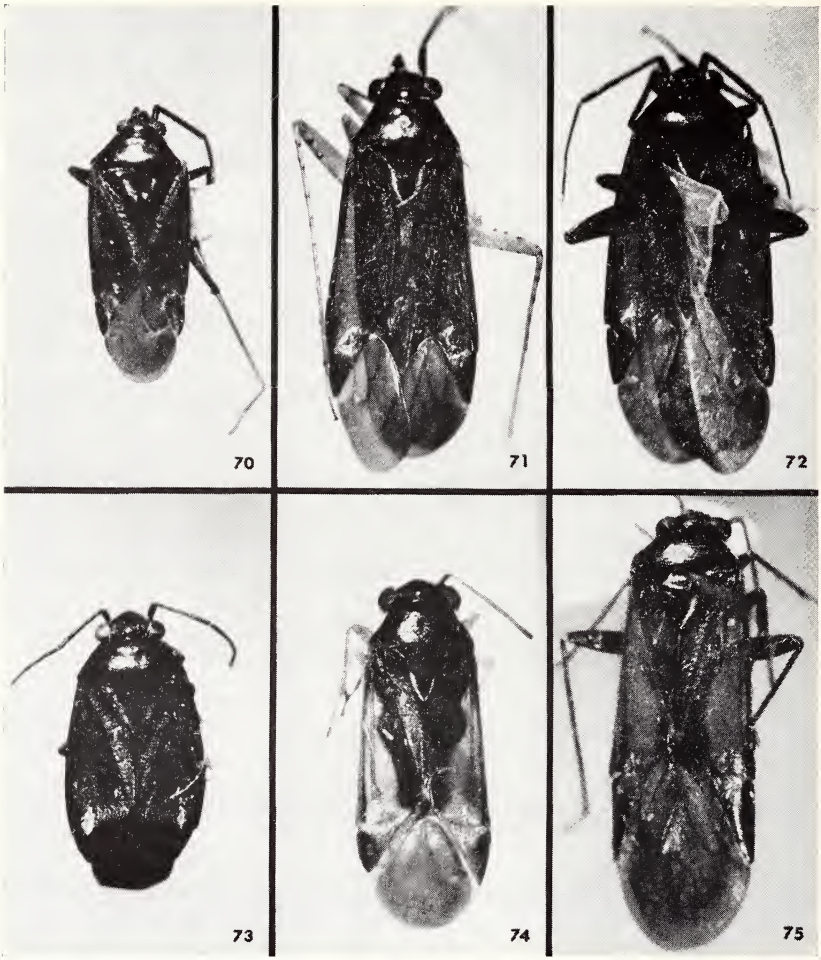
Head deflexed, clypeus just visible from above; eyes confluent with anterolateral angles of pronotum; vertex convex, posterior margin ecarinate; frons convex; antennae inserted just above ventral margins of eyes, fossae contiguous with eyes; antennal segment 1 slightly enlarged, segment 2 increasing slightly in diameter distally to about diameter of segment 1, segments 3 and 4 subequal to proximal diameter of segment 2; labium reaching at least to metacoxae; pronotum with anterior margin finely carinate, upturned, lateral margins weakly convergent anteriorly, calli indistinct; mesoscutum inclined anteriorly, scutellum weakly convex; lateral corial margins nearly straight, cuneal fracture sinuate; membrane with two cells; all tibiae with rows of tiny, closely spaced spines; tarsal claws moderately long, strongly curved, broad basally; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 273–275. Similar in structure to *Capecapsus* and *Coatonocapsus*, vesica forming single coil.

MACROPTEROUS FEMALE: Very similar to male, eyes slightly smaller, vertex relatively wider.

TYPE SPECIES: *Pseudosthenarus solani* Odhiambo.

Odhiamboella is being erected to receive a single species, *solani*, from East and South Africa. Originally described in *Pseudosthenarus*, *solani* must be placed in a new genus based on its possession of only a single type of pubescence on the dorsum and the vesica



FIGS. 70–75. Phylini. Fig. 70. *Macrotylus niger*, male, holotype. Fig. 71. *Natalophylus heteromorphae*, male, holotype. Fig. 72. *Parapseudosthenarus buchenroederae*, male (Giants Castle, Natal). Fig. 73. *Parapseudosthenarus buchenroederae*, female (Sani Pass, 6200 ft., Natal). Fig. 74. *Parasciodema albicoxa*, male, holotype. Fig. 75. *Parasciodema nigrifemur*, male, holotype.

of the male forming a single complete coil. These characters, as well as the general facies, relate *Odhiamboella* to *Coatonocapsus* and *Capecapsus* (see also discussion under *Pseudosthenarus* and *Sthenarus nigricornis*).

Odhiamboella solani (Odhiambo)
Figures 273–275

Pseudosthenarus solani Odhiambo, 1958a, pp. 241–246.

Odhiamboella solani can be separated from all other South African Phylinae by the following combination of characters: dorsum with only setiform hairs; basic coloration black, clavus and cuneus mostly yellowish; and, vesica forming a coil, apically with a single long spine.

Odhiambo (1958a) described the variation in this species from East Africa. His analysis applies in South Africa.

No host information is available for South Africa, but *solani* feeds on *Solanum* sp. in East Africa (Odhiambo, 1958a).

SPECIMENS EXAMINED: All specimens macropterous. *Transvaal*—15 ♂♂, 4 ♀♀, Argent, XII-7-10-1953 (Capener); 1 ♂, 1 ♀, Irene, Pretoria, I-23-1952 (Capener); 2 ♂♂, Letaba Valley, Tzaneen Dist., XII-10-31-1958 (Capener); 1 ♀, Rustenburg, II-22-1953 (Capener); 1 ♂, Wonderboom, 12.3.15 (Swierstra) (SANC, TM, JAS, RTS).

Parapseudosthenarus, new genus

MACROPTEROUS MALE: Elongate, nearly parallel sided; entire body smooth, dull or weakly shining; dorsum with reclining setiform hairs; dorsum, thoracic pleura, and abdominal venter with decumbent wooly, sericeous hairs; antennal segment 1 with slender black spine, segments 2, 3, and 4 with short dense decumbent vestiture and semierect hairs about as long as diameter of segment 2; head below eyes with a few, long, erect hairs; abdominal venter with reclining hairs; femora with decumbent hairs and a few, very long, erect hairs on ventral surfaces; tibiae with black spines about as long as tibial diameter.

Head declivous; vertex nearly flat, posterior margin with low, rounded carina; frons convex; eyes moderately large, protuberant, reaching almost to gula, anterior margins sinuate; antennae inserted just above ventral margins of eyes, fossae contiguous with eyes; segment 1 moderately enlarged, segment 2 of slightly smaller diameter than segment 1, segments 3 and 4 about two-thirds diameter of segment 2; bucculae narrow; gula short; pronotum with anterior margin finely carinate, upturned, lateral margins nearly straight, slightly convergent anteriorly, disc only slightly inclined posteriorly; mesoscutum separated from weakly convex scutellum by a transverse impression; cuneal incisure shallow; membrane with two cells; legs moderately long; metafemora somewhat enlarged; tarsal claws long,

gently curved, broad basally; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 289–292. Similar in structure to *Pseudosthenarus*; very small in relation to total body size; vesica U-shaped; right clasper lanceolate.

BRACHYPTEROUS FEMALE: See *P. buchenroederae*.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Parapseudosthenarus buchenroederae*, new species.

This genus is named for its resemblance to *Pseudosthenarus* Poppius.

Parapseudosthenarus can be recognized by its entirely black coloration, including all appendages, wooly and setiform hairs, and the structure of the male genitalia. The most closely related genus, *Pseudosthenarus*, always has at least part of the legs or antennae yellow or dull white. The male genitalia of *Parapseudosthenarus* appear in structure to be possible precursors of the type found in *Pseudosthenarus*.

Parapseudosthenarus buchenroederae, new species
Figures 72, 73, 289–292

MACROPTEROUS MALE: Entirely dull black, membrane smoky dark brown.

Eyes with short hairs.

Labium just surpassing apex of procoxae; pronotum with indistinct confluent calli, posterior margin nearly straight; cuneal fracture very slightly angled anteromedially; abdomen reaching to about middle of cuneus; metatarsal segment 1 about one-third length of segment 2, segments 2 and 3 subequal in length.

MEASUREMENTS: Total length 4.56, maximum width 1.76, length head .24, width head .80, interocular space .36, length pronotum .60, width pronotum 1.32, length scutellum .64, width scutellum .80, length corium 2.20, length clavus 1.76, length cuneus .84, width cuneus .48, length claval commissure .96, distance apex commissure-apex membrane 2.35, length metatibia 2.12; length antennal segments 1—.22, 2—1.08, 3—.80, 4—.44; length labial segments 1—.26, 2—.26, 3—.12, 4—.18.

MALE GENITALIA: Figures 289–292.

BRACHYPTEROUS FEMALE: Body surface, vestiture, and coloration as in macropterous male.

Eyes smaller, vertex relatively wider than in male; scutellum nearly flat; hemelytra reduced, just surpassing apex of abdomen; lateral corial margins broadly rounded; metafemora greatly enlarged.

MEASUREMENTS: Total length 3.00, maximum width 1.48, width head .76, interocular space .40.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Natal*, Giants Castle Park, 5800 ft. elevation, 6 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Buchenroedera lotononoides* Scott-Elliot) (SANC).

PARATYPES: *Natal*—3 macropterous ♂♂, same data as holotype; 3 macropterous ♂♂, 9 brachypterous ♀♀, Sani Pass, 6200 ft., 10 Mar. 1968 (Adults and nymphs on *Buchenroedera lotononoides* Scott-Elliot); 1 brachypterous ♀, Natal National Park, iii.1932 (Mackie) (SANC, BM[NH], JAS, RTS).

ADDITIONAL SPECIMENS: 1 macropterous ♂, 1 brachypterous ♀, 24 nymphs (in alcohol), same data as holotype; 1 macropterous ♂, 1 brachypterous ♀, 14 nymphs (in alcohol), Sani Pass, 6200 ft., 10 Mar. 1968 (RTS).

This species is named for the host genus, *Buchenroedera*.

See generic discussion for separation from other members of the Phylinae. Although *Parapseudosthenarus buchenroederae* closely resembles some species of *Pseudosthenarus*, the sexual wing dimorphism is much more pronounced in the former than in the latter.

This species is known only from midelevations (ca. 1875 meters [6000 feet]) on the Drakensberg on *Buchenroedera lotononoides* Scott-Elliot (Leguminosae). The host genus is African, with 22 of the 23 species restricted to Natal and the Eastern Cape (Phillips, 1951).

Parasciodema Poppius

Parasciodema Poppius, 1914a, pp. 104–105.

Parasciodema can be recognized by the following combination of characters: the pulvilli are large, and fused to nearly the entire ventral surface of the claw; the parempodia are hair-like and parallel; the body is elongate, and nearly parallel sided; the dorsum has only reclining, dark, setiform hairs; and the basic coloration is dark brown or black. *Parasciodema* is related to *Lasiolabopella*, *Lepidocapsus*, and *Eminoculus* by the structure of the pulvilli; it differs from *Lasiolabopella* in not having scale-like hairs, from *Lepidocapsus* in having only setiform hairs on the dorsum instead of setiform and wooly sericeous hairs (and also does not have an enlarged second antennal segment), and from *Eminoculus* in not having stylate eyes.

MALE GENITALIA: Figures 276–279. Vesica variously curved; phallotheca L-shaped; left clasper trough-like; right clasper lanceolate.

Female unknown.

Parasciodema is endemic to southern Africa. No biological information is available for the genus.

Parasciodema albicoxa, new species

Figures 74, 276–278

MACROPTEROUS MALE: Basic coloration dark brown; antennal segment 2 and all tibiae light brown; all coxae white, brown proximally; all femora and labial segments 2 and 3 yellow orange; labial segments 1 and 4 yellow; membrane smoky brown.

Entire body polished, shining; pronotum transversely rugose; dorsum with reclining, moderately long, black, setiform hairs; antennal segment 1 with a few decumbent hairs, segments 2, 3, and 4 with short, dense, reclining vestiture and scattered, semierect hairs about as long as diameter of segment 2; abdominal venter with reclining hairs; femora with a few very long, erect hairs on ventral surfaces; tibiae with semierect black spines about as long as tibial diameter.

Head strongly deflexed; vertex broad, posterior margin slightly concave; eyes large, protuberant, reaching posteriorly around anterolateral angles of pronotum, reaching ventrally to gula, anterior margins strongly sinuate; antennae inserted just above ventral margins of eyes, fossae contiguous with eyes; antennal segment 1 slightly enlarged, segment 2 tapered slightly proximally, distal diameter about equal to that of segment 1, segments 3 and 4 about two-thirds diameter of segment 2; bucculae small; gula obsolete; labium just surpassing mesocoxae; pronotum with anterior margin carinate, slightly upturned, lateral margins weakly concave, anterior and posterior margins nearly straight, disc slightly inclined posteriorly; mesoscutum and scutelllum flattened, indistinctly separated; lateral corial margins nearly straight, widest at apex; cuneal incisure shallow, fracture angled slightly anteromedially; membrane with two cells; abdomen reaching almost to apex of cuneus; all tibiae lacking rows of tiny, closely spaced spines; metatarsal segment 1 slightly less than one-half length of segment 2, segments 2 and 3 subequal in length.

MEASUREMENTS: Total length 3.72, maximum width 1.48, length head .16, width head .90,. interocular space .40, length pronotum .44, width pronotum 1.12, length scutellum .64, width scutellum .80, length corium 1.72, length clavus 1.44, length cuneus .76, width cuneus .36, length claval commissure .76, distance apex commissure-apex membrane 1.68, length metatibia 1.88; length antennal segments 1—.26, 2—1.08, 3—.62, 4—?; length labial segments 1—.34, 2—.38, 3—.20, 4—.30.

MALE GENITALIA: Figures 276–278.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: *Cape Province*—8 macropterous ♂♂, same data as holotype; 1 macropterous ♂, *idem*, 15.X.65 (Schoombee) (SANC, JAS, RTS).

This species is named for the light coxal coloration.

Parasciodema albicoxa is the only species in the genus with white coxae.

Parasciodema nigrifemur, new species

Figures 75, 279

MACROPTEROUS MALE: Dark brown, including all appendages; vestiture and body surface as in *Parasciodema albicoxa.*

Structure very similar to *P. albicoxa* except as follows: eyes not reaching so far ventrally and leaving genae slightly exposed; pronotum moderately inclined posteriorly; hemelytra longer relative to total length (see measurements); abdomen reaching to about basal third of cuneus; male genital capsule with distinct keel ventrally.

MEASUREMENTS: Total length 4.68, maximum width 1.62, length head .18, width head .88, interocular space .40, length pronotum .52, width pronotum 1.24, length scutellum .68, width scutellum .72, length corium 2.64, length clavus 1.56, length cuneus .96, width cuneus .60, length claval commissure .88, distance apex commissure-apex membrane 2.44, length metatibia 1.96; length antennal segments 1—.28, 2—1.16, 3—.50, 4—?; length labial segments 1—.40, 2—.44, 3—.28, 4—.38.

MALE GENITALIA: Figure 279; left clasper and phallotheca structurally very similar to those of *albicoxa.*

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Grootfontein, Middelburg, October, M. Johannsmeier (SANC).

PARATYPES: 6 macropterous ♂♂, same data as holotype (SANC, RTS).

This species is named for the dark femoral coloration.

Parasciodema nigrifemur is the only species in the genus with totally dark colored legs.

Parasciodema nitens Poppius

Parasciodema nitens Poppius, 1914a, p. 105.

This species is known only from the male holotype from "Seewald," South West Africa. Poppius (1914a) noted that the speci-

men was in the Berlin-Humboldt Museum; in fact it is in the Helsinki Museum (Type No. 11874). *P. nitens* has dark coxae and light femora, whereas *albicoxa* has nearly all white coxae and yellow femora and *nigrifemur* has dark brown coxae and femora.

Plagiognathidea Poppius

Plagiognathidea Poppius, 1914a, p. 99.

Males of *Plagiognathidea* (females are unknown) can be recognized by the following combination of characters: they are relatively small, light colored, elongate, nearly parallel sided, and flattened; the parempodia are hair-like, and parallel; the pulvilli are small; the head is strongly produced anteriorly, with the clypeus nearly reaching the distal end of antennal segment 1; and, the vesica is long, slender, and coiled (at least in *grisescens* Poppius). Poppius (1914a) related *Plagiognathidea* to *Plagiognathus* Fieber, but it appears to be most closely related to *Platyscytus* Reuter from South America on the basis of the general body form and the structure of the vesica.

Plagiognathidea contains only one described species, from "Nyassa-Geb, Langenberg." No biological information is available for the genus.

A mutilated male from Letaba River near Oliphants Camp, Kruger National Park, Transvaal (deposited in the J. A. Slater Collection), probably represents a new species of *Plagiognathidea.* The body form is similar, but the antennal proportions are very much different, from those of *grisescens*, the holotype of which is in the Helsinki Museum (Type No. 12300).

Psallus Fieber

The cosmopolitan genus *Psallus* Fieber is well known only in Europe. Wagner (1952) and Woodroffe (1957) have given reasonably complete treatments of the Western European and British species respectively, but no comprehensive work of a wider geographic scope is available. The extremely large size and wide distribution of the genus make it impossible to accurately determine specimens or describe new species at the present time, unless a comprehensive analysis is undertaken.

Poppius (1914a) recorded three species of *Psallus* from the Ethiopian Region—two from St. Helena and one, *P. dilutipes* Reuter, from Algoa Bay, South Africa. Odhiambo (1958c; 1959b) has described 13 additional species from East Africa (see below).

I have studied approximately 10 species from South Africa that are referrable to *Psallus*. Most are light green or yellow green and some have brown spots on the dorsum. The dorsum is usually covered with reclining, light or dark, setiform hairs and also decumbent, wooly, sericeous hairs, although the latter type of pubescence is not present in all species. The femora and tibiae often have dark spots at the bases of the spines. The parempodia are either hair-like and parallel or weakly fleshy and apically convergent (as in *Ellenia*). Odhiambo (1959b) noted that some species of *Psallus* have a ventral keel on the male genital capsule, but I am placing these species in *Ellenia* (see page 158).

Pseudosthenarus Poppius

Pseudosthenarus Poppius, 1914a, p. 98.

Pseudosthenarus can be characterized as follows—

MACROPTEROUS MALE: Large, robust, black; body surface dull or weakly shining; entire body covered with wooly, sericeous hairs and reclining, black, setiform hairs; eyes with short hairs; antennal segments 2, 3, and 4 with dense, short, reclining vestiture and scattered semierect hairs about as long as diameter of segment 2; ventral surfaces of all femora with a few, very long, fine, erect hairs.

Head declivous, nearly vertical; eyes granular, moderately large, occupying about two-thirds total height of head, anterior margins sinuate; vertex weakly convex, posterior margin ecarinate or with a very low rounded carina; antennae inserted at level of ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 slightly enlarged, usually with a few semierect black spines, segment 2 cylindrical or tapering slightly proximally, segments 3 and 4 about two-thirds diameter of segment 2; apex of clypeus directed posteriorly; bucculae narrow; gula obsolete; labium just reaching to trochanteral joint of procoxae; pronotum only slightly inclined posteriorly, all margins nearly straight, anterior margin finely carinate and upturned; calli weak, widely separated; mesoscutum separated from weakly convex scutellum by deep transverse impression; lateral corial margins convexly rounded, broadest at about midpoint; cuneal incisure shallow, fracture angled slightly anteromedially; membrane with two cells; abdomen reaching to about middle of cuneus; metafemora enlarged, greatest width slightly less than interocular space; all tibiae with rows of tiny closely-spaced spines and heavy black, semierect spines; metatarsal segment 1 about one-half length of segment 2, segments 2 and 3 subequal in length; tarsal claws long, gently curved,

slightly broadened basally; parempodia hair-like parallel; pulvilli minute, attached at midpoint of claw.

MALE GENITALIA: Figures 293–312. Structure unusual in Phylinae, characteristic for genus; phallus composed of gently curved vesica proper and also a sickle-shaped structure situated below main body of organ, gonopore apical; phallotheca similar in all species; left clasper flattened, splayed out, derivable from other phylines through *Parapseudosthenarus*; right clasper lanceolate.

SUBMACROPTEROUS FEMALE: Coloration and body surface texture generally as in males; antennal segment 2 usually somewhat lighter than in males.

Eyes smaller and vertex relatively wider than in males; antennal segment 2 somewhat more slender than in males; pronotum shorter and more strongly flattened than in males; hemelytra reduced, but differentiated; abdomen not quite reaching to apex of membrane.

FEMALE GENITALIA: Figures 313, 314. Posterior wall a simple sclerotized plate; sclerotized rings rather strongly infolded laterally.

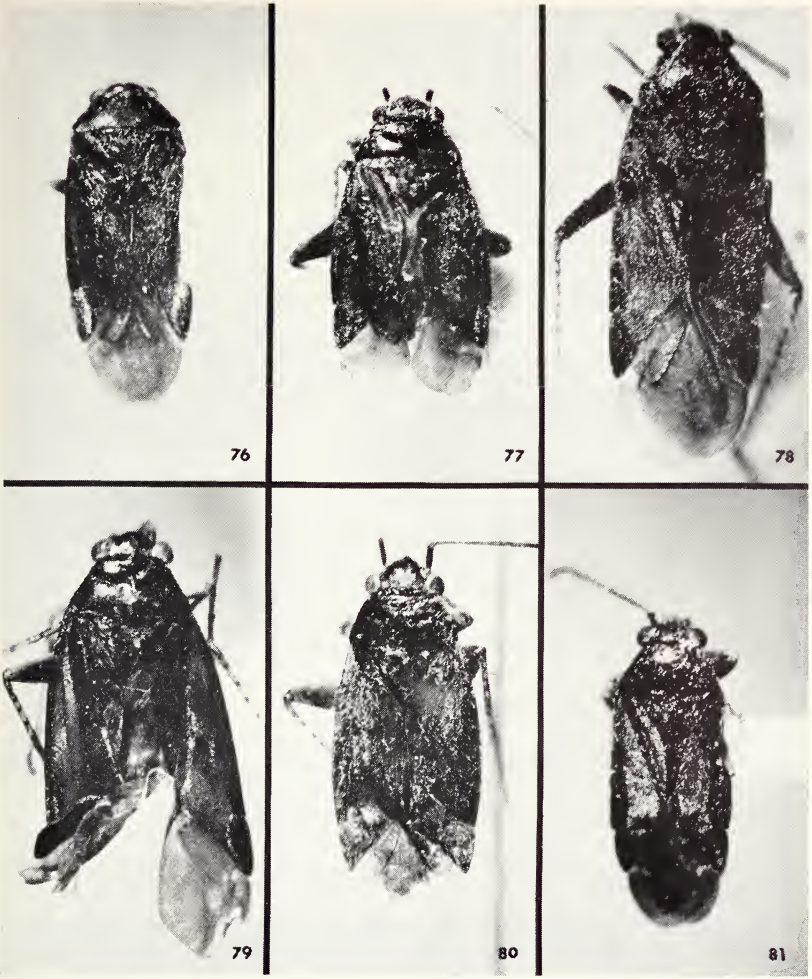
Pseudosthenarus can be most easily recognized in South Africa by the setiform and wooly hairs on the dorsum, the nearly solid black coloration with some yellow or white on the legs and antennae, and the form of the male genitalia. The left clasper of the male possesses the most useful characters for separating the species; the structure of the vesica is of little use in this regard.

Pseudosthenarus was synonymized with *Sthenarus* by Carvalho (1952a), but as can be determined from comparison of the male genitalia of *Pseudosthenarus* and *Sthenarus*, this action was incorrect. Carvalho probably based this synonymy on an examination of *P. nigricornis* Poppius (holotype in British Museum [Natural History]), which is not the type species of the genus. The male genitalia of this species are very much different than those of males of *Pseudosthenarus* from South Africa, including *P. ater* Poppius, the type species of the genus (see *Sthenarus nigricornis*).

Pseudosthenarus is actually most closely related to *Parapseudosthenarus* in general body form and structure of the male genitalia, although the genitalia of the former appear to be more highly derived than those of the latter.

Odhiambo (1958a) described a species *solani* in *Pseudosthenarus*, but it must be placed in a new genus (see *Odhiamboella*, page 175).

Pseudosthenarus as now understood contains four species and is restricted to the Southwest Cape Region of South Africa. No host or biological data are available for any members of the genus.



FIGS. 76–81. Phylini. Fig. 76. *Pseudosthenarus* near *ater*, male (Calvinia, Cape Province). Fig. 77. *Pseudosthenarus* near *ater*, female (Ceres, Cape Province). Fig. 78. *Pseudosthenarus grossus*, male, holotype. Fig. 79. *Pseudosthenarus namaquaensis*, male, holotype. Fig. 80. *Pseudosthenarus namaquaensis*, female (Kamieskroon, Cape Province). Fig. 81. *Pseudosthenarus rozeni*, male, holotype.

KEY TO MALES OF *Pseudosthenarus*

1. Length at least 4.40 mm.; ratio of length of antennal segment 2 to width of head 3:2 2
   Length under 3.50 mm.; ratio of length of antennal segment 2 to width of head about 4:3 or less 3
2. Femora and vertex completely black ..... *grossus* (Fig. 78)
   Femora mostly yellowish with black markings; vertex with yellow brown markings contiguous with eyes ..... *namaquaensis* (Fig. 79)
3. Ratio of length of antennal segment 2 to width of head 4:3; all tibiae nearly white, lacking black bands ..... *rozeni* (Fig. 81)
   Ratio of length of antennal segment 2 to width of head 5:4; all tibiae yellow with black bands ..... *ater* (Fig. 76)

Pseudosthenarus ater Poppius

Figures 76, 77, 293–302

Pseudosthenarus ater Poppius, 1914a, p. 98.

The holotype female of *Pseudosthenarus ater*, from Cape Town, is deposited in the Helsinki Museum (Type No. 12074). Additional specimens of *Pseudosthenarus* are now available and the problem of the identification of the male of *ater* arises. The sexual color dimorphism in the antennae of this species appears to be rather variable. In a long series of specimens from Rust en Vrede, Oudtshoorn District, the second antennal segment distally and the entire third and fourth antennal segments are brown with most of segment 2 being yellow, whereas in the holotype, antennal segments 2, 3, and 4 are entirely yellow. This type of variation applies in a confusing way to specimens from all of the localities listed below.

Apparently more than one species is present, based on the structure of the male genitalia. Figure 295 shows the left clasper of a male from the Cape of Good Hope, Figure 302 of a male from Calvinia; males from Rust en Vrede have the left clasper almost identical with the specimen from the Cape of Good Hope. The two claspers figured appear to represent those of different species, but deciding which is *ater*, if in fact either is, cannot be determined without further field work and additional specimens.

P. ater can be separated from other members of the genus by the characters given in the key.

MALE GENITALIA: Figures 293–302.

MEASUREMENTS: Macropterous ♂ (Rust en Vrede)—Total length 3.28, maximum width 1.40; length antennal segment 2—.88.

SPECIMENS EXAMINED: *Cape Province*—submacropterous ♀, Cape Town, Dr. Martin (holotype); 1 macropterous ♂, Cape of Good

Hope (Darwin); 2 macropterous ♂♂, 1 submacropterous ♀, Cape Province, Calvinia, XI.1931 (Mackie); 1 submacropterous ♀, Ceres, Cape Province, 1500 ft., Jan. 1921 (Turner); 13 macropterous ♂♂, 9 submacropterous ♀♀, Rust en Vrede, Oudtshoorn Dist., Mus. Expd., Oct. 1951 (HM, SAM, BM[NH], JAS, RTS).

Pseudosthenarus grossus, new species
Figures 78, 303–305

MACROPTEROUS MALE: Large; generally dull black or brownish black; profemora distally and all tibiae and tarsi light yellow brown; tibial spines with black bases forming black bands.

MEASUREMENTS: Total length 4.80, maximum width 1.72, length head .24, width head .84, interocular space .48, length pronotum .56, width pronotum 1.40, length scutellum .72, width scutellum .84, length corium 3.00, length clavus 1.84, length cuneus .76, width cuneus .48, length claval commissure 1.08, distance apex commissure-apex membrane 2.10, length metatibia 2.32; length antennal segments 1—.32, 2—1.30, 3—?, 4—?; length labial segments 1—.30, 2—.26, 3—.10, 4—.14.

MALE GENITALIA: Figures 303–305.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Het Kruis, Mus. Expd., Oct. 1947 (SAM).

PARATYPES: *Cape Province*—1 macropterous ♂, same data as holotype; 1 macrotperous ♂, Goedehoop, Heidelburg Dist., Mus. Expd., Oct. 1951 (SAM, RTS).

This species is named for its very large size.

This is the only species of *Pseudosthenarus* in which the femora are totally black.

Pseudosthenarus namaquaensis, new species
Figures 79–80, 308–314

MACROPTEROUS MALE: Large, elongate species; generally dull black or brownish black; femora and tibiae yellow, femora black on ventral surfaces, tibial spines with black bases; tarsal segments 1 and 2 light, 3 dark; vertex with a rounded yellow orange spot adjacent to mesial margin of each eye; membrane smoky brown.

MEASUREMENTS: Total length 4.40, maximum width 1.68, length head .24, width head .92, interocular space .44, length pronotum .56, width pronotum 1.32, length scutellum .72, width scutellum .92, length corium 2.28, length clavus 1.80, length cuneus .88, width cuneus .44, length claval commissure 1.00, distance apex

commissure-apex membrane 2.00, length metatibia 2.36, length antennal segments 1—.36, 2—1.60, 3—1.00, 4—?; length laibal segments 1—.30, 2—.24, 3—.14, 4—.08.

MALE GENITALIA: Figures 308–312.

SUBMACROPTEROUS FEMALE: Coloration generally as in male, except antennal segments 1 and 2 yellowish, especially on dorsal surface; mesothoracic and metathoracic pleura and all coxae generally light brown or yellow; black markings on femora either few in number or absent.

Structurally differing from male as in generic diagnosis.

FEMALE GENITALIA: Figures 313, 314.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Kamieskroon, Namaqualand, Sept. 1930, Mus. Staff (SAM).

PARATYPES: *Cape Province*—8 macropterous ♂♂, 25 submacropterous ♀♀, same data as holotype; 1 macropterous ♂, Bowesdorp, Namaqualand, Sept. 1941; 1 submacropterous ♀, Lamberts Bay, Nov. 1956 (SAM, JAS, RTS).

This species is named for its occurrence in Namaqualand.

Pseudosthenarus namaquaensis can be separated from *grossus*, the only other large species in the genus, by the yellow coloration of the femora.

Pseudosthenarus rozeni, new species

Figures 81, 306, 307

MACROPTEROUS MALE: Generally dull black; extreme distal portion of femora and all tibiae white; tibial spines black but without black bases, black bands not formed on tibiae; tarsi dark brown; membrane smoky black.

MEASUREMENTS: Total length 3.32, maximum width 1.32, length head .12, width head .76, interocular space .36, length pronotum .52, width pronotum 1.08, length scutellum .48, width scutellum .68, length corium 1.56, length clavus 1.24, length cuneus .56, width cuneus .32, length claval commissure .68, distance apex commissure-apex membrane 1.52, length metatibia 1.80; length antennal segments 1—.20, 2—1.00, 3—.60, 4—?; length labial segments 1—.24, 2—.24, 3 and 4—.18.

MALE GENITALIA: Figures 306, 307.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Kommetjie, X-29-XI-1966, J. G. Rozen Collector (AMNH).

This species is named for the collector Dr. J. G. Rozen, of the American Museum of Natural History.

Pseudosthenarus rozeni can be grouped with *P. ater* on the basis of its small size. The ratio of the length of the second antennal segment to the width of the head across the eyes, however, is somewhat different than in *ater* and the tibial spines do not have black bases.

"Sthenarus-Campylomma"

Although little mention is made of the fact in the literature, *Campylomma* Reuter and *Sthenarus* Fieber, as presently constituted, may be in large part synonymous. Both genera have European type species and revision on a world basis has never been carried out. Leston (see Carvalho and Leston, 1952) and Odhiambo (1958a) have pointed out some of the problems in the taxonomy of *Sthenarus*. Both *Campylomma* and *Sthenarus* occur primarily in the Old World, but a limited number of species of *Sthenarus* have been described from North America and *Campylomma verbasci* Meyer is introduced there (Knight 1941; 1968).

Poppius (1914a) recorded six species of *Sthenarus* and two species of *Campylomma* from Africa, but none specifically from South Africa. Carvalho et al. (1960), incorrectly recorded *Paramixia australis* from South Africa as *Sthenarus basalis* Poppius.

I have examined type material of *Sthenarus vestitus* Poppius and *Campylomma angustior* Poppius from Africa. The main generic difference between the two species seems to be color. It is therefore possible that at least species from Africa recorded under the two generic names may in fact all be members of a single genus.

In South Africa there are at least eight species that resemble *Campylomma* and *Sthenarus*, but accurate determinations cannot be made at this time. They can generally be recognized by their very small size and head that is concave behind. See also discussion under *Sthenarus nigricornis*.

NOTES ON EXTRALIMITAL SPECIES

Sthenarus nigricornis (Poppius)

Pseudosthenarus nigricornis Poppius, 1914a, p. 99.

Sthenarus nigricornis (Poppius) is not congeneric with *P. ater*, the type species of *Pseudosthenarus*, and I am therefore temporarily placing it in *Sthenarus* as per Carvalho (1952a). The general facies of *nigricornis* are very similar to those of *ater* but it differs in having a much longer and more slender labium and genitalia of a quite different structure. The vesica of *nigricornis* is much more similar to the type found in *Sthenarus* than in *Pseudosthenarus* as I have been

able to determine by examination of the holotype of *nigricornis* in the British Museum (Natural History).

Stoebea, new genus

MACROPTEROUS MALE: Small, elongate; dorsum smooth, dull, densely covered with moderately long, reclining setiform hairs (dark on dark background areas, light on light areas), and decumbent, wooly, sericeous hairs; anterolateral angles of pronotum with a single, long, erect, fine spine; eyes with short hairs; antennae with short, decumbent, light vestiture; thoracic pleura (sparsely) and abdominal venter with reclining light hairs; femora with a few long, erect, very fine hairs on ventral surfaces; tibiae and tarsi with reclining light hairs; tibiae with semierect dark spines, slightly longer than tibial diameter, with dark bases.

Head nearly vertical; eyes weakly granular, relatively small, only slightly protuberant, confluent with anterolateral angles of pronotum, occupying three-fourths of height of head; vertex convex, posterior margin straight, ecarinate; frons strongly convex; antennae inserted just above level of ventral margins of eyes, fossae nearly contiguous with eyes; antennal segment 1 moderately enlarged, segment 2 nearly cylindrical, of slightly smaller diameter than segment 1, segments 3 and 4 about one-half diameter of segment 2; bucculae slightly expanded; gula short; labium reaching to posterior margin of abdominal sternite 5; pronotum with anterior margin finely carinate, upturned; calli obsolete; mesoscutum and scutellum nearly flat; lateral corial margins nearly straight; cuneal incisure obsolete, fracture slightly angled anteromedially; membrane with two cells; abdomen reaching to about midpoint of cuneus; legs long; metafemora enlarged, flattened; metatibiae with rows of tiny, closely-spaced spines; metatarsal segment 1 about one-third length of segment 2, segments 2 and 3 subequal in length; tarsal claws long, slender, evenly curved, slightly broadened basally; parempodia hair-like, parallel; pulvilli minute.

MALE GENITALIA: Figures 280–285. Vesica S-shaped, strongly twisted, with a single attenuated apical spine, gonopore subapical; phallotheca similar in all species; left and right claspers typical of Phylini.

BRACHYPTEROUS FEMALE: See *S. barbertonensis*.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Stoebea barbertonensis*, new species.

This genus is named for the host plant genus, *Stoebe*.

Stoebea is characterized by its small size, light coloration with green orange, or reddish marking, vestiture of erect setiform and

decumbent, wooly, sericeous hairs, and second antennal segment which is usually about 3½ times as long as the width of the interocular space. *Stoebea* resembles *Erythrocorista* Lindberg (1958) from the Cape Verde Islands; this is only superficial, however, for *Erythrocorista* is an orthotyline (see page 282).

Stoebea is presently known only from South Africa. Where host plant data are avaliable the genus occurs on species of *Stoebe* (Compositae).

Specimens of *Stoebea* from South Africa that may represent new species in addition to those described below, are a male from Rust en Vrede, Oudtshoorn District, Cape Province (deposited in the South African Museum) that closely resembles *S. elginensis*, a male from Lyttelton, Pretoria, Transvaal (deposited in J. A. Slater Collection), which appears to be closely related to *S. plettenbergensis*, and a female from Johannesburg, Transvaal (deposited in J. A. Slater Collection), that may be the same species as the Lyttelton specimen.

Stoebea barbertonensis, new species

Figures 82, 280–282

MACROPTEROUS MALE: Head light orange with greenish suffusion around eyes, jugae, and bucculae; pronotum mostly white along lateral margins and midline, otherwise amber, anterior margin medially and posterolateral angles suffused with green; scutellum amber; anterior half of clavus, corium on basal fifth, corium faintly along anterior three-fourths of lateral margin, corium at level of apex of clavus, and cuneus white; remainder of corium and clavus amber (tending to gray brown), in some areas with distinct brown spots at bases of setiform hairs; posteromesial margin of cuneus and veins of membrane yellow; membrane smoky brown; antennae, coxae, and tarsi brown or light brown; thoracic pleura and abdominal venter yellow or yellow brown; abdomen heavily green; femora nearly white on proximal half, brown on distal half, with some small, round, dark, brown spots; tibiae nearly white, spines with small dark bases.

MEASUREMENTS: Total length 3.20, maximum width 1.08, length head .28, width head .65, interocular space .32, length pronotum .36, width pronotum .96, length scutellum .44, width scutellum .52, length corium 1.48, length clavus 1.28, length cuneus .60, width cuneus .36, length claval commissure .68, distance apex commissure-apex membrane 1.40, length metatibia 1.92; length antennal segments 1—.28, 2—1.24, 3—.52, 4—.20; length labial segments 1—.34, 2—.36, 3—.30, 4—.38.

MALE GENITALIA: Figures 280–282.

BRACHYPTEROUS FEMALE: Basic coloration, body surface, and vestiture as in macropterous male.

Eyes smaller than in male, vertex relatively wider; hemelytra just covering abdomen; cuneus and membrane strongly reduced; lateral corial margins broadly rounded, convex.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

MEASUREMENTS: Total length 2.64, maximum width 1.24, width head .72, interocular space .44.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, 22 mi. S. Barberton, 4900 ft. elevation, 24 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Stoebe vulgaris* Levyns) (SANC).

PARATYPES: *Transvaal*—9 macropterous ♂♂, 13 brachypterous ♀♀, same data as holotype; 2 macropterous ♂♂, 1 brachypterous ♀, 14 mi. S. Barberton, 5200 ft. elevation, 24 Mar. 1968 (Adults and nymphs on *Stoebe vulgaris* Levyns) (SANC, BM[NH], JAS, RTS).

ADDITIONAL SPECIMENS: 1 macropterous ♂, 1 brachypterous ♀, 6 nymphs (in alcohol), same data as holotype (RTS).

This species is named for the town of Barberton.

Stoebea barbertonensis is the only species of *Stoebea* in which all of the antennal segments are brown; in *plettenbergensis* antennal segment 1 is almost entirely white. Both *barbertonensis* and *plettenbergensis* have the distal half of the metafemora distinctly darker than the proximal half, whereas in *elginensis* the metafemora are generally light with only a few dark spots distally. The coloration of *elginensis* is distinctly reddish whereas the other two species are usually green or yellow, sometimes grading to brown.

This species is known only from *Stoebe vulgaris* Levyns (Compositae). The host genus is restricted to Africa and the Mascarene Islands and is massed in the South West Cape region in South Africa (Phillips, 1951). Type locality of *barbertonensis* and nearby collecting localities have typically South West Cape type vegetation, including *Erica*, *Stoebe*, *Protea*, etc.

Stoebea elginensis, new species

Figures 283, 284

MACROPTEROUS MALE: Basic coloration very light, yellowish; midline of head and pronotum, posterior corners of pronotum, clavus broadly along scutellum and commissure, entire exocorium, and base of cuneus white; endocorium and clavus broadly along claval suture dull reddish; remainder of dorsum yellow to light yellow brown;

cells of membrane including veins and posterior and lateral margins (broadly) smoky brown; membrane just posterior to cuneus and mesiad of cells white; extreme base of membrane dark brown; metatibiae with some faint dark spots on apical half; tibial spines with weak dark spots at bases; all tarsal segments 3 brown; antennal segment 2 distally and segments 3 and 4 infuscate; labial segment 4 brown.

Body surface and vestiture as in generic discussion.

Head produced anteriorly, clypeus visible from above.

MEASUREMENTS: Total length 3.40, maximum width 1.28, length head .36, width head .64, interocular space .36, length pronotum .36, width pronotum 1.08, length scutellum .48, width scutellum .68, length corium 1.60, length clavus 1.20, length cuneus .60, width cuneus .32, length claval commissure .64, distance apex commissure-apex membrane 1.56, length metatibia 1.76; length antennal segments 1—.26, 2—1.08, 3—.72, 4—?; length labial segments 1—.44, 2—.44, 3—.40, 4—.40.

MALE GENITALIA: Figures 283, 284.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Elgin Forest Reserve, 10.iii.1954, at light, 1000 ft., Caledon District, J. Balfour-Brown, BM. 1954-797 (BM[NH]).

PARATYPES: *Cape Province*—1 macropterous ♂, same data as holotype; 1 macropterous ♂, Bainskloof Pass Summit, 21 Jan. 1968, UV Light (BM[NH], RTS).

This species is named for the Elgin Forest near Somerset West.

See discussion under *barbertonensis*.

Stoebea plettenbergensis, new species

Figure 285

MACROPTEROUS MALE: Basic coloration of dorsum white; head weakly and irregularly, pronotum broadly on either side of midline, mesoscutum, scutellum, elongate oval marking along claval suture, diffuse quadrate marking at apex of endocorium, and apex of cuneus along mesial margin light orange; head, anterior lobe of pronotum, and mesoscutum with slightly greenish tinge; membrane generally whitish; cells and veins of membrane, area posteriad of cuneus and small cell, and margin of membrane (narrowly) smoky brown; antennal segment 1 white, segment 2 white proximally, weakly infuscate distally, segments 3 and 4 brown; basal half of labium light colored, apical half infuscate; venter and legs generally cream; femora generally with scattered, small brown spots; metafemora brown

on distal third; tibial spines with dark bases; thoracic pleura weakly suffused with orange and green; abdominal venter sublaterally with weak brown longitudinal stripe; all tarsal segments 3 brown.

MEASUREMENTS: Total length 2.64, maximum width 1.08, length head .12, width head .62, interocular space .32, length pronotum .36, width pronotum .92, length scutellum .36, width scutellum .52, length corium 1.36, length clavus .88, length cuneus .48, width cuneus .28, length claval commissure .64, distance apex commissure-apex membrane 1.16, length metatibia 1.60; length antennal segments 1—.22, 2—1.06, 3—.60, 4—.34; length labial segments 1—.26, 2—.30, 3—.28, 4—.36.

MALE GENITALIA: Figure 285.

BRACHYPTEROUS FEMALE: Basic coloration and vestiture as in male.

Structural modifications as in female of *barbertonensis*.

MEASUREMENTS: Total length 2.12, maximum width 1.14, width head .64, interocular space .40.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, 6 mi. E. Plettenberg Bay, elevation 500 ft., 12–13 Feb. 1968, J. A. & S. Slater, T. Schuh, M. Sweet (Adults and nymphs on *Stoebe plumosa* Thunb.) (SANC).

PARATYPES: 5 macrotperous ♂♂, 5 brachypterous ♀♀, same data as holotype; 1 brachypterous ♀, 4 mi. W. Gydo Pass Summit, N. of Ceres, 26 Jan. 1968 (SANC, JAS, RTS).

This species is named for the type locality near Plettenberg Bay.

See discussion under *barbertonensis*.

This species is known to occur only on *Stoebe plumosa* Thunb.

Widdringtoniola, new genus

MACROPTEROUS MALE: Small, stout bodied; body surface smooth, dull or weakly shining; dorsum with reclining, black, setiform hairs about as long as diameter of antennal segment 1; all antennal segments with short, decumbent, black hairs; antennal segment 1 with a few, erect, fine black spines, segments 2, 3, and 4 with relatively short, reclining, fine, light hairs; abdominal venter with short, decumbent, dark hairs; tibiae with reclining dark hairs of length slightly less than diameter of tibia and a few semierect dark spines about equal in length to tibial diameter.

Head short, broad; eyes rather small, finely granular; frons viewed from above and from side strongly convex; anterior margins of eyes strongly sinuate; antennae inserted just above level of ventral margin of eyes, fossae contiguous with eyes; antennal segment 1 only

slightly enlarged, segment 2 cylindrical, about equal in diameter to segment 1, segments 3 and 4 about two-thirds diameter of segment 2; height of genae about one-third height of eye; bucculae narrow; gula obsolete; mesoscutum and scutellum nearly flat; hemelytra nearly parallel sided; cuneal incisure shallow, fracture slightly angled anteromedially; membrane with two cells; abdomen reaching middle of cuneus; only metatibiae with rows of tiny closely-spaced spines; tarsal claws moderately long, weakly curved, slightly broadened basally; parempodia weakly fleshy, convergent apically; pulvilli minute.

MALE GENITALIA: Figures 286–288. Vesica S-shaped, twisted, with single attenuated apical spine subtended by well developed gonopore; phallotheca and claspers typical of Phylini.

MACROPTEROUS FEMALE: See *W. kirstenboschiana.*

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

TYPE SPECIES: *Widdringtoniola kirstenboschiana*, new species.

This genus is named for the host plant genus, *Widdringtonia.*

Widdringtoniola most closely resembles species of *Campylomma* by virtue of its small size and light yellowish coloration. The parempodia are similar to those found in some *Campylomma* species and also in *Ellenia*, being weakly fleshy and convergent apically. *Widdringtoniola* has the posterior margin of the vertex poorly defined and not carinate and the anterior margin of the pronotum is not obscured by the head, whereas in *Campylomma* the head obscures the anterior margin of the pronotum. The prominently bulging frons and reclining, heavy, black setae on the dorsum are also diagnostic of the genus.

Widdringtoniola kirstenboschiana, new species

Figures 83, 286–288

MACROPTEROUS MALE: Basic coloration light yellow or greenish yellow; antennal segments 3 and 4 infuscate.

Eyes with extremely short hairs.

Labium not quite surpassing mesocoxae; pronotal calli very low, separated medially, with a weak, transverse impression along posterior margin; pronotum with anterior margin sinuate, lateral margins straight, nearly parallel, posterior margin nearly straight medially, convex laterally; metatarsal segment 1 about one-half length of segment 2, segment 2 about one-half length of segment 3.

MEASUREMENTS: Total length 2.52, maximum width .96, length head .20, width head .68, interocular space .36, length pronotum .36, width pronotum .84, length scutellum .32, width scutellum .48, length corium 1.20, length clavus .88, length cuneus .40,

width cuneus .26, length claval commissure .96, distance apex commissure-apex membrane 1.12, length metatibia 1.38; length antennal segments 1—.18, 2—.90, 3—.42, 4—.26; length labial segments 1—.18, 2—.18, 3—.07, 4—.18.

MALE GENITALIA: Figures 286–288.

MACROPTEROUS FEMALE: Similar to male except as follows: eyes slightly smaller than in male, vertex relatively wider; antennal segment 1 of slightly greater diameter than segment 2, segments 3 and 4 nearly equal in diameter to segment 2; lateral pronotal margins distinctly rounded; lateral corial margins weakly convex, body appearing ovoid; abdomen just surpassing apex of cuneus.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Kirstenbosch Gardens, Cape Town, 29 Jan. 1968, J. A. & S. Slater, T. Schuh, M. Sweet (Adults and nymphs on *Widdringtonia cupressoides* [L.] Endl.) (SANC).

PARATYPES: 25 macropterous ♂♂, 19 macropterous ♀♀, same data as holotype. *Transvaal*—4 macropterous ♂♂, 9 macropterous ♀♀, Pretoria, Meintjies Kop, 19 Mar. 1968 (Adults and nymphs on *Widdringtonia cupressoides* [L.] Endl.); 1 macropterous ♂, 7 macropterous ♀♀, Woodbush, T.P., Nov. 1932, Govt. Forester (numerous on *Widdringtonia*) (SANC, TM, SAM, BM[NH], JAS, RTS).

This species is named for the Kirstenbosch Gardens, Cape Town.

See generic discussion.

Widdringtoniola kirstenboschiana is apparently host specific on *Widdringtonia cupressoides* (L.) Endl. The host genus is restricted to southern Africa, extending north to eastern Rhodesia and Malawi. *W. cupressoides* is restricted to Table Mountain and the forests eastward to King Williamstown District (Hutchinson, 1946). The records of *kirstenboschiana* from Pretoria are from the host species introduced as an ornamental planting.

TRIBE PILOPHORINI

Aloea Linnavuori

Aloea Linnavuori (in press).

Aloea can be distinguished from all other genera with convergent recurved parempodia by its small size, unique red and cream coloration, and phyline genitalia. The genus is most closely related to *Neoambonea*, *Parambonea*, and *Ambonea*.

MALE GENITALIA: Figures 318–320. Vesica U-shaped, not

twisted, with poorly developed, subapical gonopore, form very similar to that found in *Neoambonea* and *Ambonea*; phallotheca somewhat L-shaped; left clasper splayed out, wing-like, nearly identical in structure to that of *Neoambonea* and *Parambonea*; right clasper lanceolate.

FEMALE GENITALIA: Figures 315–317. Posterior wall a simple sclerotized plate, with posterior margin strongly evaginated; sclerotized rings weakly infolded laterally.

This genus is apparently restricted to the host genus *Aloe* (Liliaceae) in the Ethiopian Region. Linnavuori (in press) has described four species from North Africa and Yemen, all occurring on species of *Aloe*. These tiny mirids live on the leaves of the plants, generally secreting themselves in the base of the rosette. When disturbed they run very rapidly to the undersides of the leaves. The extremely rapid movements make them difficult to catch. During my collecting I did not observe any specimens take flight.

Aloea australis, new species

Figure 84

MACROPTEROUS MALE: Head, antennae, labium, scutellum, hemelytra, and legs cream except as noted below; base of antennal segment 1, juga, lora, pronotum, mesoscutum, extreme base of hemelytra, apex of corium (broadly), and mesial margin of cuneus red; thoracic pleura and venter, mesocoxae and metacoxae proximally, and abdomen maroon; genital capsule cream apically.

Body surface and vestiture as in *A. samueli*.

Structure very similar to that of *A. samueli* except as follows: gula obsolete, buccal cavity reaching to posterior margin of head; veins of membrane forming nearly right angle posteromedially.

MEASUREMENTS: Total length 2.96, maximum width 1.12, length head .20, width head .84, interocular space .44, length pronotum .32, width pronotum .88, length scutellum .44, width scutellum .52, length corium 1.36, length clavus .54, length cuneus .48, width cuneus .28, length claval commissure .32, distance apex commissure-apex membrane 1.32, length metatibia 1.28; length antennal segments 1—.28, 2—.82, 3—?, 4—?; length labial segments 1—.44, 2—.46, 3—.10, 4—.10.

MALE GENITALIA: Very similar to *A. samueli*.

FEMALE: See discussion below.

FEMALE GENITALIA: See *A. samueli*.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Pretoria, April 66, H. K. Munro (Host plant—*Aloe* spp.) (SANC).

PARATYPES: 10 macropterous ♂♂, same data as holotype (RTS).

ADDITIONAL SPECIMENS: *Transvaal*—1 macropterous ♂, 15 submacropterous ♀♀, same data as holotype; 4 macropterous ♂♂, 9 submacropterous ♀♀, Pretoria, 23.11.1926 (Munro); 1 submacropterous ♀, Pretoria, XI.1957 (Vari) (SANC, TM, BM[NH], JAS, RTS).

This species is named for its occurrence in southern Africa.

Aloea australis resembles *samueli* very closely but differs as follows: the bases of the hemelytra in *australis* are red whereas in *samueli* they are cream; the mesial margin of the cuneus is red in *australis* and cream in *samueli* (see below); the general body form is more robust in *samueli* than in *australis* which is particularly noticeable in the ratio of the length to width of the scutellum (see measurements).

In the paratypic series of *australis* all of the included specimens are males and have the cuneus red only on the mesial margin. Nearly all of the specimens listed under "additional specimens" have the cuneus entirely red, but are structurally nearly identical to the paratypes, including the form of the male genitalia. It is possible that two species are present here, but only further field work will determine this.

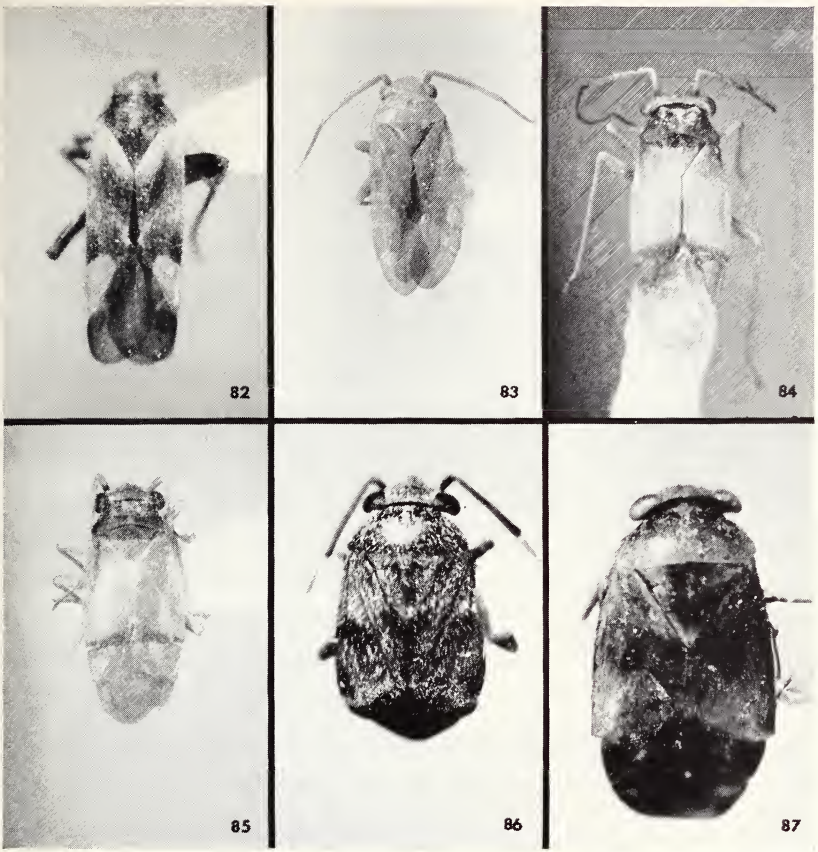
Three males and seven nymphs taken on *Aloe* sp. at the Oliphants River near the Oliphants Camp, Kruger National Park (deposited in the J. A. Slater Collection), almost certainly represent an additional new species of *Aloea*, based on their coloration and antennal proportions, which differ from *australis* and *samueli*.

Aloea samueli, new species

Figures 85, 315–320

MACROPTEROUS MALE: Small, elliptical; hemelytra (except as noted below), most of head, antennae, labium, and legs cream; pronotum, mesoscutum, and narrow transverse fascia along cuneal fracture (interrupted only at base of membrane), and apex of juga red; head weakly suffused with red; antennal segment four brown; genital capsule cream, suffused with red; remainder of venter deep reddish brown.

Entire body dull; head, pronotum (particularly anterior half), thorax, and abdomen laterally with decumbent, flattened, sericeous hairs; dorsum also with reclining, golden hairs; all antennal segments with decumbent, short, light hairs, segment 1 with one or two erect, light spines on interior surface, segment 2 with an irregular row of



FIGS. 82–87. Phylini, Pilophorini. Fig. 82. *Stoebea barbertonensis*, male, holotype. Fig. 83. *Widdringtoniola kirstenboschiana*, male (Pretoria, Transvaal). Fig. 84. *Aloea australis*, male, holotype. Fig. 85. *Aloea samueli*, male, holotype. Fig. 86. *Ambonea munroi*, male (Rustenburg, Transvaal). Fig. 87. *Ambonea rustenburgensis*, male, holotype.

erect, light hairs, slightly longer than segmental diameter, on latero-ventral surface (with antennae lying back over body); ventral surfaces of femora with several long, erect, fine, light hairs; abdominal venter with decumbent light hairs; tibiae with a few semierect light spines, about as long as tibial diameter.

Head strongly declivous, vertex and frons broad, flat; posterior margin of vertex finely carinate; eyes moderately large, protuberant,

antennae inserted at level of ventral margin of eyes, fossae removed from eyes by distance nearly equal to diameter of antennal segment 2; antennal segment 1 moderately enlarged, segment 2 cylindrical, about two-thirds diameter of segment 1, segments 3 and 4 about two-thirds diameter of segment 2; clypeus enlarged, broad, flattened, curved posteroventrally; bucculae small; gula about as long as two times diameter of antennal segment 1; labial segment 4 flattened dorsoventrally, nearly twice as broad as segment 3; labium just surpassing mesocoxae; pronotum with anterior margin finely carinate, upturned, calli small, widely separated, distinctly raised; posterior margin of pronotum forming distinct inverted "V" across mesoscutum; scutellum flat; corium weakly convex laterally, widest slightly posterior to level of midpoint of claval commissure; cuneal incisure shallow, fracture nearly perpendicular to corial margin; membrane very long, with two cells, posterior margin of cells evenly rounded; abdomen reaching to apex of cuneus; only metatibiae with rows of tiny, closely-spaced spines; metatarsal segments 1 and 2 subequal in length, segment 3 about 1½ times length of segment 2; tarsal claws relatively short, weakly curved; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MEASUREMENTS: Total length 2.60, maximum width 1.12, length head .16, width head .84, interocular space .44, length pronotum .28, width pronotum .23, length scutellum .48, width scutellum .60, length corium 1.24, length clavus 1.04, length cuneus .56, width cuneus .40, length claval commissure .56, distance apex commissure-apex membrane 1.04, length metatibiae 1.20; length antennal segments 1—.32, 2—.72, 3—.46, 4—approximately .60; length labial segments 1—.38, 2—.40, 3—.08, 4—.10.

MALE GENITALIA: Figures 318–320.

FEMALE: Submacropterous, cuneus and membrane relatively shorter than in male; antennal segment 2 shorter than in male and of slightly smaller diameter, without row of erect hairs; posterior margin of pronotum not as strongly excavated as in male.

FEMALE GENITALIA: Figures 315–317.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Pretoria, Wonderboom, 3 Apr. 1968, J. A. & S. Slater, T. Schuh (Adults and nymphs on *Aloe* sp.) (SANC).

PARATYPES: 12 macropterous ♂♂, 10 submacropterous ♀♀, same data as holotype (SANC, JAS, RTS).

ADDITIONAL SPECIMENS: 3 ♂♂, 58 nymphs (in alcohol), same data as holotype (RTS).

This species is named for Mr. Samuel T. Slater.
See discussion under *A. australis*.

Ambonea Odhiambo

Ambonea Odhiambo, 1960b, pp. 393–400.

Ambonea can be characterized as follows: the parempodia apically are convergent and recurved; the head is short and broad and the posterior margin of the vertex finely carinate; the dorsum is covered with flattened decumbent sericeous hairs and reclining setiform hairs; and, the structure of the male genitalia is characteristic. The genus is most closely related to *Hypseloecus* Reuter from Europe, and somewhat less closely related to *Aloea*, *Parambonea*, and *Neoambonea* from Africa. *Ambonea* can be separated from *Neoambonea* because it lacks the punctures on the dorsum and from *Parambonea* because it has two types of pubescence on the dorsum. *Pseudambonea* has a similar facies to *Ambonea*, but is a member of the Orthotylini, based on the structure of the male and female genitalia.

MALE GENITALIA: Figures 321–326. Vesica similar in structure to *Aloea* and *Neoambonea*; phallotheca somewhat L-shaped, structure complex; left clasper with long sensory processes, short body; right clasper lanceolate.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate with an evaginated posterior margin.

Ambonea currently contains four species from East and South Africa.

Ambonea munroi, new species

Figures 86, 321–323

MACROPTEROUS MALE: Stout bodied; basic coloration red; anterior third of pronotum laterally, posterior margin of pronotum across mesoscutum, clavus narrowly along claval commissure, corium along medius, thoracic pleura, abdominal venter, and coxae (heavily) suffused with black; all coxae yellowish, mesocoxae and metacoxae suffused with red; vertex with rounded yellowish spots contiguous with mesial margins of eyes; tibiae light yellowish with bands of red formed by dark bases of tibial spines; tarsi light brown; antennal segments 3 and 4 yellowish (from paratype, segments 3 and 4 missing in holotype).

Dorsum smooth, dull; entire body densely covered with reclining, setiform hairs and decumbent, wooly sericeous hairs; pronotum at

about midpoint of lateral margin with a long, erect, slender spine; antennal segment 1 with some decumbent hairs and a few erect, dark spines, segments 2, 3, and 4 with short dense vestiture; femora with a few, very long, erect, fine hairs on ventral surfaces; tibiae with dark spines about as long as tibial diameter, arranged on tibiae in groups.

Head broad, declivous; eyes large, appearing almost substylate; vertex very steeply inclined, posterior margin finely carinate; frons distinctly transversely rugose; anterior margins of eyes sinuate, eyes occupying about three-fourths height of head; antennae inserted just above ventral margin of eyes; antennal segment 1 slightly enlarged, antennal segment 2 tapering slightly proximally, distal diameter about equal to diameter of segment 1, segments 3 and 4 about two-thirds diameter of segment 2 (from paratype); bucculae slightly expanded; gula obsolete; labium just surpassing metacoxae at trochanteral joint; pronotum with anterior margin finely carinate, upturned, lateral margins broadly convex, posterior margin nearly straight; mesoscutum and scutellum nearly flat; lateral corial margins weakly convex; cuneal incisure obsolete, fracture slightly angled anteromedially; cuneus and membrane strongly declivous, membrane with two cells, posterior margin of cells broadly rounded; abdomen just surpassing apex of cuneus; all tibiae with rows of tiny, closely-spaced spines; metatarsal segments 2 and 3 subequal in length, segment 1 about two-thirds length of segment 2 (from paratype); claws relatively short, evenly curved, broad at base; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MEASUREMENTS: Total length 3.12, maximum width 1.36, length head .20, width head 1.08, interocular space .48, length pronotum .52, width pronotum 1.28, length scutellum .76, width scutellum .88, length corium 1.64, length clavus 1.44, length cuneus .64, width cuneus .40, length claval commissure .64, distance apex commissure-apex membrane approx. 1.20, length metatibia 1.60; length antennal segments 1—.24, 2—1.06, 3—?, 4—?; length labial segments 1—.44, 2—.46, 3—.32, 4—.40.

MALE GENITALIA: Figures 321–323.

MACROPTEROUS FEMALE: Very similar to macropterous male.

FEMALE GENITALIA: See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Cullinan area, Jan. 1966, H. K. Munro (Host plant—*Loranthus rubromarginatus*) (SANC).

PARATYPES: *Transvaal*—1 macropterous ♂, 2 macropterous ♀♀, same data as holotype; 2 macropterous ♀♀, Hartebeespoort Dam,

20.5.65 (Paliatseas); 2 macropterous ♂♂, Rustenburg, XI-8-1952 (Capener); 1 macropterous ♂, Rustenburg XII-10-1952 (Capener); 3 macropterous ♀♀, Rustenburg, 7–14 Nov. 1967 (Capener) (Adults on *Loranthus zeyheri*) (SANC, JAS, RTS).

This species is named for Dr. H. K. Munro, well known South African dipterist, who collected the holotype.

Ambonea munroi can be separated from *rustenburgensis* by its size and bright red coloration.

The hosts of this species are species of *Loranthus* spp. (Loranthaceae).

A female specimen from Kimberly, Cape Province (deposited in J. A. Slater Collection), is generally bright red like *munroi* but differs slightly in coloration and may represent a new species.

Ambonea rustenburgensis, new species

Figures 87, 324–326

MACROPTEROUS MALE: Stout bodied; generally yellow brown, dorsum heavily suffused with darker brown; mesial two-thirds of cuneus suffused with red; membrane smoky brown; head anteriorly and ventrally, antennae, propleuron, prosternum, procoxae, basalar plate, all tibiae and tarsi, metathoracic scent gland opening, and abdominal venter light yellow brown or yellow white; mesocoxae and metacoxae suffused with brown; all femora brown proximally, mottled mesially, and yellow brown distally; mesothoracic and metathoracic pleura and sterna brownish black.

Body surface texture and vestiture as in *munroi* except as follows: tibiae with semierect dark spines, without dark bases, of length slightly greater than tibial diameter.

Structure similar to *munroi* except as follows: head nearly vertical; antennal segment 2 cylindrical, about three-fourths diameter of segment 1 (segments 3 and 4 missing in holotype); labium almost reaching trochanteral joint of metacoxae; cuneal incisure deep, fracture at right angles to longitudinal axis of body; metatarsal segments 2 and 3 subequal in length, segment 1 about one-half length of segment 2.

MEASUREMENTS: Total length 3.80, maximum width 2.00, length head .12, width head 1.28, interocular space .64, length pronotum .48, width pronotum 1.52, length scutellum .88, width scutellum 1.12, length corium 1.88, length clavus 1.56, length cuneus .76, width cuneus .44, length claval commissure .60, distance apex commissure-apex membrane 1.60, length metatibia 1.92; length an-

tennal segments 1—.28, 2—1.24, 3—?, 4—?; length labial segments 1—.36, 2—.28, 3—.52, 4—.36.

MALE GENITALIA: Figures 324–326.

MACROPTEROUS FEMALE: Very similar to male.

FEMALE GENITALIA: See generic discussion.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Rustenburg, III-22-1953, A. L. Capener (SANC).

PARATYPES: *Transvaal*—1 macropterous ♂, 1 macropterous ♀, same data as holotype; 1 macropterous ♀, Rustenburg, XII-14-24-1961 (Capener) (JAS, RTS).

This species is named for the town of Rustenburg.

Ambonea rustenburgensis can be separated from all other described species in the genus by its nearly unicolorous metatibiae.

Neoambonea, new genus

MACROPTEROUS MALE: Stout bodied; entire dorsum rather weakly but distinctly punctured and finely transversely rugulose; pronotum polished, shining, remainder of dorsum dull; entire body covered with reclining, golden hairs about as long as diameter of antennal segment 2, and decumbent, somewhat flattened, wooly, sericeous hairs; antennal segment 1 with some inconspicuous, decumbent hairs; segments 2, 3, and 4 with dense, reclining, light vestiture about as long as diameter of antennal segment 3; femora, tibiae, and tarsi with reclining hairs, femora also with a few, very long, fine hairs on ventral surfaces.

Head broad, strongly flattened anteroposteriorly; vertex nearly vertical, posterior margin finely carinate, weakly concave; eyes moderately large, occupying about two-thirds of height of head; antennae inserted just at level of ventral margins of eyes, fossae only slightly removed from anterior margins of eyes, segment 1 very slightly enlarged, segment 2 cylindrical, slightly smaller in diameter than segment 1, segments 3 and 4 about two-thirds diameter of segment 2; clypeus large, somewhat flattened; genae about two-thirds height of eye; bucculae only slightly expanded; gula short, nearly vertical; labium short; pronotum with anterior margin carinate, upturned; pronotum slightly elevated posteriorly; mesoscutum narrowly exposed; scutellum convex; lateral corial margins irregularly convex; cuneal incisure very deep; membrane with two cells, large cell short, posterior margin very broadly rounded; cuneus and membrane strongly declivous; legs relatively short; femora narrow; all tibiae with rows of tiny, closely-spaced spines and semierect spines about as long as tibial diameter; tarsal claws moderately long, broad at base, evenly

curved; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MALE GENITALIA: Figures 329–331. Very similar in structure to *Aloea*.

MACROPTEROUS FEMALE: Very similar to male.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate with posterior margin strongly evaginated.

TYPE SPECIES: *Neoambonea cynanchi*, new species.

This genus is named for its similarity to *Ambonea*.

Neoambonea can be recognized by the fleshy, apically convergent, recurved parempodia, black coloration with light antennae and tibiae, broad vertical head, and distinctly punctured dorsum with reclining setiform hairs in addition to decumbent, wooly, sericeous hairs. *Parambonea*, the most closely related genus, has the dorsum with only transverse rugosities and reclining setiform hairs and has black antennae and tibiae.

Neoambonea cynanchi, new species

Figures 88, 329–331

MACROPTEROUS MALE: General coloration black or brownish black; antennae (segment 2 darkening distally, segments 3 and 4 light brown), all femora distally, all tibiae and tarsi, and labial segments 1, 2, and 3 yellowish; ring on proximal third of antennal segment 1 red; vertex with two rounded reddish markings contiguous with mesial margins of eyes.

Frons weakly convex; labium slightly surpassing procoxae at trochanteral joint; calli indistinct, widely separated medially; pronotum with anterior margin evenly convexly rounded, lateral margins very weakly convex, posterior margin sinuate, forming a shallow inverted "V"; cuneal fracture perpendicular to longitudinal axis of body; lateral margin of cuneus convex; abdomen reaching to about middle of cuneus; metatarsal segments all subequal in length.

MEASUREMENTS: Total length 3.28, maximum width 1.80, length head .12, width head .84, interocular space .44, length pronotum .44, width pronotum 1.20, length scutellum .64, width scutellum .64, length corium 1.52, length clavus 1.32, length cuneus .60, width cuneus .56, length claval commissure .68, distance apex commissure-apex membrane 1.36, length metatibia 1.40; length antennal segments 1—.30, 2—.90, 3—.50, 4—approximately .70; length labial segments 1—.22, 2—.24, 3—.14, 4—.06.

MALE GENITALIA: Figures 329–331.

MACROPTEROUS FEMALE: Very similar to male.

FEMALE GENITALIA: Posterior wall a simple sclerotized plate with posterior margin strongly evaginated.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, 20 mi. E. Machadodorp, Schoemannskloof, 4300 ft. elevation, 22 Mar. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults and nymphs on *Cynanchum africanum* R.Br.) (SANC).

PARATYPES: 4 macropterous ♂♂, 6 macropterous ♀♀, same data as holotype. *Cape Province*—4 macropterous ♂♂, 9 macropterous ♀♀, Storms River Mouth, 18.II.66 (Capener). *Natal*—1 macropterous ♀, Umkomaas, July 1948 (Capener) (SANC, JAS, RTS).

This species is named for the host genus, *Cynanchum*.

Neoambonea cynanchi is very closely related to *Neoambonea slateri*. The larger size and prominent eyes that are not closely appressed to the anterolateral angles of the pronotum are the most useful characters for separating the two species; the latter species is smaller and has the eyes contiguous with the anterolateral angles of the pronotum. *N. slateri* also lacks the red stripe on antennal segment 1 that is present in *cynanchi*.

The host of this species is *Cynanchum africanum* R. Br. (Asclepiadaceae).

Neoambonea slateri, new species

Figure 89

MACROPTEROUS MALE: Coloration, surface texture and vestiture very similar to *Neoambonea cynanchi*, but antennal segment 1 without red stripe.

Structurally very similar to *cynanchi*; smaller (see measurements); head concave posteriorly, eyes contiguous with anterolateral margins of pronotum; labium nearly reaching mesocoxae at trochanteral joint.

MEASUREMENTS: Total length approx. 2.40, maximum width 1.44, length head .08, width head .88, interocular space .48, length pronotum .48, width pronotum 1.12, length scutellum .48, width scutellum .64, length corium 1.28, length clavus 1.08, length cuneus .48, width cuneus .44, length claval commissure .56, distance apex commissure-apex membrane .88, length metatibia 1.32; length antennal segments 1—.19, 2—.80, 3—.44, 4—.52; length labial segments 1—.24, 2, 3, and 4—.52.

MALE GENITALIA: Not dissected.

Female unknown.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*,

Keurboomsrivier, 12 Feb. 1968, T. Schuh, J. A. & S. Slater, M. Sweet (Adults on *Cynanchum obtusifolium* L. F.) (SANC).

PARATYPE: 1 macropterous ♂, same data as holotype (RTS).

This species is named for Dr. J. A. Slater of the University of Connecticut.

See discussion under *N. cynanchi.*

The host of this species is *Cynanchum obtusifolium* L.F. (Asclepiadaceae).

Parambonea, new genus

MACROPTEROUS MALE: Stout bodied; head, pronotum, and scutellum polished, shining; pronotum and scutellum transversely finely rugose and with the appearance of faint punctations; hemelytra dull, very faintly transversely rugose; venter dull; entire body with moderately long, reclining, golden hairs; antennae with fine, decumbent, light pubescence, segments 2 and 3 (4 missing in holotype) with a few semierect, fine, light hairs about the length of diameter of antennal segment 2, segment 1 with a fine, light spine on interior surface; femora, tibiae, and tarsi with reclining light hairs; femora with a few very long, erect, fine hairs on ventral surfaces; anterolateral angles of pronotum with a light, very fine, long, erect spine.

Head broad, extremely flat; vertex nearly vertical, posterior margin very finely carinate; eyes large, extending posteriorly around anterolateral angles of pronotum; frons weakly convex; eyes occupying about one-half height of head; antennae inserted just below ventral margin of eyes, fossae slightly removed from eyes; antennal segment 1 slightly enlarged, segment 2 tapering somewhat proximally, about three-fourths diameter of segment 1, segment 3 cylindrical, about equal in diameter to proximal diameter of segment 2; genae very high; apex of clypeus directed posteroventrally, clypeus somewhat flattened; bucculae slightly enlarged, gula obsolete; pronotum broad, flattened, very slightly inclined posteriorly, with carinate, upturned, anterior margin; calli indistinct, widely separated medially, pronotum depressed on either side of middle behind calli; mesoscutum narrowly exposed, scutellum flat; lateral corial margins weakly convex, cuneal incisure deep, fracture very slightly angled anteromedially; lateral margin of cuneus convex; cuneus and membrane strongly deflexed; membrane with two cells, posterior margin of cells broadly rounded; legs relatively short; femora not noticeably enlarged; tibiae with reclining light spines about as long as tibial diameter, without conspicuous semierect spines; all tibiae with rows of tiny, closely-spaced spines; tarsal claws moderately long, broad

basally, evenly curved; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MALE GENITALIA: Figures 327, 328. Vesica somewhat sickle-shaped, flattened, gonopore undeveloped; phallotheca straight, similar in structure to *Pilophorus*, opening apical; left clasper very similar to that of *Neoambonea* and *Aloea*; right clasper lanceolate.

MACROPTEROUS FEMALE: Very similar to male.

FEMALE GENITALIA: Not dissected.

TYPE SPECIES: *Parambonea transvaalensis*, new species.

This genus is named for its similarity to *Ambonea*.

Parambonea is very closely related to *Neoambonea*, but differs from it by lacking the punctations on the dorsum, having completely black antennae and legs, and having the vesica and the phallotheca structurally distinct (see also discussion under *Neoambonea*).

Parambonea transvaalensis, new species

Figures 90, 327, 328

MACROPTEROUS MALE: Entirely black, membrane smoky brown black; vertex with rounded, light brown spot on either side, removed from mesial margin of eyes and posterior margin of vertex by distance equal to about diameter of antennal segment 2.

Posterior margin of vertex nearly straight; labium reaching between procoxae and mesocoxae; pronotum with anterior and lateral margins nearly straight, posterior margin distinctly sinuate; abdomen reaching almost to apex of cuneus; metatarsal segments 1 and 2 subequal in length, segment 3 slightly longer than segment 2.

MEASUREMENTS: Total length approx. 2.80, maximum width 1.56, length head .08, width head .88, interocular space .52, length pronotum .44, width pronotum 1.24, length scutellum .52, width scutellum .64, length corium 1.36, length clavus 1.12, length cuneus .56, width cuneus .52, length claval commissure .60, distance apex commissure-apex membrane 1.36, length metatibia 1.36; length antennal segments 1—.22, 2—.74, 3—.46, 4—?; length labial segments 1—.26, 2, 3, and 4—.48.

MALE GENITALIA: Figures 327, 328.

MACROPTEROUS FEMALE: Very similar to male.

FEMALE GENITALIA: Not dissected.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Transvaal*, Nat. Botanical Gardens, Pretoria, 22 Nov. 1967, J. A. & S. Slater, T. Schuh (SANC).

ADDITIONAL SPECIMENS: *Transvaal*—1 macropterous ♂, Foun-

FIGS. 88–93. Pilophorini. Fig. 88. *Neoambonea cynanchi*, male, holotype. Fig. 89. *Neoambonea slateri*, male, holotype. Fig. 90. *Parambonea transvaalensis*, male, holotype. Fig. 91. *Paramixia australis*, male, holotype. Fig. 92. *Paramixia suturalis*, female (St. Lucia Estuary, Natal). Fig. 93. *Pilophorus pilosus*, male (Port Shepstone, Natal).

tains, Pretoria, XII-20-1950 (Capener); 2 macropterous ♀♀, Kloofzicht, II-13-1952 (Capener); 1 macropterous ♀, Pretoria, 3.2.34 (Munro); 1 macropterous ♀, Pretoria, 17.1.1932 (van Son) (TM, BM[NH], JAS, RTS).

This species is named for its occurrence in the Transvaal.

See generic discussion.

The single additional male specimen from Fountains, Pretoria, resembles the holotype very closely, especially in the form of the genitalia, but it is slightly smaller and may be teneral. The four female specimens from the Pretoria area all appear to be conspecific with one another, but are smaller than the males examined and therefore may represent another species.

Paramixia Reuter

Paramixia Reuter, 1900, p. 264—Carvalho, 1958a, p. 86.—Wagner, 1970a, pp. 1–3.

Troitskiella Poppius, 1914a, pp. 81–82. **New Synonymy.**

Schroederiella Poppius, 1914a, p. 88. (Synonymized by: Wagner, 1970a, p. 3).

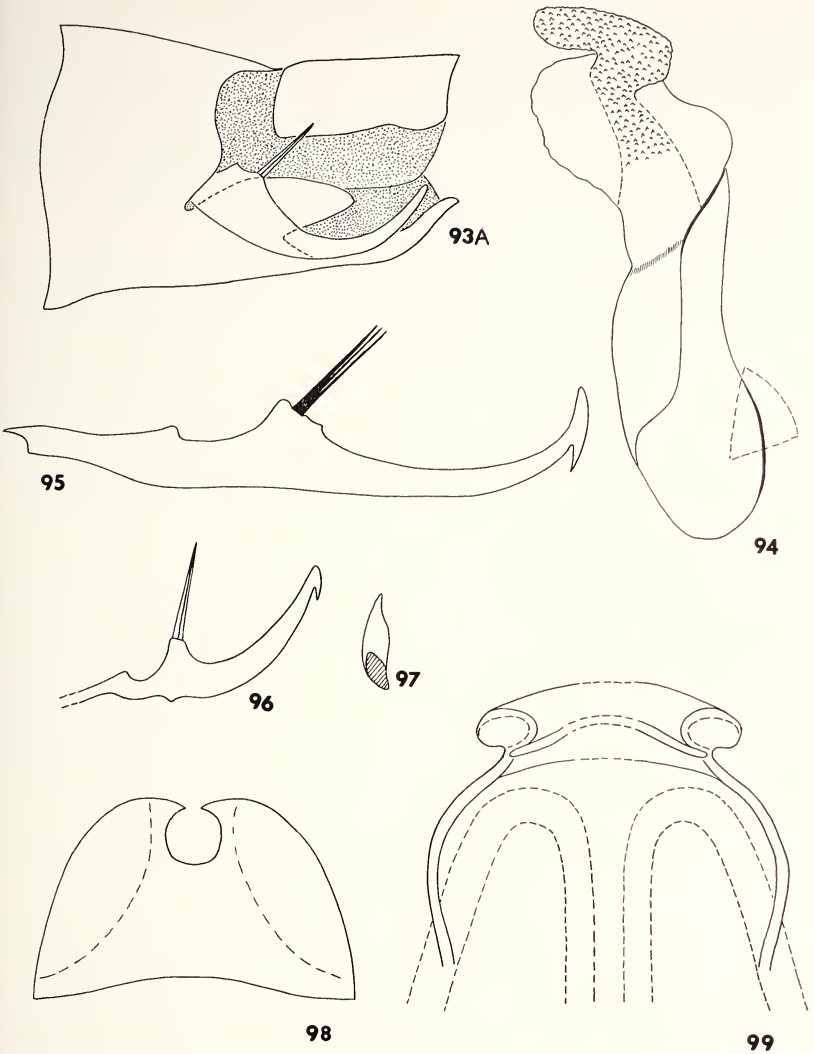
Cephalocapsus Poppius, 1914a, pp. 88–91. **New Synonymy.**

Orthotylellus Knight, 1935, p. 207. **New Synonymy.**

Amixia Carvalho, 1952a, p. 75 (in part).—Carvalho, 1960, p. 194 (in part).

Reuter (1900) described *Paramixia* with a single included species, *P. suturalis* Reuter, from the Nile Valley; later in his catalog (Reuter, 1910a) he placed the genus in the Division Phylaria. Poppius (1914a) did not include *Paramixia* in his treatment of the Ethiopian Miridae. Carvalho (1952a; 1958a) placed *Paramixia* in the *Phylinae*. Lindberg (1958), in recording *Paramixia suturalis* from the Cape Verde Islands, noted that the structure of the parempodia and the claws should place the genus in the subfamily Orthotylinae. His figures indicated, however, that the male genitalia are of the Phylinae-type. Wagner (1970a) discussed the relationships of the genus.

Poppius (1914a) described *Troitskiella* (with one included species, *T. minuta* Poppius, from Bukoba, Tanzania), *Cephalocapsus* (with the type species *C. clypealis* Poppius, from Malawi and three additional species from Africa and Madagascar), and *Schroederiella* (with a single included species, *S. nigra* Poppius from Mt. Kilimanjaro). He placed *Troitskiella* in the Heterotomaria and *Cephalocapsus* and *Schroederiella* in the Phylinae. Poppius indicated in his key that the last two genera were related by virtue of the "arolia" being free, extending to the apex of the claws, and converging apically. Examination of the type specimens of *Troitskiella minuta*, *Cephalocapsus clypealis*, and *Schroederiella nigra* indicates that in fact the



FIGS. 93A–99. Nichomachini male and female genitalia. Fig. 93A. Lateral view of male genital capsule, *Pseudonichomachus mimeticus*. Fig. 94. Lateral view of phallus, *idem*. Fig. 95. Left clasper, *idem*. Fig. 96. Left clasper, *Nichomachus sweeti*. Fig. 97. Right clasper, *idem*. Fig. 98. Posterior wall, *idem*. Fig. 99. Sclerotized rings, *idem*.

"arolia" (parempodia) of all of them are apically convergent and recurved and arise from between the claws and not from the basal tooth of the claw as Poppius apparently presumed in the case of *Cephalocapsus* and *Schroederiella*. Further examination reveals that *Cephalocapsus* Poppius, and *Troitskiella* Poppius are synonymous with *Paramixia* Reuter, on the basis of the structure of the claws, male genitalia, and external morphology. Wagner (1970a) synonymized *Schroederiella* with *Paramixia* and discussed the close relationship of *Cephalocapsus* and *Paramixia*.

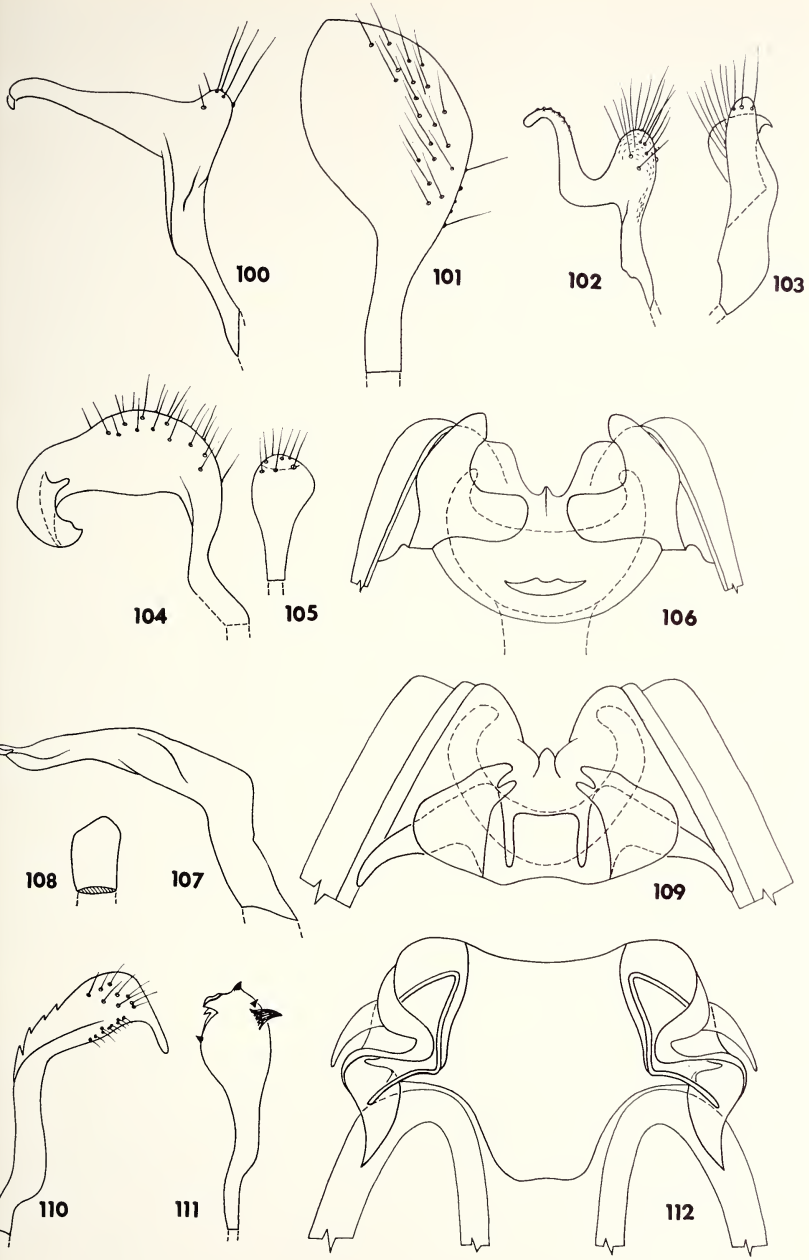
Carvalho (1952a) synonymized *Troitskiella* with *Amixia* Reuter. As noted above, *Troitskiella* is a synonym of *Paramixia*; therefore if Carvalho was correct in synonymizing *Troitskiella* with *Amixia*, *Paramixia* would also be a synonym of *Amixia*. Wagner (1957a) studied *Amixia*, and showed that it has hair-like parempodia (as opposed to what is indicated in Reuter's original description) and also an S-shaped phallus unlike that of *Paramixia*, and that in fact *Amixia* is a generic synonym of *Orthonotus* Stephens. Therefore, *Troitskiella* is not a synonym of *Orthonotus*, but of *Paramixia*. Wagner (1957a) did not examine *Troitskiella*.

Knight (1935) described *Orthotylellus* Knight from Samoa, with a single included species, *O. samoanus* Knight. Usinger (1946) described three additional species in *Orthotylellus* from Guam, *O. rufescens* Usinger, *O. pallescens* Usinger, and *O. brunnescens* Usinger. Carvalho (1948) described *Rhinocloa carmelitana* Carvalho, from Brazil, which he later transferred to *Orthotylellus* (Carvalho, 1955b). Carvalho (1956b) has illustrated the male genitalia of the Pacific species of *Orthotylellus* and Maldonado (1969) those of *O. carmelitanus*. Comparison of these genitalic illustrations with the male genitalia of *Paramixia* clearly indicates that *Orthotyllelus* Knight is synonymous with *Paramixia* Reuter.

China (1938) described three new species of *Cephalocapsus*

→

FIGS. 100–112. Halticini and Orthotylini male and female genitalia. Fig. 100. Left clasper, *Namaquacapsus melanostethoides*. Fig. 101. Right clasper, *idem*. Fig. 102. Left clasper, *Cyrtorhinus melanops*. Fig. 103. Right clasper, *idem*. Fig. 104. Left clasper, *Pseudambonea capeneri*. Fig. 105. Right clasper, *idem*. Fig. 106. Posterior wall, *idem*. Fig. 107. Left clasper, *Pseudoloxops transvaalensis*. Fig. 108. Right clasper, *idem*. Fig. 109. Posterior wall, *Pseudopilophorus capeneri*. Fig. 110. Left clasper, *idem*. Fig. 111. Right clasper, *idem*. Fig. 112. Sclerotized rings, *idem*.


100
101
102
103
104
105
106
108
107
109
110
111
112

from Madeira Island, moved a fourth species to that genus, and discussed the difficulty of placing the genus in a subfamily on the basis of the pretarsal structures. China stated that to his knowledge *Cephalocapsus* and *Schroederiella* were the only plagiognathine (Phylinae) genera with "free arolia". This assumption by China was based on the work of Poppius who used the term "arolium" in a strict sense to mean a fleshy pad. Although China (1938) interpreted the structure of the claws of his specimens of "*Cephalocapsus*" correctly, he apparently misinterpreted Poppius' conception of the "arolia" in *Cephalocapsus*. I interpret Poppius' (1914a) use of the term "arolia" in the case of *Cephalocapsus* and *Schroederiella* to refer to the pulvilli and not the parempodia. The inclusion of *Cephalocapsus* and *Schroederiella* in the Phylinae by Poppius (1914a) was based on his misinterpretation of the structure of the claw and parempodia, although he interpreted it correctly in *Troitskiella*. Kerzhner and Yaczewski (1964) noted that there has been much confusion regarding these structures and that the pseudarolia (pulvilli) were called "arolia" in almost all [European] literature until 1955.

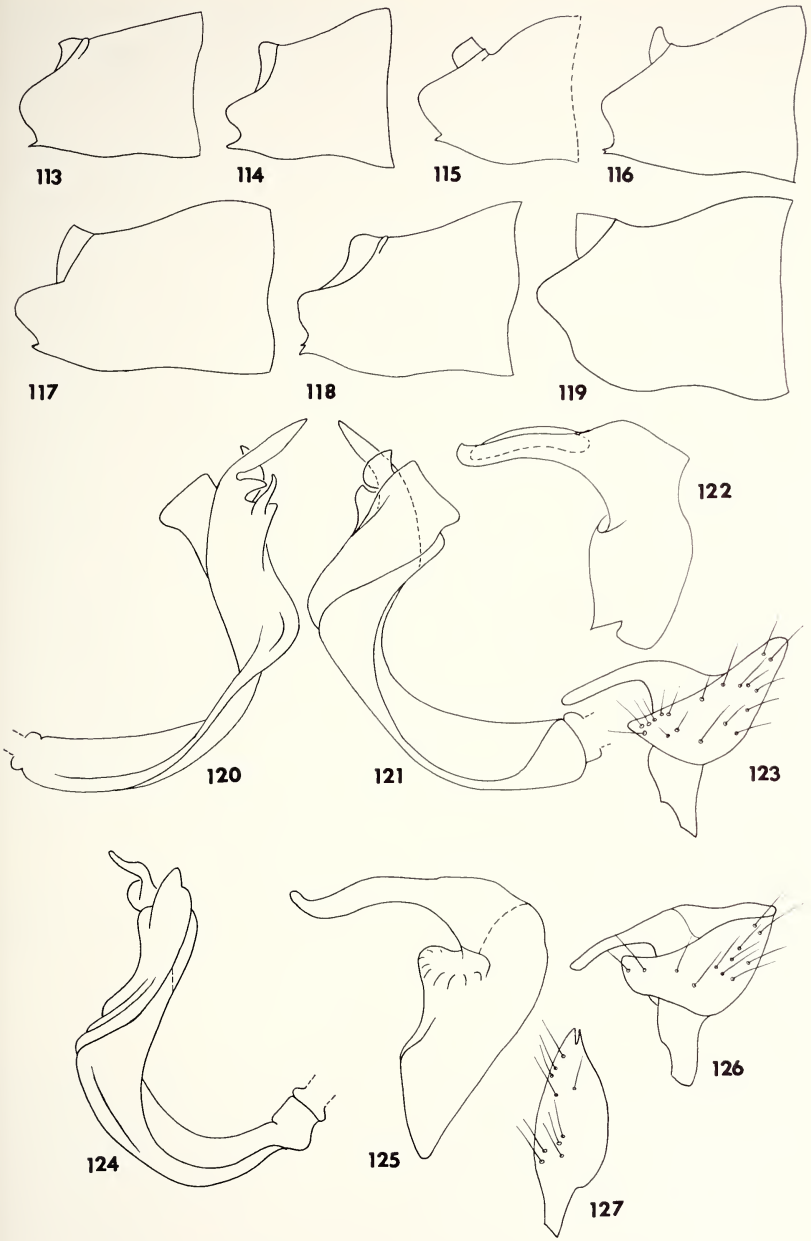
Wagner (1961) reviewed and revised the species which China (1938) placed in *Cephalocapsus* and created a new genus, *Chinacapsus* Wagner, to receive them. China (1938) in his original work did not examine the male genitalia. Wagner (1961) illustrated the vesica, claspers, and phallotheca for most species concerned; comparison of the vesica in particular, indicates that *Chinacapsus* is not congeneric with *Paramixia*.

Wagner (1970a) described the parempodia of *Paramixia* as being of the same structure as those of *Chinacapsus* (see Wagner, 1961). Careful examination of large numbers of specimens of *Paramixia* from South Africa indicates that the parempodia are apically convergent and recurved, and not rod-like and weakly convergent apically as are those of *Chinacapsus*. The vesica in *Paramixia* is also

---

→

FIGS. 113–127. Hallodapini, *Acrorrhinium* male genitalia. Fig. 113. Lateral view of male genital capsule, *A. brincki*. Fig. 114. *idem*, *A. drakensbergensis*. Fig. 115. *idem*, *A. oudtshoornensis*. Fig. 116. *idem*, *A. capensis*. Fig. 117. *idem*, *A. monticola*. Fig. 118. *idem*, *A. muntingi*. Fig. 119. *idem*, *A. incrassata*. Fig. 120. Lateral view of vesica, *A. brincki*. Fig. 121. Obverse view of vesica, *idem*. Fig. 122. Phallotheca, *idem*. Fig. 123. Left clasper, *idem*. Fig. 124. Lateral view of vesica, *A. drakensbergensis*. Fig. 125. Phallotheca, *idem*. Fig. 126. Left clasper, *idem*. Fig. 127. Right clasper, *idem*.


113
114
115
116
117
118
119
120
121
122
123
124
125
126
127

unlike that of *Chinacapsus*. The vesica of the latter genus resembles the form found in *Sthenarus* and related genera, whereas in *Paramixia* the structure of the vesica is similar to what is found in the Pilophorini. Based on the structure of the parempodia and vesica I am placing *Paramixia* in the Pilophorini.

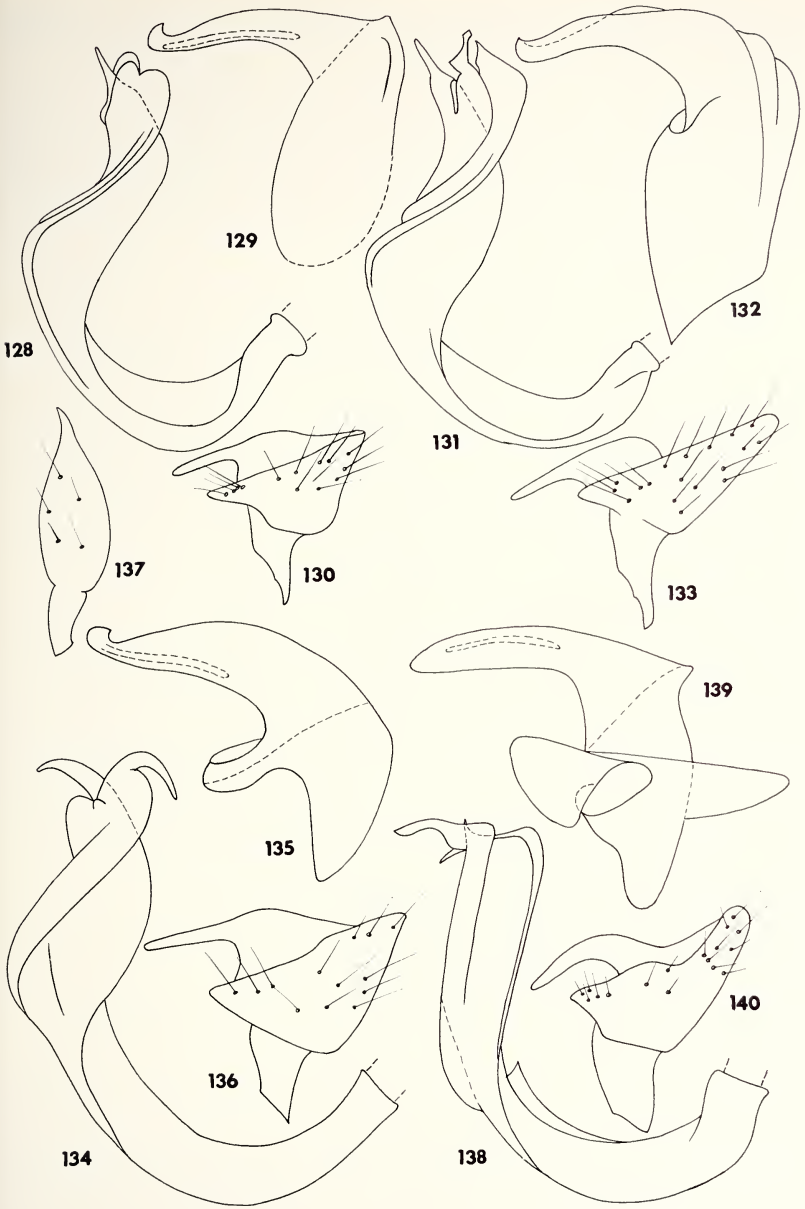
Paramixia can be characterized by its relatively small size, fleshy, recurved, convergent parempodia, declivous but not vertical head with a finely carinate posterior margin that slightly overlaps the anterior margin of the pronotum, shining, decumbent, dorsal pubescence (both *P. suturalis* and *P. australis* have in addition some flattened, decumbent, sericeous hairs), sexual dimorphism of antennal segment 2 (length about one-fourth greater than width of head across eyes in male and about equal to width of head across eyes in female), and the structure of the male genitalia, in which the vesica is a simple sclerotized tube curved into almost a complete coil (Figs. 332, 335), the phallotheca is L-shaped (Fig. 333), the left clasper is strongly flattened laterally (rather than anteroposteriorly as in most Pilophorini) (Fig. 334), and the right clasper is flat and lanceolate. The posterior wall of the female is a simple sclerotized plate and does not show the conspicuous evagination of the posterior margin found in all other members of the Pilophorini.

The great range of color variation encompassed in extensive collections of *Paramixia* from South Africa (see species discussions) gives some idea of the possible problems in the taxonomy of the genus. Before a definitive discussion of the species can be undertaken more extensive field work will have to be done. The male genitalia, however, do appear to be extremely stable from species to species, as for example in *suturalis* and *australis*.

The vesica of the holotype of *Paramixia nigra* (Poppius) is illustrated in Figure 336. A female specimen, probably representing a new species near *nigra*, with the data "Abachaus, Otjivarongo, N'

→

FIGS. 128–140. Hallodapini, *Acrorrhinium* male genitalia. Fig. 128. Lateral view of vesica, *A. oudtshoornensis*. Fig. 129. Phallotheca, *idem*. Fig. 130. Left clasper, *idem*. Fig. 131. Lateral view of vesica, *A. capensis*. Fig. 132. Phallotheca, *idem*. Fig. 133. Left clasper, *idem*. Fig. 134. Lateral view of vesica, *A. monticola*. Fig. 135. Phallotheca, *idem*. Fig. 136. Left clasper, *idem*. Fig. 137. Right clasper, *idem*. Fig. 138. Lateral view of vesica, *A. incrassata*. Fig. 139. Phallotheca, *idem*. Fig. 140. Left clasper, *idem*.


128
129
130
131
132
133
134
135
136
137
138
139
140

South-west Africa, XII.1949, G. Hobohm," is in the Transvaal Museum. This specimen is black with all of the appendages light in color.

Paramixia is restricted to the Cyperaceae and Juncaceae in South Africa. Lindberg (1958) also cites records on Gramineae from the Cape Verde Islands. Usinger (1946) recorded species from Guam on *Rhynchospora corymbosa* and *Scleria margaritifera*; Maldonado (1969) recorded *carmelitanus* on *Cyperus rotundus* and *Cajanus cajan* in Puerto Rico.

List of species of *Paramixia*

australis, new species. South Africa: Natal, Transvaal, Cape Province

bergrothi Poppius (*Cephalocapsus*), 1914a, p. 90. **New Combination.** Madagascar.

brunnescens Usinger (*Orthotylellus*), 1946, pp. 81–82. **New Combination.** Guam.

carmelitanus Carvalho (*Rhinocloa*), 1948, p. 8. **New Combination.** Tropical America.

clypealis Poppius (*Cephalocapsus*), 1914a, pp. 90–91. **New Combination.** Malawi.

femoralis Poppius (*Cephalocapsus*), 1914a, pp. 89–90. **New Combination.** Malawi.

howanus Poppius (*Cephalocapsus*), 1914a, p. 89. **New Combination.** Madagascar.

minuta* Poppius (*Troitskiella*), see *Paramixia suturalis* Reuter **New Synonymy.

nigra Poppius (*Schroederiella*), 1914a, p. 88. Kilimanjaro.

pallescens Usinger (*Orthotylellus*), 1946, pp. 80–81. **New Combination.** Guam.

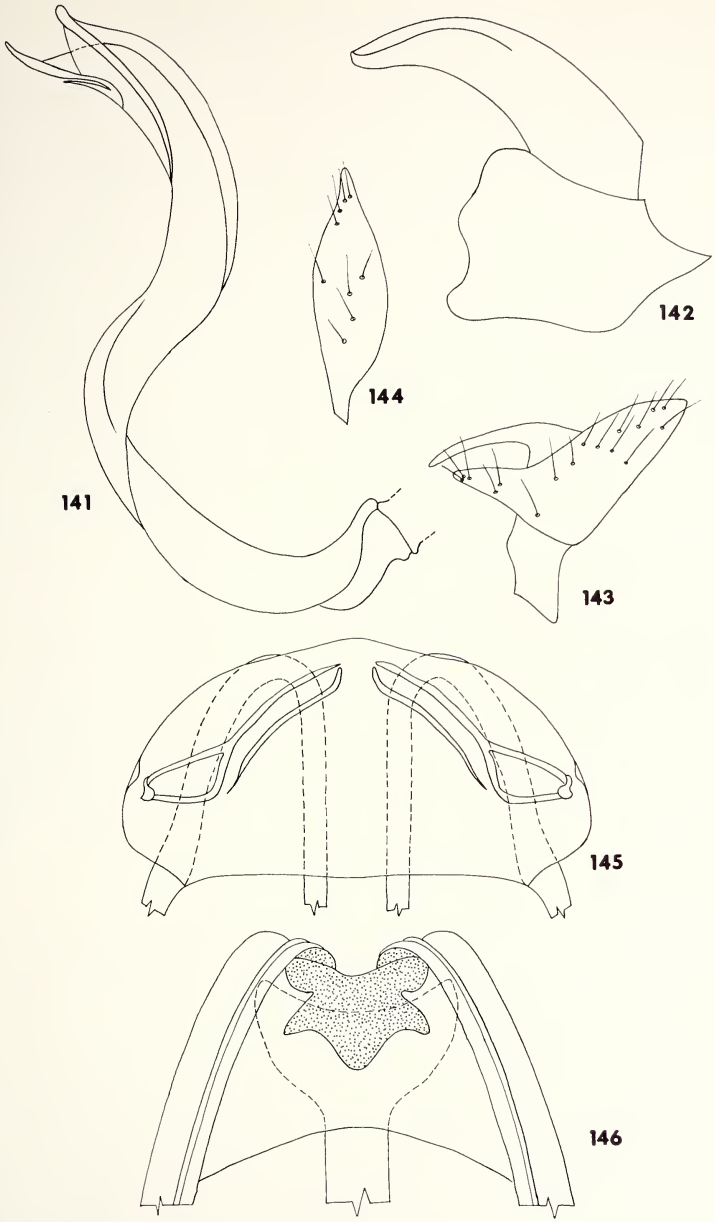
rufescens Usinger (*Orthotylellus*), 1946, pp. 79–80. **New Combination.** Guam.

samoanus Knight (*Orthotylellus*), 1935, p. 207. **New Combination.** Samoa.

suturalis Reuter (*Paramixia*), 1900, p. 264. Southern Mediterranean; Africa.

→

FIGS. 141–146. Hallodapini, *Acrorrhinium* male and female genitalia. Fig. 141. Lateral view of vesica, *A. muntingi*. Fig. 142. Phallotheca, *idem*. Fig. 143. Left clasper, *idem*. Fig. 144. Right clasper, *idem*. Fig. 145. Sclerotized rings, *A. drakensbergensis*. Fig. 146. Posterior wall, *idem*.


141
142
143
144
145
146

Paramixia australis, new species
Figures 91, 332–334

Sthenarus basalis Carvalho, Dutra, and Becker, 1960 (*nec* Poppius), pp. 452–453.

MACROPTEROUS MALE: Basic coloration black; distal four-fifths of antennal segment 1, antennal segment 2, distal third of labial segment 1, ventral margins of bucculae, ventral margins of prothoracic pleuron, posterior margin of mesosternum, all coxae distally, all trochanters, distal fifth of all femora, all tibiae, all tarsal segments 1 and 2, and dorsal margin of left clasper tan; tibial spines with black bases forming narrow bands; veins of membrane reddish.

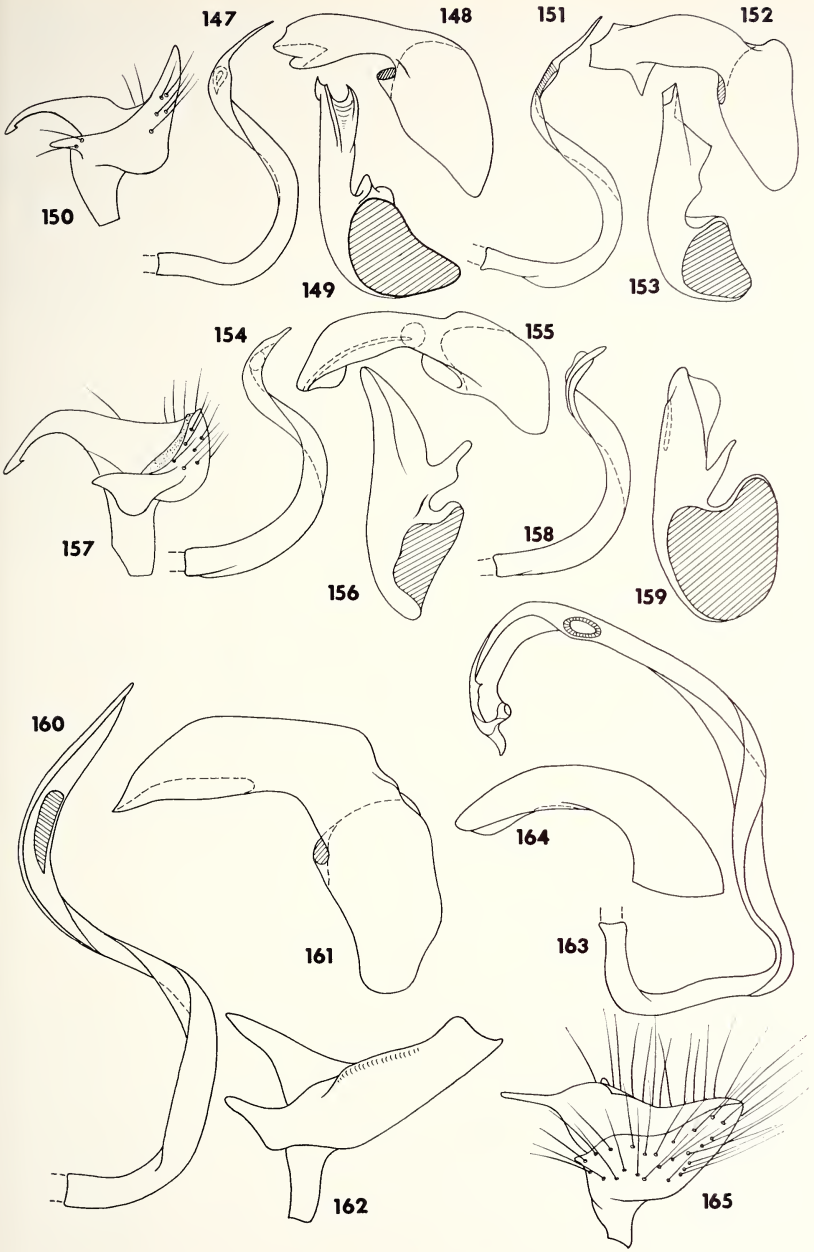
Body and appendages polished, shining; dorsum faintly transversely rugose; coxae mostly pruinose; dorsum and abdominal venter with reclining golden hairs; dorsum and thoracic pleura with decumbent, wooly, sericeous hairs; antennal segment 1 with a fine spine on interior surface, segments 2, 3, and 4 with reclining, short, dull pubescence; genae below eyes with several long erect hairs; femora with short decumbent hairs and a few long erect hairs, particularly on ventral surfaces.

Head declivous, roughly triangular in dorsal view; clypeus flattened; eyes rather large, protuberant, contiguous with anterior margin of pronotum; vertex nearly as wide as anterior margin of pronotum, posterior margin straight, finely carinate; vertex and frons weakly convex; antennae inserted just above ventral margins of eyes; antennal segment 1 slightly enlarged, segment 2 cylindrical, about equal to diameter of segment 1, segments 3 and 4 about two-thirds diameter of segment 2; labium just surpassing metacoxae at

---

→

FIGS. 147–165. Hallodapini male genitalia. Fig. 147. Lateral view of vesica, *Carinogulus transvaalensis*. Fig. 148. Lateral view of phallotheca, *idem*. Fig. 149. Ventral view of phallotheca, *idem*. Fig. 150. Left clasper, *idem*. Fig. 151. Lateral view of vesica, *Carinogulus hobohmi*. Fig. 152. Lateral view of phallotheca, *idem*. Fig. 153. Ventral view of phallotheca, *idem*. Fig. 154. Lateral view of vesica, *Carinogulus varii*. Fig. 155. Lateral view of phallotheca, *idem*. Fig. 156. Ventral view of phallotheca, *idem*. Fig. 157. Left clasper, *idem*. Fig. 158. Lateral view of vesica, *Carinogulus kochi*. Fig. 159. Ventral view of phallotheca, *idem*. Fig. 160. Lateral view of vesica, *Formicopsella regneri*. Fig. 161. Phallotheca, *idem*. Fig. 162. Left clasper, *idem*. Fig. 163. Lateral view of vesica, *Hallodapus albofasciatus*. Fig. 164. Phallotheca, *idem*. Fig. 165. Left clasper, *idem*.


147
148
151
152
150
149
153
154
155
157
156
158
159
160
164
161
163
162
165

trochanteral joint; pronotum with anterior margin nearly straight, lateral margins convexly rounded anteriorly, nearly straight on posterior three-fourths, posterior margin nearly straight across scutellum, evenly rounded laterally; pronotum slightly convex, lateral margin one-third distance posteriorly with a long, erect, slender spine; scutellum weakly convex; lateral corial margins convex; cuneal incisure shallow; cuneus and membrane declivous; membrane with two cells; legs rather short; all tibiae with rows of tiny, closely-spaced spines; tibial spines weak on protibiae, heavier and arranged in groups on mesotibiae and metatibiae; metatarsal segments 1, 2, and 3 subequal in length; parempodia fleshy, convergent apically, recurved; pulvilli minute.

MEASUREMENTS: Total length 2.28, maximum width 1.00, length head .20, width head .64, interocular space .32, length pronotum .32, width pronotum .84, length scutellum .40, width scutellum .52, length corium 1.04, length clavus .84, length cuneus .40, width cuneus .28, length claval commissure .44, distance apex commissure-apex membrane .96, length metatibia 1.24; length antennal segments 1—.20, 2—.80, 3—.44, 4—.42; length labial segments 1—.32, 2—.32, 3—.23, 4—.30.

MALE GENITALIA: Figures 332–334.

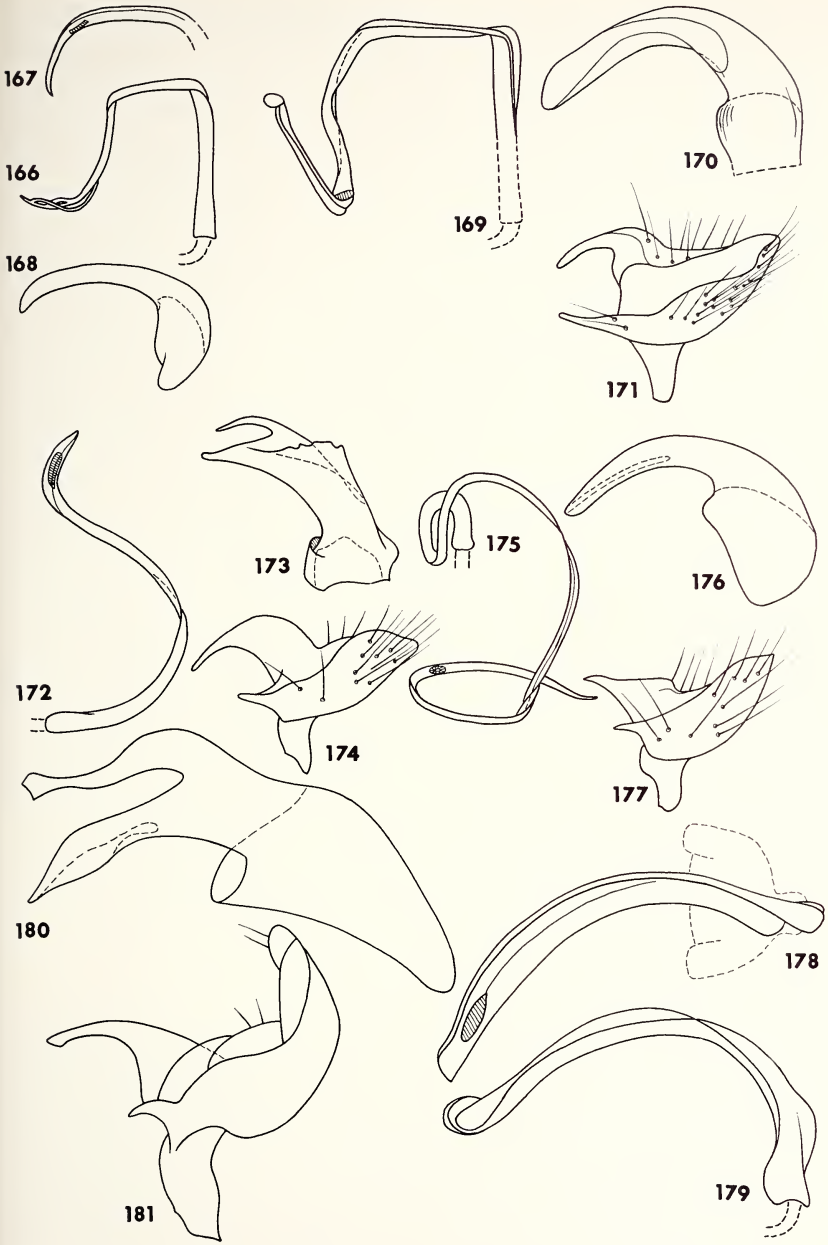
MACROPTEROUS FEMALE: Very similar to male; antennal proportions somewhat different (see generic discussion).

FEMALE GENITALIA: Posterior wall a simple sclerotized plate without evaginated posterior margin.

HOLOTYPE: Macropterous ♂, SOUTH AFRICA: *Cape Province*, Kirstenbosch Gardens, Cape Town, 29 Jan. 1968, J.A.&S. Slater, T. Schuh, M. Sweet (Adults and nymphs on *Cyperus rotundus* L.) (SANC).

→

FIGS. 166–181. Hallodapini male genitalia. Fig. 166. Lateral view of vesica, *Hallodapus pseudosimilis*. Fig. 167. Apex of vesica, *idem*. Fig. 168. Phallotheca, *idem*. Fig. 169. Lateral view of vesica, *Hallodapus quadrimaculatus*. Fig. 170. Phallotheca, *idem*. Fig. 171. Left clasper, *idem*. Fig. 172. Lateral view of vesica, *Hallodapus similis*. Fig. 173. Phallotheca, *idem*. Fig. 174. Left clasper, *idem*. Fig. 175. Lateral view of vesica, *Hallodapus transvaalensis*. Fig. 176. Phallotheca, *idem*. Fig. 177. Left clasper, *idem*. Fig. 178. Dorsal view of vesica, *Pangania fasciatipennis*. Fig. 179. Lateral view of vesica, *idem*. Fig. 180. Phallotheca, *idem*. Fig. 181. Left clasper, *idem*.

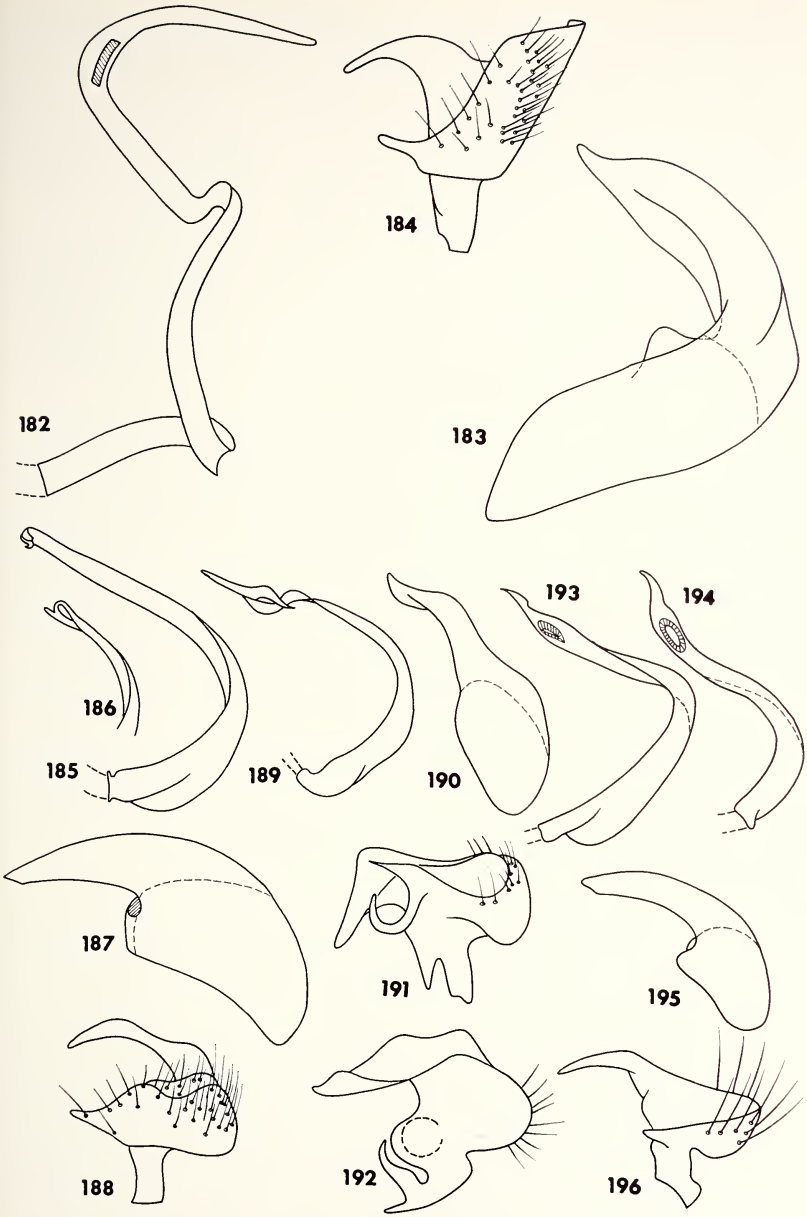

167
166
168
169
170
171
172
173
174
175
176
177
178
179
180
181

PARATYPES: All specimens macropterous. *Cape Province*—7 ♂♂, 16 ♀♀, same data as holotype; 2 ♂♂, 6 ♀♀, Cape Peninsula, Noordhoek Beach (Adults on *Scirpus dioecus* Boeck.); 1 ♂, Brackenhill Falls, 6 mi. E. Knysna, 11 Feb. 1968; 1 ♀, Citrusdal, Oliphants River, 26 Jan. 1968; 1 ♀, Elands Height, 15 miles SW Mt. Fletcher, 9.III.51 (Brinck and Rudebeck); 2 ♀♀, just S. Outiniqua Pass Summit, S. of Oudtshoorn, 7 Feb. 1968; 1 ♂, Rondvlei near Knysna, 8 Feb. 1968; 1 ♂, 1 ♀, Schoemannspoort, 12 mi. N. Oudtshoorn, 7 Feb. 1968. *Natal*—1 ♂, 4 ♀♀, 20 mi. S. Durban, Illovo River mouth, 17 Apr. 1968; 1 ♂, 1 ♀, 28 mi. WSW Durban, Stony Hill, 17 Apr. 1968; 5 ♂♂, 1 ♀, Eshowe, 15 Nov. 1967; 1 ♂, *idem*, at light; 2 ♂♂, 1 ♀, Mooi R.; 20 ♂♂, 19 ♀♀, Mtunzini Plantation, 5 mi. N. Mtunzini, 15 Nov. 1967 (Adults and nymphs on *Scirpus costatus* Boeck.); 2 ♂♂, Pietermaritzburg Burrow, Town Bush, elevation 3100 ft., 15 Apr. 1968; 1 ♀, Pinetown; 5 ♂♂, 26 ♀♀, Port Shepstone, 5.97; 7 ♂♂, 6 ♀♀, St. Lucia Estuary, 14 Nov. 1967 (Adults and nymphs on *Cyperus latifolius* Pair.); 1 ♂, Umbilo, Durban, 2.1.27 (Bevis); 1 ♀, Umgeni, 30.1.18 (Merve); 4 ♀♀, 5 mi. N. Umkomaas, 17 Apr. 1968; 4 ♀♀, Weenen, XI-XII.1923 (Thomasset). *Transvaal*—6 ♂♂, 6 ♀♀, 13 mi. S. Barberton, 5300 ft. elevation, 24 Mar. 1968 (Adults and nymphs on *Cyperus distans* L.); 8 ♂♂, 6 ♀♀, Bridal Veil Falls, Sabie, 29 Nov. 1967; 8 ♂♂, 20 ♀♀, Hartebeespoort Dam, 20 mi. W. Pretoria, 30 Oct. 1967; 4 ♀♀, Kruger Nat. Park, 9 mi. SSW Skukuza, 26 Apr. 1968; 1 ♀, Kruger Nat. Park, 3 mi. E. Skukuza Camp, 25 Apr. 1968; 2 ♀♀, Lake Chrissie, 6 Nov. 1967; 1 ♂, 5 ♀♀, Letaba Valley, Tzaneen Dist., XII-10-13-1958 (Capener); 1 ♂, 1 ♀, Louis Trichardt, Jan. & Feb. 1928 (Lawrence); 2 ♀♀, 10–15 miles SE Lydenburg, 7.V.51, 6500 ft. (Brinck and Rudebeck); 1 ♂, 1 ♀, 5 mi. N. Lydenburg, 30 Nov. 1967; 1 ♂, 10 mi. E. Machadodorp, 30 Nov. 1967, at

---

→

FIGS. 182–196. Hallodapini male genitalia. Fig. 182. Lateral view of vesica, *Skukuza slateri*. Fig. 183. Phallotheca, *idem*. Fig. 184. Left clasper, *idem*. Fig. 185. Lateral view of vesica, *Systellonotus brincki*. Fig. 186. Apex of vesica, *idem*. Fig. 187. Phallotheca, *idem*. Fig. 188. Left clasper, *idem*. Fig. 189. Lateral view of vesica, *Trichophorella australis*. Fig. 190. Phallotheca, *idem*. Fig. 191. Lateral view of left clasper, *idem*. Fig. 192. Dorsal view of left clasper, *idem*. Fig. 193. Lateral view of vesica, *Trichophthalmocapsus hessei*. Fig. 194. Lateral view of vesica, *Trichophthalmocapsus australis*. Fig. 195. Phallotheca, *idem*. Fig. 196. Left clasper, *idem*.


182
184
183
186
185
189
190
193
194
187
191
195
188
192
196

light; 2 ♂♂, 2 ♀♀, 15 mi. NE Machadodorp, 4500 ft. elevation, 26–27 Mar. 1968; 6 ♂♂, 20 ♀♀, top Magoebaskloof, 6000 ft., 12 Dec. 1967; 1 ♂, Mariepskop near Klaserie, 6300 ft., 30 Nov. 1967; 1 ♀, 1.7 mi. N. Mooketsi, 13 Dec. 1967; 1 ♀, Pretoria, 3.II.1955 (Vari); 1 ♀, Sabie, 29 Nov. 1967; 26 ♂♂, 24 ♀♀, Little Sabie River, Sabie, 29 Nov. 1967; 1 ♀, 6 mi. N. Warmbaths, 7 Dec. 1967 (SANC, TM, SAM, BM[NH], USNM, HM, JAS, RTS).

ADDITIONAL SPECIMENS: *Cape Province*—7 nymphs (in alcohol), same data as holotype. *Natal*—17 nymphs (in alcohol), Mtunzini Plantation, 5 mi. N. Mtunzini, 15 Nov. 1967 (Adults and nymphs on *Scirpus costatus* Boeck.); 8 nymphs, St. Lucia Estuary, 14 Nov. 1967 (Adults and nymphs on *Cyperus latifolius* Pair.). *Transvaal*—27 nymphs (in alcohol), Little Sabie River, Sabie, 29 Nov. 1967 (RTS).

This species is named for its occurrence in southern Africa.

Paramixia australis is usually nearly all black, but may have extensive reddish markings, particularly on the hemelytra. It can be separated from *suturalis*, the only other described species of *Paramixia* from South Africa, as follows: the basic coloration is generally black; the proximal fifth of antennal segment 1 is black, and the distal four-fifths tan; the spines of the metatibiae have black bases; and, the vesica forms a smooth "C".

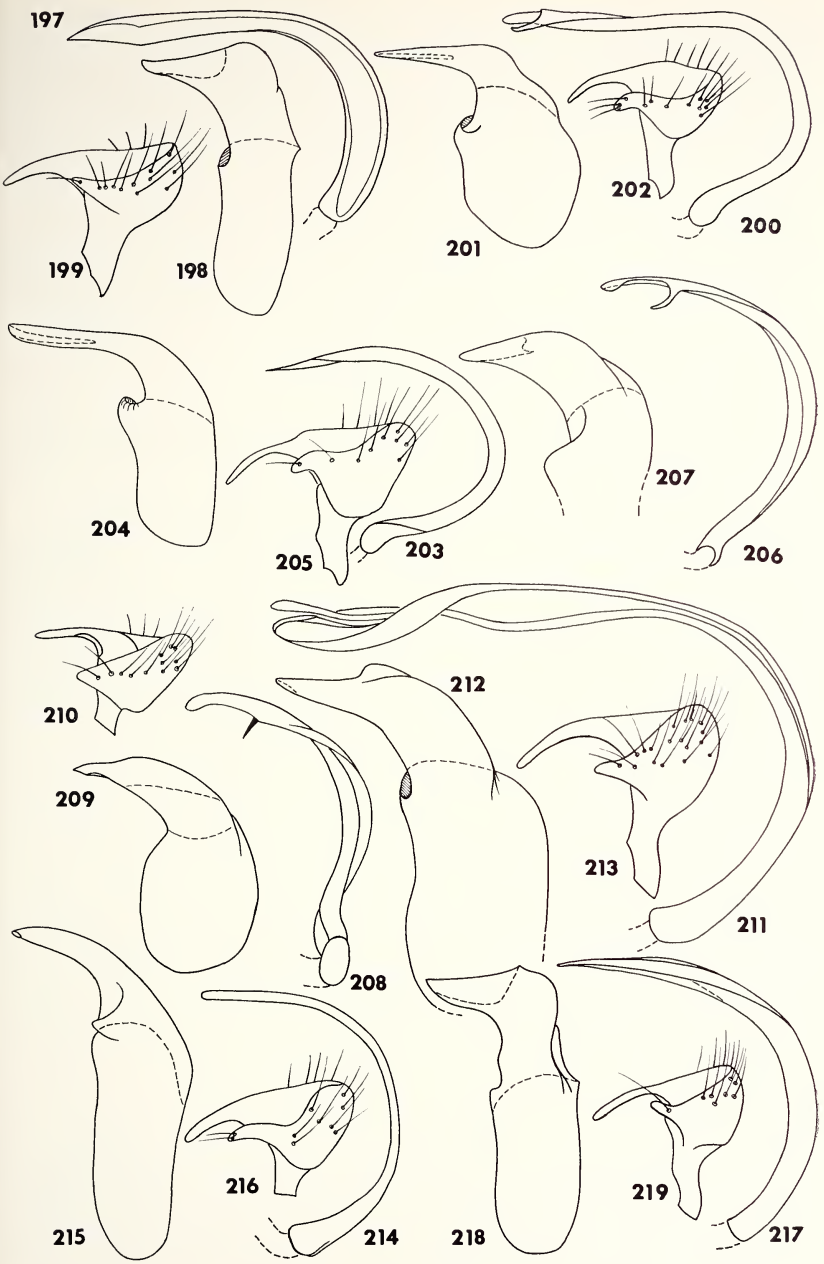
Carvalho et al. (1960) incorrectly recorded *australis* from South Africa as *Sthenarus basalis* Poppius.

The distribution of *australis* is sympatric with that of *suturalis*, where *suturalis* occurs, and also extends over most of the remainder

---

→

FIGS. 197–219. Leucophoropterini, *Karoocapsus* male genitalia. Fig. 197. Lateral view of vesica, *K. bifasciatus*. Fig. 198. Phallotheca, *idem*. Fig. 199. Left clasper, *idem*. Fig. 200. Lateral view of vesica, *K. brunneus*. Fig. 201. Phallotheca, *idem*. Fig. 202. Left clasper, *idem*. Fig. 203. Lateral view of vesica, *K. middelburgensis*. Fig. 204. Phallotheca, *idem*. Fig. 205. Left clasper, *idem*. Fig. 206. Lateral view of vesica, *K. flavomaculatus*. Fig. 207. Phallotheca, *idem*. Fig. 208. Lateral view of vesica, *K. obscurus*. Fig. 209. Phallotheca, *idem*. Fig. 210. Left clasper, *idem*. Fig. 211. Lateral view of vesica, *K. occidentalis*. Fig. 212. Phallotheca, *idem*. Fig. 213. Left clasper, *idem*. Fig. 214. Lateral view of vesica, *K. pulchrus*. Fig. 215. Phallotheca, *idem*. Fig. 216. Left clasper, *idem*. Fig. 217. Lateral view of vesica, *K. trifasciatus*. Fig. 218. Phallotheca, *idem*. Fig. 219. Left clasper, *idem*.


197
199
198
201
202
200
204
205
203
207
206
210
212
209
213
211
208
215
216
214
218
219
217

of the low and midaltitude regions of South Africa, although the Kalahari, Karoo, and South West Africa have not been well enough collected to know if it occurs there. Before we began our collecting in 1967–1968 only 52 specimens from 12 localities were to be found in all available collections. It is now known that *australis* is one of the most common and widespread species of Phylinae in South Africa.

Known host plants for this species include *Scirpus dioecus* Boeck., *Scirpus costatus* Boeck., *Cyperus rotundus* L., *Cyperus latifolius* Pair., and *Cyperus distans* L. (see also discussion under *P. suturalis*).

Paramixia suturalis Reuter

Figures 92, 335

Paramixia suturalis Reuter, 1900, p. 264.—Lindberg, 1958, p. 105.—Carvalho, 1958a, p. 86.—Linnavuori, 1961, p. 23.—Wagner, 1970a, pp. 4–5.

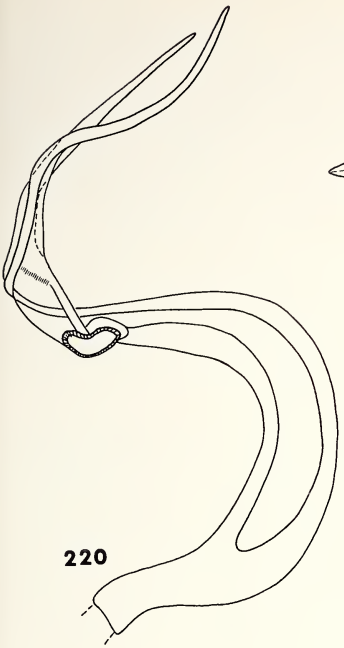
Troitskiella minuta Poppius, 1914a, pp. 81–82. **New Synonymy.**

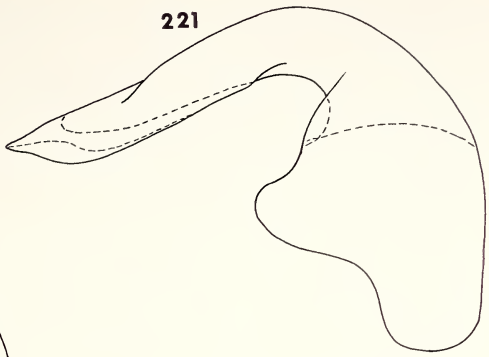
Paramixia suturalis can be recognized by the following characters: basic coloration usually light yellow green, some specimens medium brown; antennal segment 1 entirely brownish black; metatibial spines without dark bases, tibiae unicolorous tan; and, vesica C-shaped, but rather sharply bent subapically, apical section "wavy" (Figure 335). The male genitalia of specimens from South Africa agree very closely in structure with those of specimens from the Cape Verde Islands (Lindberg, 1958) and the Nile Valley.

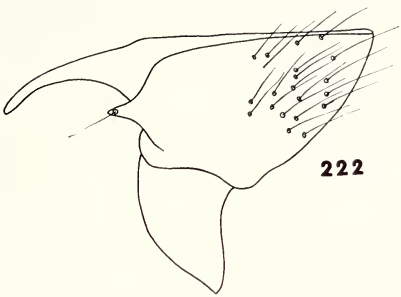
Wagner (1970a) redescribed *Paramixia suturalis* and provided illustrations. As noted above, Wagner's (1970a) interpretation of the structure of the parempodia in *Paramixia* was incorrect and therefore his illustrations of these structures are not accurate. Wagner examined 3 specimens of *suturalis* from the Helsinki Museum, from which Reuter (1900) apparently originally described the species, but did not designate a lectotype. I have selected a male bearing the following labels as the lectotype: "Vall, Nil."; "spec. typ. Reuter"; "Mus. Zool. H:fors, Spec. typ. No. 3443, *Paramixia*

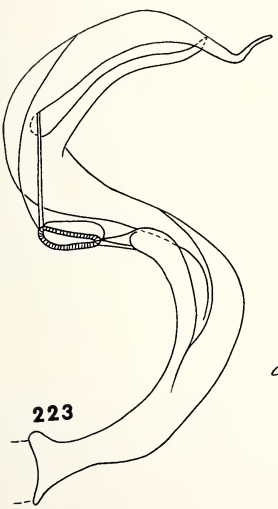
→

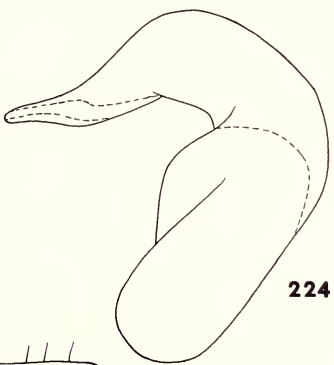
FIGS. 220–225. Phylini, *Austropsallus* male genitalia. Fig. 220. Lateral view of vesica, *Austropsallus drakensbergensis*. Fig. 221. Phallotheca, *idem*. Fig. 222. Left clasper, *idem*. Fig. 223. Lateral view of vesica, *Austropsallus middelburgensis*. Fig. 224. Phallotheca, *idem*. Fig. 225. Left clasper, *idem*.

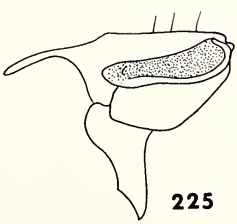

220


221


222


223


224


225

suturalis Reut.". I have also added the label "LECTOTYPE *Paramixia suturalis* Reuter, det. R.T. Schuh."

Examination of the holotype of *Troitskiella minuta* Poppius indicates that the coloration of this species fits well within the range of variation found in *P. suturalis* and that the external morphology and structure of the male genitalia are identical with *suturalis* from the Nile Valley and from South Africa. I am therefore synonymizing *Troitskiella minuta* Poppius with *Paramixia suturalis* Reuter.

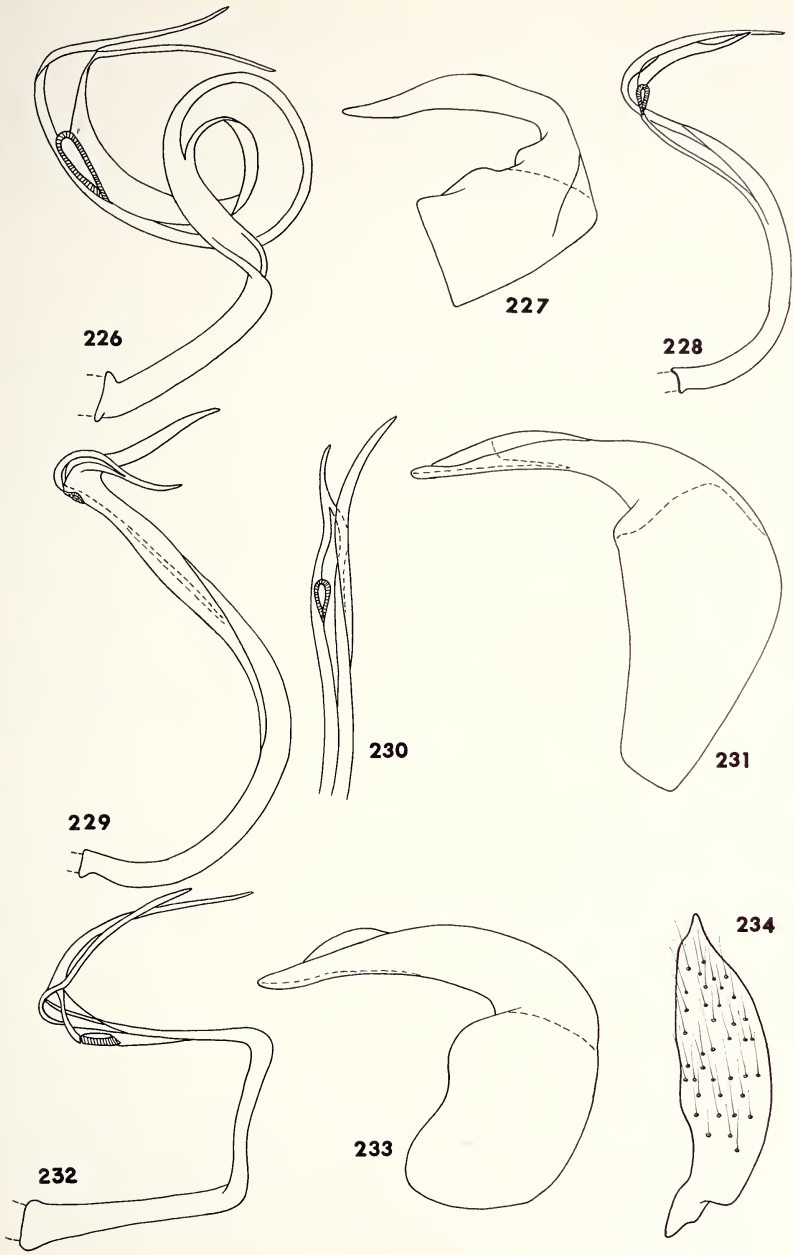
Paramixia suturalis is a primarily tropical species occuring in East and West Africa and extending northward into the southern Mediterranean and southward into southern Africa. In South Africa this species is restricted to the coastal region of Natal, the lowveld of the eastern Transvaal, and from Pretoria north into the interior of the Transvaal.

Lindberg (1958) recorded *suturalis* as occurring on Cyperaceae and Gramineae, and specifically on *Cynodon dactylon.* In South Africa it breeds on *Juncus kraussii* Hochst., *Scirpus costatus* Boeck., and *Cyperus latifolius* Pair. In nearly all situations where I collected *suturalis* in South Africa it was living in association with *Paramixia australis*, *Cymodema basicornis* (Motschulsky), *Cymodema tabida* Spinola, and less commonly with *Cymus waelbroecki* and an additional undescribed species of *Cymus.*

SPECIMENS EXAMINED: *Natal*—1 ♀, Eshowe, 15 Nov. 1967; 1 ♂, 3 ♀♀, Mtunzini Plantation, 5 mi. N. Mtunzini, 15 Nov. 1967 (Adults and nymphs on *Scirpus costatus* Boeck.); 11 ♂♂, 17 ♀♀, St. Lucia Estuary, 14 Nov. 1967 (Adults and nymphs on *Juncus kraussii* Hochst. and *Cyperus latifolius* Pair.). *Transvaal*—1 ♀, Harebeespoort Dam, 20 mi. W. Pretoria, 30 Oct. 1967; 6 ♂♂, 2 ♀♀, Little Sabie River, Sabie, 29 Nov. 1967; 1 ♀, 17 mi. N. Louis Trichardt, 14 Dec. 1967; 1 ♂, Kruger Nat. Park, confluence of Limpopo and Luvuvho Rivers, Pafuri, 7 May 1968; 1 ♂, 1 nymph, Kruger Nat. Park, 8 mi. W. Shingwidzi, Shingwidzi River, 4 May 1968; 1 ♀, top Magoebaskloof, 6000 ft., 12 Dec. 1967 (SANC, HM, BM[NH], JAS, RTS).

→

FIGS. 226–234. Phylini, *Austropsallus* male genitalia. Fig. 226. Lateral view of vesica, *A. albonotum.* Fig. 227. Phallotheca, *idem.* Fig. 228. Lateral view of vesica, *A. senecionus.* Fig. 229. Lateral view of vesica, *A. saniensis.* Fig. 230. Apex of vesica, *idem.* Fig. 231. Phallotheca, *idem.* Fig. 232. Lateral view of vesica, *A. helichrysi.* Fig. 233. Phallotheca, *idem.* Fig. 234. Right clasper, *idem.*


226
227
228
229
230
231
232
233
234

Pilophorus Hahn

Pilophorus Hahn, 1826, p. 22.

This very large genus is poorly represented in Africa, with only one known species. Most described members of the genus are Nearctic and Palearctic, but a large undescribed fauna is present in Southeast Asia. No species of *Pilophorus* are known from the Neotropical Region.

Pilophorus pilosus Odhiambo

Pilophorus pilosus Odhiambo, 1958b, pp. 326–330.

Pilophorus pilosus can be separated from all other South African Miridae by the following combination of characters: the parempodia are fleshy, convergent apically, and recurved; and the dorsum is black with narrow, transverse bands of scale-like, sericeous hairs on the clavus and corium. Odhiambo (1958b) in the original description of this species, provided excellent illustration of the male genitalia and the hemelytra. The type specimens of *pilosus* from Uganda agree very closely with all specimens known from South Africa.

No host or ecological information is available for *pilosus*.

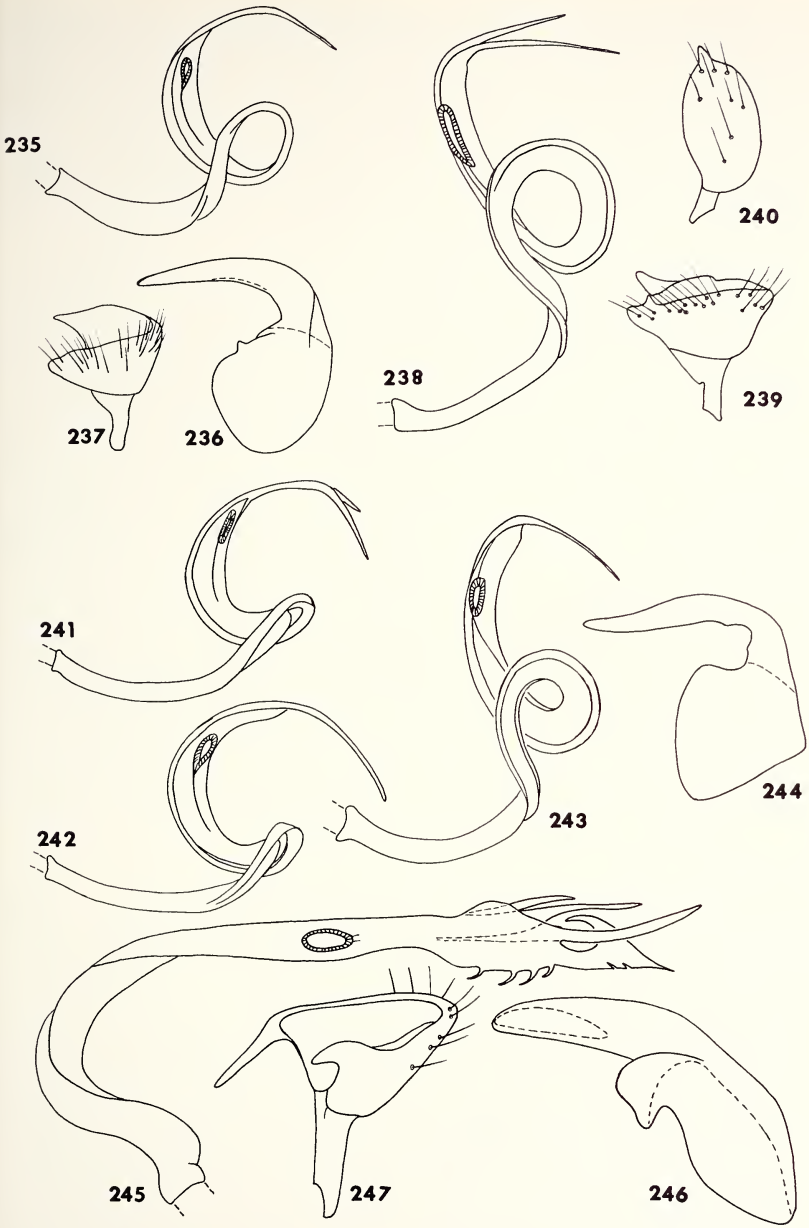
SPECIMENS EXAMINED: Natal—4 macropterous ♂♂, 1 macropterous ♀, Port Shepstone, 5.97. *Transvaal*—1 ♀, Letaba Valley, Tzaneen Dist., XII-20-1962 (Capener) (BM[NH], JAS, RTS).

ZOOGEOGRAPHY

No attempts have been made to analyze the zoogeography of the Miridae of southern Africa. In the following discussion I have tried to bring together those factors which seem to be most important in influencing the distributional patterns of the Orthotylinae and Phylinae in this region.

→

FIGS. 235–247. Phylini male genitalia. Fig. 235. Lateral view of vesica, *Capecapsus tradouwensis*. Fig. 236. Phallotheca, *idem*. Fig. 237. Left clasper, *idem*. Fig. 238. Lateral view of vesica, *Coatonocapsus transvaalensis*. Fig. 239. Left clasper, *idem*. Fig. 240. Right clasper, *idem*. Fig. 241. Lateral view of vesica, *Coatonocapsus johannsmeieri*. Fig. 242. Lateral view of vesica, *Coatonocapsus pallidus*. Fig. 243. Lateral view of vesica, *Coatonocapsus sweeti*. Fig. 244. Phallotheca, *idem*. Fig. 245. Lateral view of vesica, *Denticulophallus adenandrae*. Fig. 246. Phallotheca, *idem*. Fig. 247. Left clasper, *idem*.


235
240
238
239
237
236
241
244
243
242
245
247
246

The Miridae as a group are largely phytophagous, or if predatory they are often host specific on a given species of phytophagous insect. Thus, one would expect the distributions of host plants to be important in considering the distributions of mirids. Aside from edaphic factors, it seems that precipitation is the most important single factor affecting plant distributions (Stuckenberg, 1969) and therefore it must be important in determining the distributions of the Miridae in at least an indirect way.

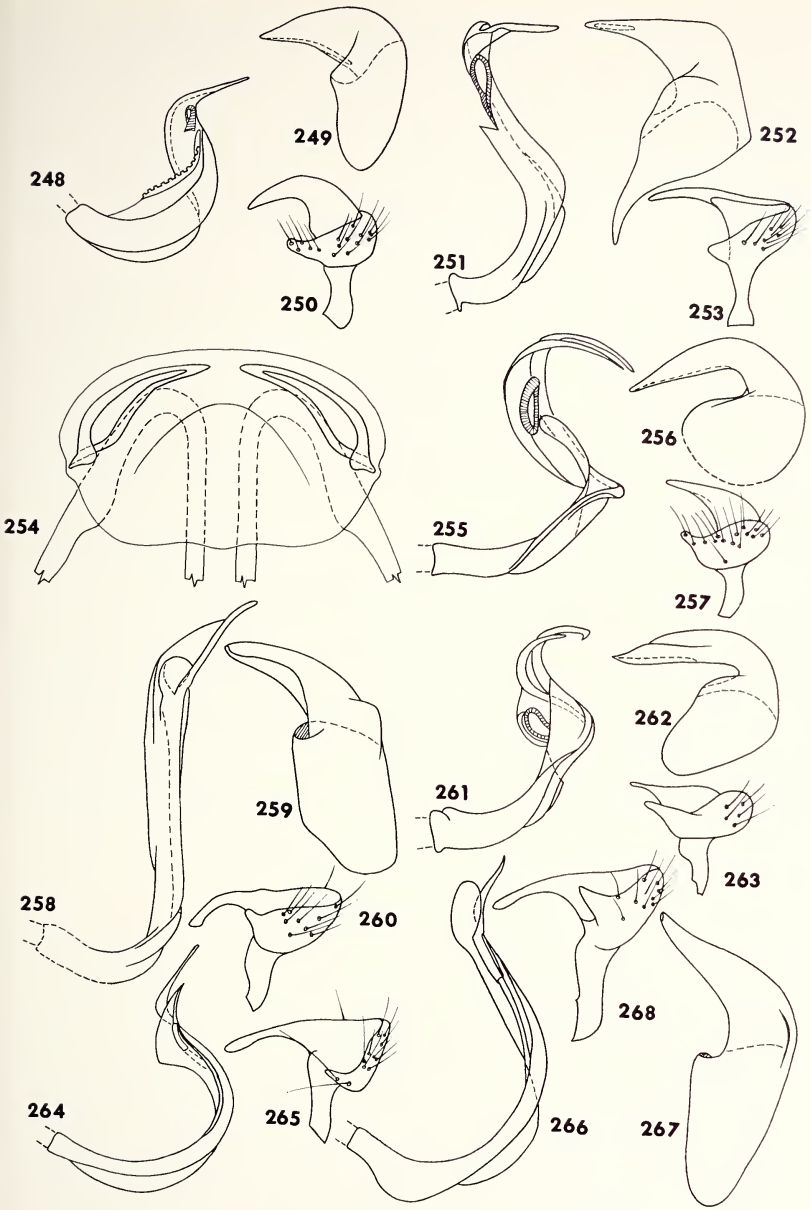
As pointed out by Stuckenberg (1969), the South African flora can be divided into three basic components which are roughly correlated with the amounts of rainfall and the rainfall regime. These are (1) the "Karoo" and (2) the "tropical and subtropical forest and grassland," which receive most of their precipitation during the summer months, and (3) the "macchia" which receives most of its rainfall during the winter months. Sufficient data do not exist at present to allow for a careful correlation of the distribution of the mirid fauna with the floral types of South Africa, but certainly a strong affinity does exist at least between the endemic Orthotylinae and Phylinae and the almost totally endemic floras of the Southwest Cape (primarily macchia) and the Karoo (see following analyses).

Recently Stuckenberg (1969) has applied H.P. Bailey's (1960) concept of "effective temperature" (denoted as "ET" in the following text) to South Africa and shown that the distributions of snakes and amphibians agree remarkably well with this measure of effective solar radiation. Stuckenberg (1969) points out that in using an effective temperature analysis the biologies of the animals under consideration must be taken into account, especially for those

---

→

FIGS. 248–268. Phylini male and female genitalia. Fig. 248. Lateral view of vesica, *Ellenia obscuricornis*. Fig. 249. Phallotheca, *idem*. Fig. 250. Left clasper, *idem*. Fig. 251. Lateral view of vesica, *Eminoculus drosanthemi*. Fig. 252. Phallotheca, *idem*. Fig. 253. Left clasper, *idem*. Fig. 254. Sclerotized rings, *idem*. Fig. 255. Lateral view of vesica, *Lamprosthenarus* near *sjostedti*. Fig. 256. Phallotheca, *idem*. Fig. 257. Left clasper, *idem*. Fig. 258. Lateral view of vesica, *Lasiolabopella capeneri*. Fig. 259. Phallotheca, *idem*. Fig. 260. Left clasper, *idem*. Fig. 261. Lateral view of vesica, *Lepidocapsus rubrum*. Fig. 262. Phallotheca, *idem*. Fig. 263. Left clasper, *idem*. Fig. 264. Lateral view of vesica, *Macrotylus niger*. Fig. 265. Left clasper, *idem*. Fig. 266. Lateral view of vesica, *Macrotylus hemizygiae*. Fig. 267. Phallotheca, *idem*. Fig. 268. Left clasper, *idem*.


248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268

animals that have an ability to control their environment. Certain taxa in the Orthotylinae and Phylinae (e.g. *Paramixia* and *Pangania*) are obviously restricted by factors other than host plant distributions in that the distributions of the mirid taxa are limited in South Africa, whereas the hosts are much more wide-ranging. This would suggest then, that distributions of at least certain of the Miridae are amenable to an "effective temperature" analysis. In those cases where adequate distributional data are available a positive correlation does seem to exist (see below).

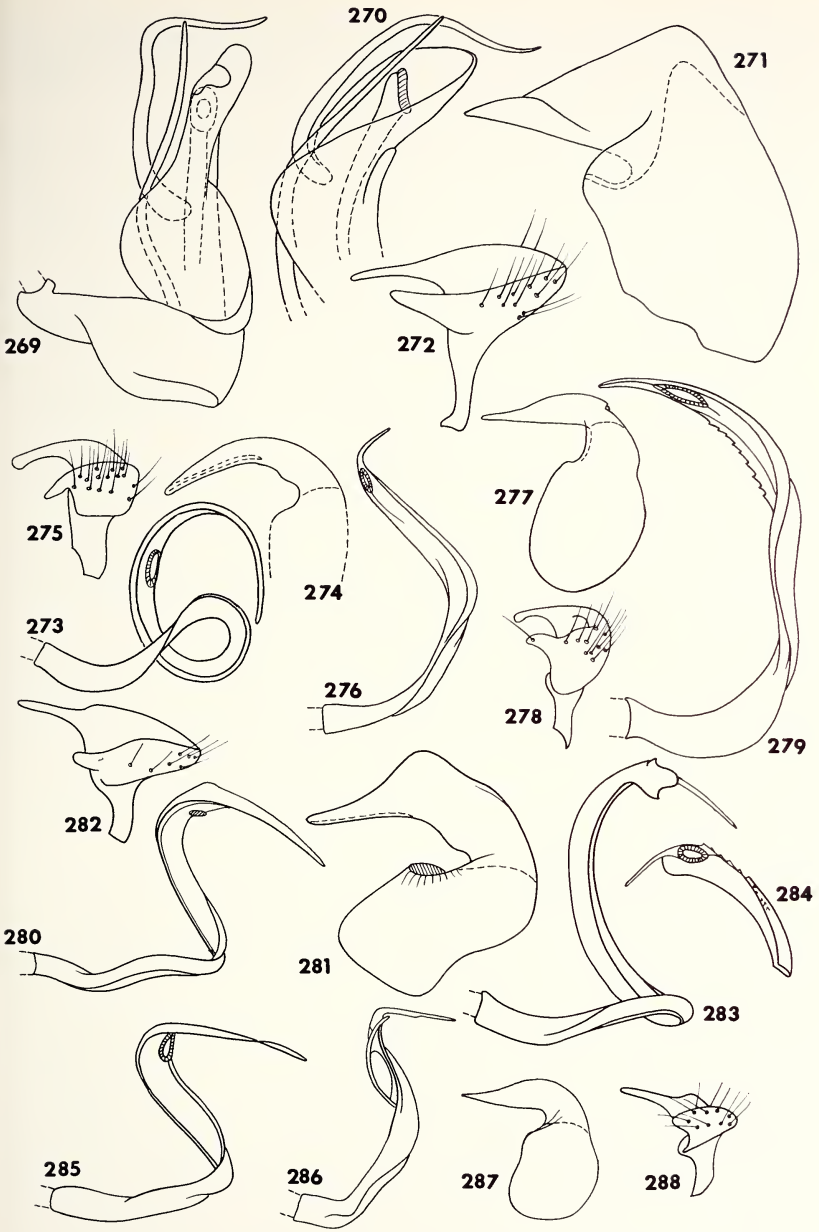
Consideration of the distributions of the Orthotylinae and Phylinae in relation to the long term evolution of the fauna in South Africa is difficult because no fossils exist by which it is possible to determine dates of origin. Even though it is not possible to determine the antiquity of the South African fauna, certain strong correlations appear to exist between the distributions of the Orthotylinae and Phylinae (especially the endemic elements) and the South African paleogenic element.

Stuckenberg (1962) recognized two centers of paleogenic endemicity in South Africa—the Cape Center and the Eastern Highlands Center. In the Orthotylinae and Phylinae group "1a" (see below) in the endemic fauna fits closely with Stuckenberg's Cape Center and group "1b" with his Eastern Highlands Center. Stuckenberg (1962) felt that the Eastern Highlands Center was the node from which many paleogenic groups have spread. He based this conclusion on the ancient nature of the region, which was formed by the pre-Cretaceous Stormberg lava series, and the fact that much of the Cape Center was drowned by Cretaceous seas. The greater

---

→

FIGS. 269–288. Phylini male genitalia. Fig. 269. Lateral view of vesica, *Natalophylus heteromorphae*. Fig. 270. Apex of vesica, *idem*. Fig. 271. Phallotheca, *idem*. Fig. 272. Left clasper, *idem*. Fig. 273. Lateral view of vesica, *Odhiamboella solani*. Fig. 274. Phallotheca, *idem*. Fig. 275. Left clasper, *idem*. Fig. 276. Lateral view of vesica, *Parasciodema albicoxa*. Fig. 277. Phallotheca, *idem*. Fig. 278. Left clasper, *idem*. Fig. 279. Lateral view of vesica, *Parasciodema nigrifemur*. Fig. 280. Lateral view of vesica, *Stoebea barbertonensis*. Fig. 281. Phallotheca, *idem*. Fig. 282. Left clasper, *idem*. Fig. 283. Lateral view of vesica, *Stoebea elginensis*. Fig. 284. Apex of vesica (obverse view), *idem*. Fig. 285. Lateral view of vesica, *Stoebea plettenbergensis*. Fig. 286. Lateral view of vesica, *Widdringtoniola kirstenboschiana*. Fig. 287. Phallotheca, *idem*. Fig. 288. Left clasper, *idem*.


270
271
269
272
275
274
277
273
276
278
279
282
284
280
281
283
285
286
287
288

diversity and morphological specialization of the Orthotylinae and Phylinae in the Cape Center suggests that area as containing the most isolated elements in the South African fauna, and thus possibly being the evolutionary center for these taxa.

Recent evidence from continental drift suggests that Africa has moved northward (Dietz and Holden, 1970) and therefore the region of Mediterranean climate has probably been reduced. Also, Pleistocene pluvials probably created an increased area of Mediterranean climate and allowed for northward expansion of the flora and fauna that is now compressed into the Southwest Cape (see van Zinderen Bakker, 1967). Both of these factors may thus be important in the evolutionary history of the Cape Center and help to explain the tremendous diversity that is found there as well as to eliminate, at least in part, the need for "explosive local evolution" as proposed by Stuckenberg (1962).

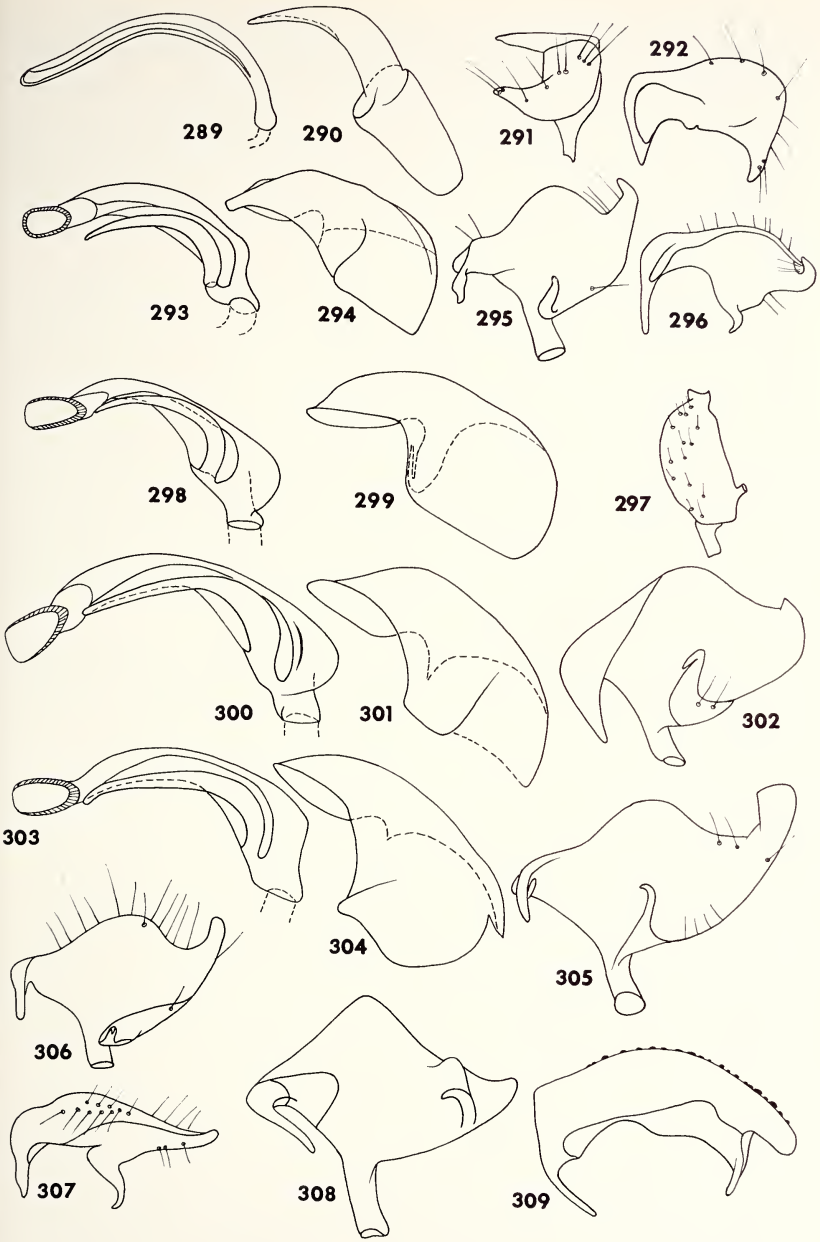
Although certain groups of plants and animals have transantarctic distributions including South Africa, no evidence exists for such a pattern within the Orthotylinae and Phylinae except possibly in the Leucophoropterini (see tribal discussion). This apparent absence of circumaustral distributions may be the result of incomplete taxonomic knowledge, and certainly merits further investigation.

The seasonal distribution of the Miridae in South Africa is at best only poorly understood. Knight (1941; 1968) has confirmed in North America that mirid reproduction generally takes place during the height of growth and flowering in the host. It is at this

---

→

FIGS. 289–309. Phylini, *Parapseudosthenarus* and *Pseudosthenarus* male genitalia. Fig. 289. Lateral view of vesica, *Parapseudosthenarus buchenroederae*. Fig. 290. Phallotheca, *idem*. Fig. 291. Lateral view of left clasper, *idem*. Fig. 292. Dorsal view of left clasper, *idem*. Fig. 293. Lateral view of vesica, *Pseudosthenarus ater* (Cape of Good Hope). Fig. 294. Phallotheca, *idem*. Fig. 295. Posterior view of left clasper, *idem*. Fig. 296. Dorsal view of left clasper, *idem*. Fig. 297. Right clasper, *idem*. Fig. 298. Lateral view of vesica, *P. ater* (Oudtshoorn District). Fig. 299. Phallotheca, *idem*. Fig. 300. Lateral view of vesica, *P. ater* (Calvinia). Fig. 301. Phallotheca, *idem*. Fig. 302. Posterior view of left clasper, *idem*. Fig. 303. Lateral view of vesica, *Pseudosthenarus grossus*. Fig. 304. Phallotheca, *idem*. Fig. 305. Posterior view of left clasper, *idem*. Fig. 306. Posterior view of left clasper, *P. rozeni*. Fig. 307. Dorsal view of left clasper, *idem*. Fig. 308. Posterior view of left clasper, *P. namaquaensis*. Fig. 309. Dorsal view of left clasper, *idem*.


289
290
291
292
293
294
295
296
298
299
297
300
301
302
303
304
305
306
307
308
309

time that the foliage is most succulent. The life cycles of mirids are thus rather short, terminating with the laying of eggs in plant tissue and diapause in the egg stage until the plant begins growing again the following season. Because a distinct summer-winter seasonality exists for most of South Africa and plant growth is correlated with this, it can be predicted that mirid abundance will be greatest in spring and early summer. The limited temporal samples that are available to some extent confirm this, particularly in the Southwest Cape.

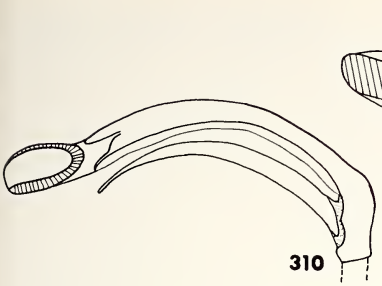
As noted by Stuckenberg (1962), the known distributions of many groups of animals in South Africa may reflect the activity patterns of entomologists. This should be borne in mind in the following analysis. Areas within South Africa for which the mirid fauna has been very poorly sampled include: the dry arid areas of the northwestern Transvaal; the Eastern Cape; the Orange Free State; the Northern Cape; the Great Karoo; Namaqualand; South West Africa; and, the Tsitsikama Forest area. Two areas of particular interest in South Africa, the Southwest Cape and the Drakensberg have received limited collecting, but deserve much greater attention than has been given in the past, particularly in view of the rapid shrinkage of the endemic flora.

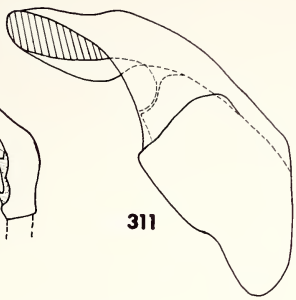
The Orthotylinae and Phylinae of South Africa can be divided into five components: 1) endemic; 2) tropical African; 3) paleotropical; 4) pantropical; and 5) cosmopolitan (including holarctic elements).

1) The following genera are endemic to South Africa (those in parentheses are known only from a limited number of localities and may prove to be more widely distributed): *Austropsallus*, *Carinogulus*, *Coatonocapsus*, *Denticulophallus*, *Eminoculus*, (*Lasiolabopella*), *Karoocapsus*, *Namaquacapsus*, *Natalophylus*, *Neoambonea*, *Nichomachus*, *Parambonea*, *Parapseudosthenarus*, *Parasciodema*, *Pseudambonea*, *Pseudonichomachus*, *Pseudopilophorus*, *Pseudosthenarus*, *Stoebea*, *Widdringtoniola*, and (*Zanchiella*). They occur primarily in the Southwest Cape and the Drakensberg, are morphologically isolated, and have speciated in the region.

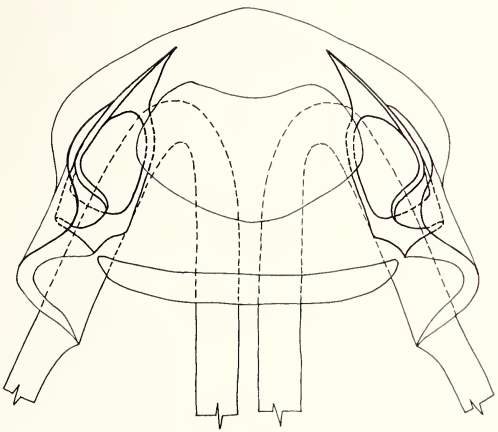
→

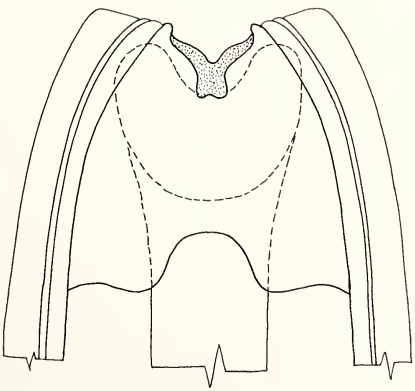
FIGS. 310–314. Phylini, *Pseudosthenarus* male and female genitalia. Fig. 310. Lateral view of vesica, *P. namaquaensis*. Fig. 311. Phallotheca, *idem*. Fig. 312. Ventral view of phallotheca, *idem*. Fig. 313. Sclerotized rings, *idem*. Fig. 314. Posterior wall, *idem*.


310


311


312


313


314

2) The tropical African element in South Africa is composed of the following genera: *Aloea*, *Ambonea*, *Felisacodes*, *Formicopsella*, *Lamprosthenarus*, *Lepidocapsus*, *Myombea*, *Nanniella*, *Odhiamboella*, *Pangania*, *Plagiognathidea*, *Skukuza*, *Systellonotopsis*, *Trichophorella*, and *Trichophthalmocapsus*. Most of these genera are restricted to sub-Saharan Africa, although *Aloea* is known from North Africa and also from the Arabian Peninsula (Linnavuori, personal communication).

3) Genera occurring in South Africa which have paleotropical distributions are *Acrorrhinium*, *Azizus*, *Hallodapus*, *Pseudoloxops*, *Systellonotus*, and *Zanchius*.

4) Pantropical genera in South Africa are *Ellenia* and *Paramixia*.

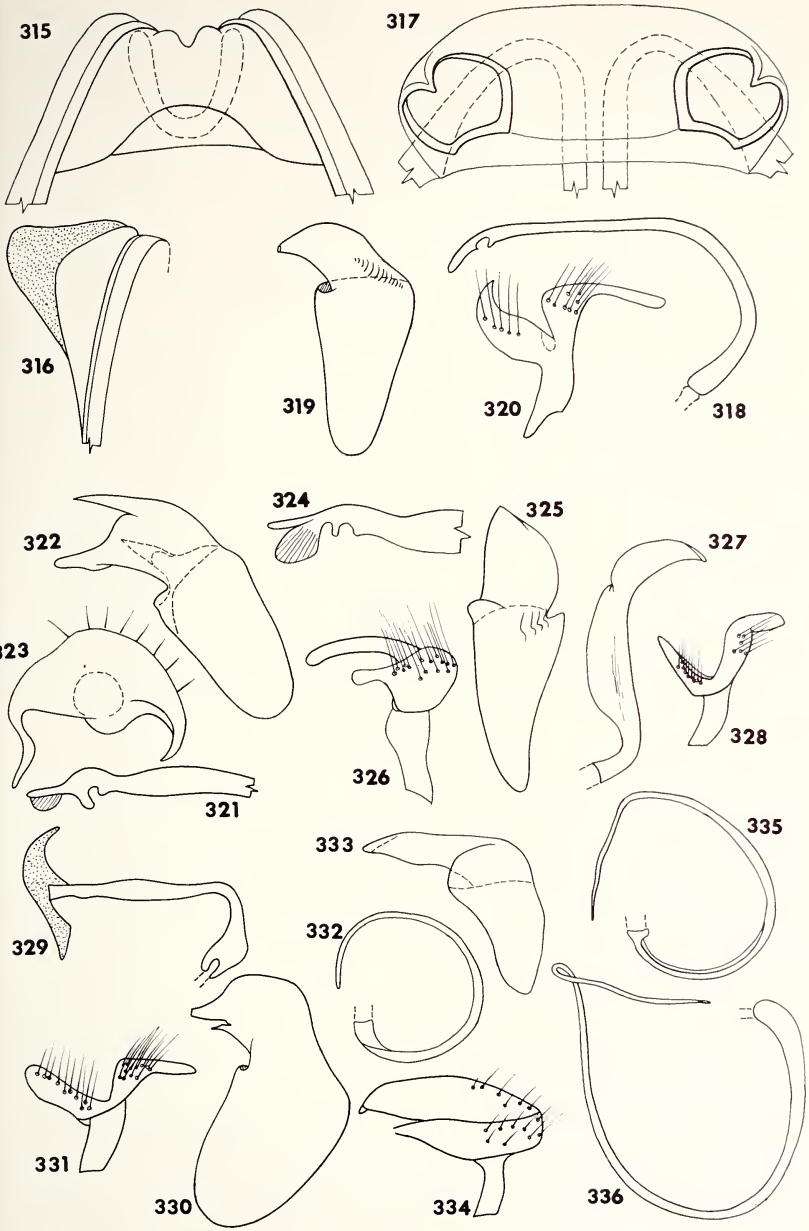
5) Cosmopolitan genera in South Africa are *Cyrtorhinus, Halticus, Macrotylus, Orthotylus, Pilophorus, Psallus, Sthenarus-Campylomma,* and *Tytthus*. Not all of these genera are truly cosmopolitan but all show very wide distributions; some are not presently well known from certain regions, particularly South America and Australia. Such genera as *Orthotylus, Pilophorus, Psallus,* and *Sthenarus-Campylomma* are very large and complex and in need of monographic revision; the presently recorded distributions for these genera may be inaccurate since some may not represent monophyletic units.

The 54 genera of South African Orthotylinae and Phylinae show several more or less distinct distributional patterns within the region. They correlate well with those known for other groups, including the Lygaeidae (see Slater, 1964), other insect groups (see Stucken-

---

→

FIGS. 315–336. Pilophorini male and female genitalia. Fig. 315. Anterodorsal view of posterior wall, *Aloea samueli*. Fig. 316. Lateral view of posterior wall, *idem*. Fig. 317. Sclerotized rings, *idem*. Fig. 318. Lateral view of vesica, *idem*. Fig. 319. Phallotheca, *idem*. Fig. 320. Anterior view of left clasper, *idem*. Fig. 321. Apex of vesica, *Ambonea munroi*. Fig. 322. Phallotheca, *idem*. Fig. 323. Dorsal view of left clasper, *idem*. Fig. 324. Apex of vesica, *Ambonea rustenburgensis*. Fig. 325. Phallotheca, *idem*. Fig. 326. Lateral view of left clasper, *idem*. Fig. 327. Lateral view of vesica, *Parambonea transvaalensis*. Fig. 328. Anterior view of left clasper, *idem*. Fig. 329. Lateral view of vesica, *Neoambonea cynanchi*. Fig. 330. Phallotheca, *idem*. Fig. 331. Anterior view of left clasper, *idem*. Fig. 332. Lateral view of vesica, *Paramixia australis*. Fig. 333. Phallotheca, *idem*. Fig. 334. Left clasper, *idem*. Fig. 335. Lateral view of vesica, *Paramixia suturalis*. Fig. 336. Lateral view of vesica, *Paramixia nigra*.


315
317
316
319
320
318
324
325
322
327
323
326
328
321
333
335
329
332
331
330
334
336

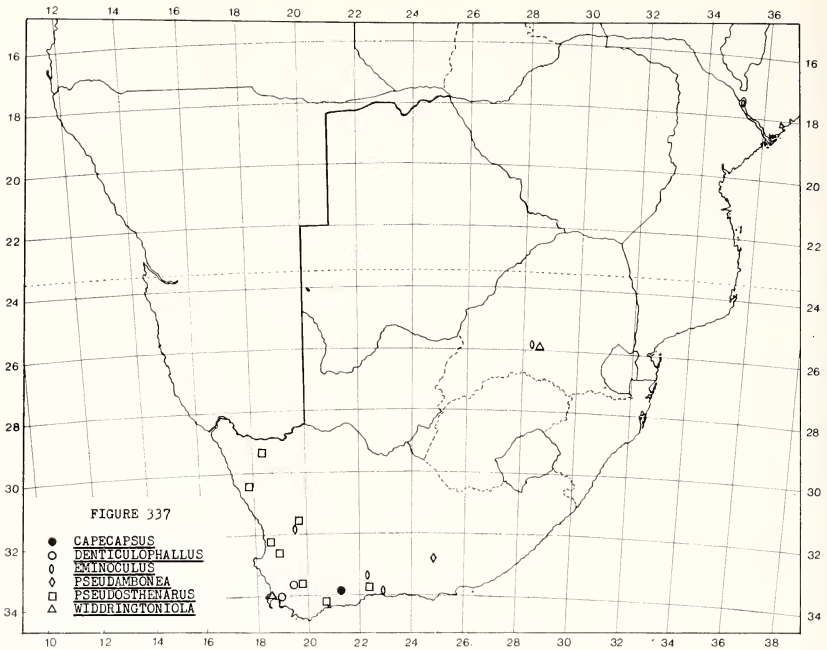


FIG. 337. Distribution of six genera of the Miridae in South Africa (see text for explanation).

berg, 1962) and non-insects including Amphibia and Reptilia (see Poynton, 1964; Stuckenberg, 1969). The five main patterns are discussed below, but must be considered as strictly tentative because of the infant state of the taxonomy of the South African Miridae. Distributions which are anomalous and cannot be analyzed with certainty are discussed under the most appropriate heading or in a general section at the end.

1) The most important pattern is that of endemic species distributions. This is the largest element of the South African fauna, representing 43% of the total genera. It can best be portrayed by division into several subgroups..

a) The most restricted pattern involves taxa confined to the Southwest Cape and Karoo (including portions of Namaqualand) (Figure 337) which are probably adapted to the unique flora of the area. Included genera are: *Eminoculus*, *Denticulophallus*, *Widdringtoniola*, *Pseudosthenarus*, and *Capecapsus*. The first three taxa are known to occur on endemic plant genera. The host of *Pseudo-*

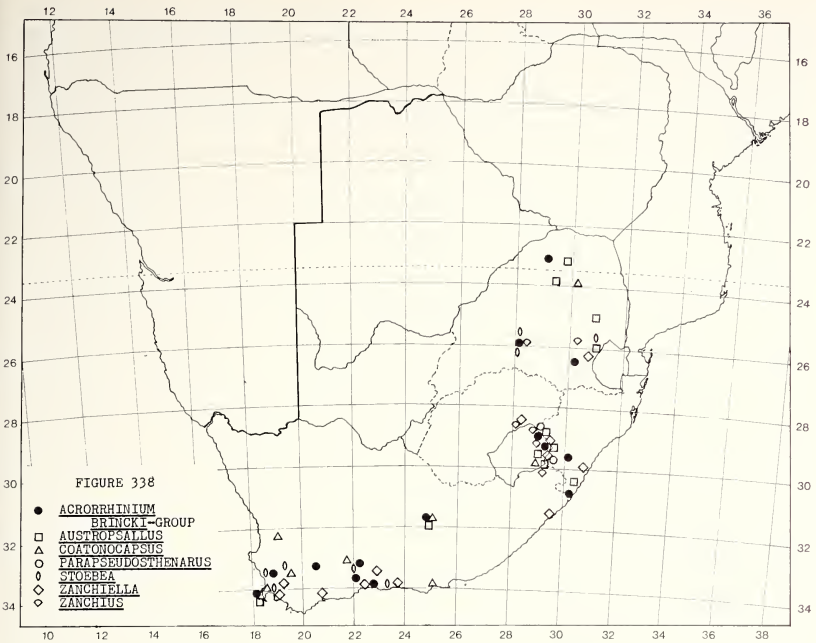


FIG. 338. Distribution of seven genera of the Miridae in South Africa (see text for explanation).

sthenarus is not known, but the most closely related genus, *Parapseudosthenarus*, occurs at midaltitudes on the Drakensberg in Natal on *Buchenroedera* (Leguminosae), a plant genus which is endemic to Africa and almost completely restricted to South Africa (Phillips, 1951). The occurrence of *Widdringtoniola* and *Eminoculus* in the Transvaal is almost certainly the result of transplanting the hosts as ornamentals in Pretoria. The morphological distinctiveness of *Eminoculus* and *Pseudosthenarus* suggests long isolation in South Africa.

b) A pattern of wider distribution is that of endemicity in the Southwest Cape but having strong affinities with the Drakensberg montane region and outlying Southwest Cape floral elements. Genera with this distribution are *Austropsallus*, *Coatonocapsus*, *Stoebea*, *Parapseudosthenarus*, the *Acrorrhinium brincki* group, *Zanchius* (except *Z. nigrolineatus*), and *Zanchiella*. These genera, in large part, show a strong association with the endemic flora of South Africa and particularly with elements of the Southwest Cape Flora (Figure

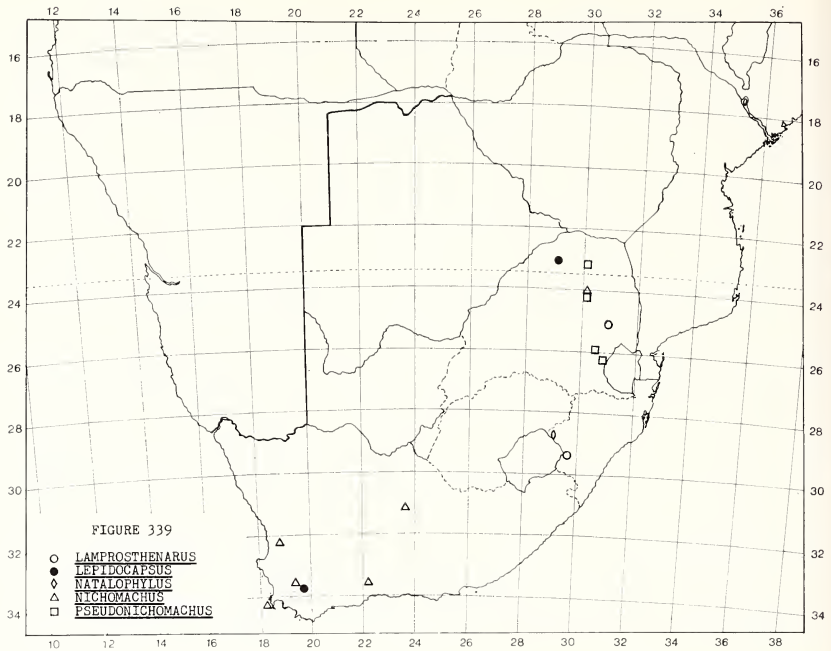


FIG. 339. Distribution of five genera of the Miridae in South Africa (see text for explanation).

338). The occurrence of *Zanchius buddleiae* in the central Transvaal is almost certainly the result of introduction of the host into the National Botanical Gardens in Pretoria. Although the distributions are not well known for all species, at least *Austropsallus drakensbergensis* is generally distributed in the northern Drakensberg, and further collecting will probably substantiate similar occurrences for other taxa. This is in marked contrast to both genera and species in "pattern a" which are not known to occur in the Drakensberg in Natal or the Transvaal. This agrees with many plants endemic to South Africa, where those in the Southwest Cape show very limited distributions and those of the Drakensberg and other outlying Cape Floral elements show much wider distributions.

Zanchius and *Zanchiella* (Figure 338) are related to *Felisacodes* (see pattern 2), but I have placed them here because they appear to have radiated in South Africa and are primarily restricted to the endemic flora.

Nichomachus and *Pseudonichomachus* (Figure 339) have been

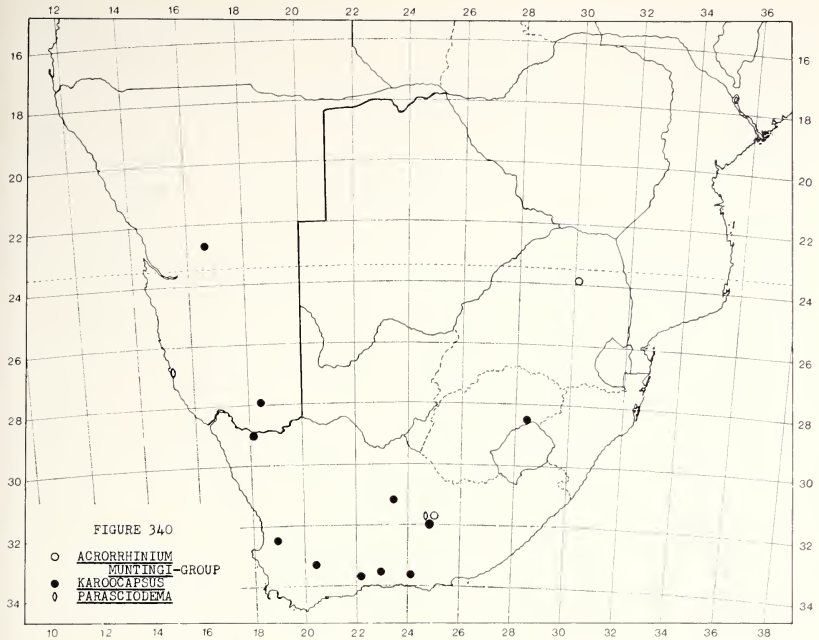


FIG. 340. Distribution of three genera of the Miridae in South Africa (see text for explanation).

collected from localities at relatively high elevations in the Transvaal where there are patches of Southwest Cape related vegetation. The species from the Cape Province are either from the Macchia region proper or from the Karoo.

Natalophylus is known from a single locality on the Drakensberg at about 6000 feet (1875 meters) (Figure 339). Its morphological specialization in the male genitalia relative to the related *Phylus* from Europe, suggests isolation and possible endemism in South Africa. This genus may be dervied from a *Phylus*-like ancestor which arrived in South Africa from the north. The host genus *Heteromorpha* (Umbelliferae) is endemic to Africa (Phillips, 1951).

Lepidocapsus and *Lamprosthenarus* are known from the Southwest Cape and montane regions of South Africa, respectively (Figure 339). Both of these genera also occur in tropical Africa, but at the present time it is not possible to determine with which area they have their strongest affinities.

An additional genus which may have a "type b" distribution is

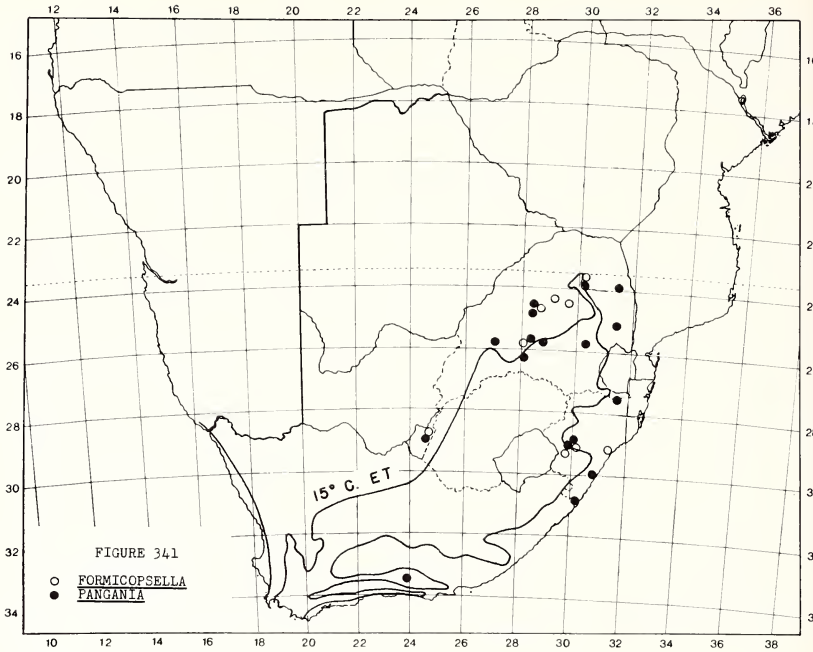


FIG. 341. Distribution of two genera of the Miridae in South Africa (see text for explanation).

Pseudambonea, which is known at present only from a single locality in the eastern Cape, north of Port Elizabeth.

c) A third endemic pattern includes Namaqualand, the Great Karoo, and the dry Southwest Cape (with possible strong affinities with the Little Karoo). Genera having this distribution are *Karoocapsus*, *Parasciodema*, the *Acrorrhinium munting* group, and to some extent *Austropsallus* and *Coatonocapsus*. Figure 340 shows the distribution of these taxa; many of the species are currently known only from Grootfontein, Middelburg, Cape Province (Note: In several cases the same species taken at Middelburg are also recorded from Zomerkomst, Politzi, Transvaal. According to Acocks (1951), the vegetation of these areas is unrelated. The latter localities may be in error.). The only close relatives of *Karoocapsus* are from Australia, which indicates that this unique South African genus is probably a relict.

Namaquacapsus from Namaqualand (Figure 345) possibly has this type of distribution. It shows great morphological specialization,

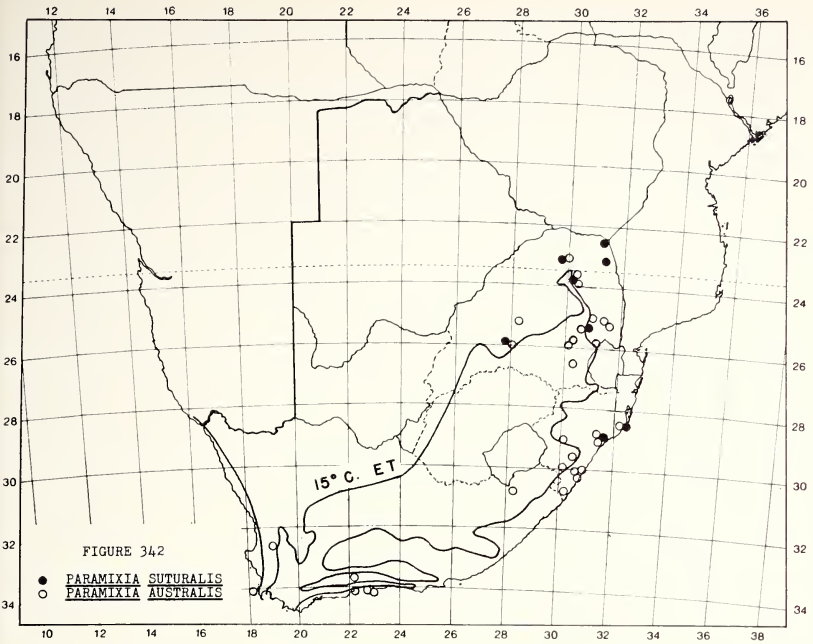


FIG. 342. Distribution of two species of the Miridae in South Africa (see text for explanation).

particularly in the type of vestiture. The distribution of the Halticini, to which *Namaquacapsus* belongs, is however primarily Mediterranean and therefore it is discussed under "pattern 4".

2) A pattern showing primarily tropical affinities in South Africa and more or less confined to an area delimited by the 15° ET isoline includes *Cyrtorhinus*, *Formicopsella*, *Hallodapus*, *Lasiolabopella*, *Macrotylus niger*, *Odhiamboella*, *Pangania*, *Paramixia*, *Pseudoloxops*, *Trichophorella*, *Trichophthalmocapsus*, and *Tytthus*. These genera constitute 23% of the South African fauna. Most of the taxa with this distributional pattern belong to tropical African and paleotropical faunal elements and show greater diversity in tropical Africa than in South Africa (see Figure 343).

Pangania fasciatipennis and *Formicopsella regneri* present well documented examples of this type of distribution (Figure 341). Both species are apparently associated with *Acacia*, particularly *A. karroo*. The distribution of these two mirid species is well defined by the 15° ET isoline despite the wider distribution of their host,

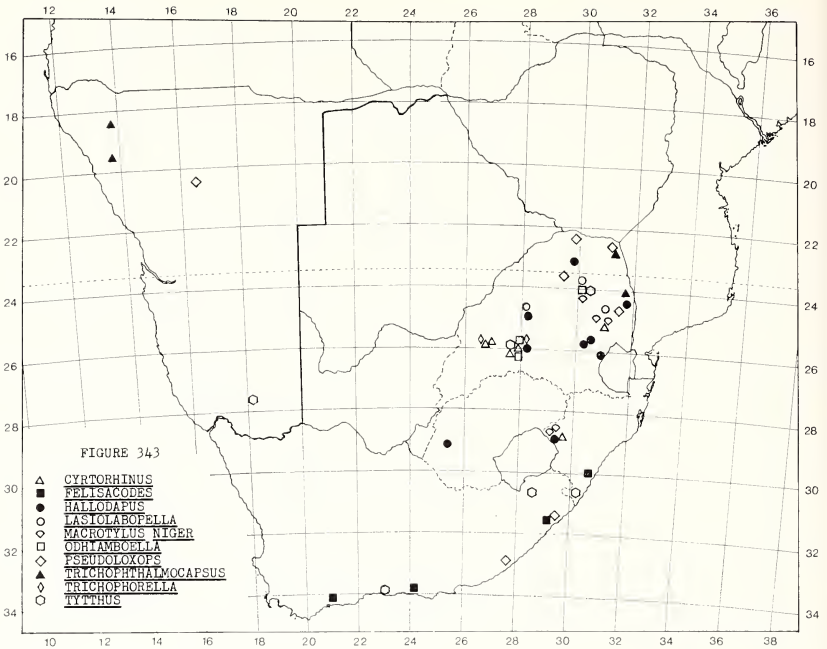


FIG. 343. Distribution of nine genera and one species of the Miridae in South Africa (see text for explanation).

especially in the highveld of the Transvaal and the Orange Free State. The one record of *Pangania* from the Southwest Cape, from the Little Karoo at Nooitgedacht near Oudtshoorn, corresponds with the 15° ET isoline and also with the distribution of *Acacia* in that area. Both of these species come to light and are relatively easily collected. The known distribution is therefore probably relatively accurate, although they will most likely be found in much of South Africa that is as yet very poorly collected. *Paramixia* has a similar distribution (Figure 342), although here one species is more strictly tropical than another, but nonetheless the 15° ET isoline defines well the distribution of the genus within South Africa.

Felisacodes has what is apparently a "forest relict" distribution (Figure 343). It is known from Chirinda, Rhodesia, and Mt. d'Ambre, Madagascar, as well as South Africa.

3) A pattern of wide distribution within South Africa, and in some cases involving East Africa, includes *Systellonotus* and *Ellenia.* These two genera constitute 4% of the fauna.

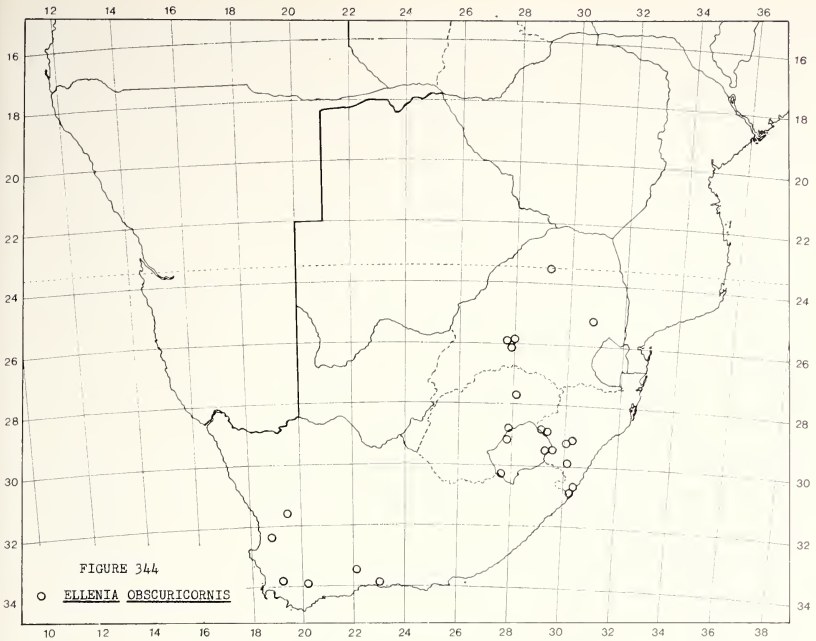


FIG. 344. Distribution of a species of the Miridae in South Africa (see text for explanation).

Systellonotus is chiefly Mediterranean is distribution. In South Africa it is not restricted to the area of Mediterranean climate but is widely distributed, being known from Natal, the Orange Free State, and South West Africa (Figure 345). This may represent a disjunct Mediterranean distribution, but the widespread occurrence of the genus is South Africa suggests that it may eventually be found in East Africa as well.

Ellenia obscuricornis is widely distributed in South Africa and East Africa (Figure 344); however, in South Africa it does not occur in tropical localities, such as the low veld in the Transvaal and the Natal tropical corridor. There is some indication that *Ellenia*, in South Africa, may be more or less restricted to *Senecio*, a very diverse and widely distributed genus. The absence of *Ellenia* from tropical South Africa, even though it occurs in East Africa, is not readily explicable.

4) A pattern of distribution associated with very dry areas and possibly showing some endemism in South West Africa includes

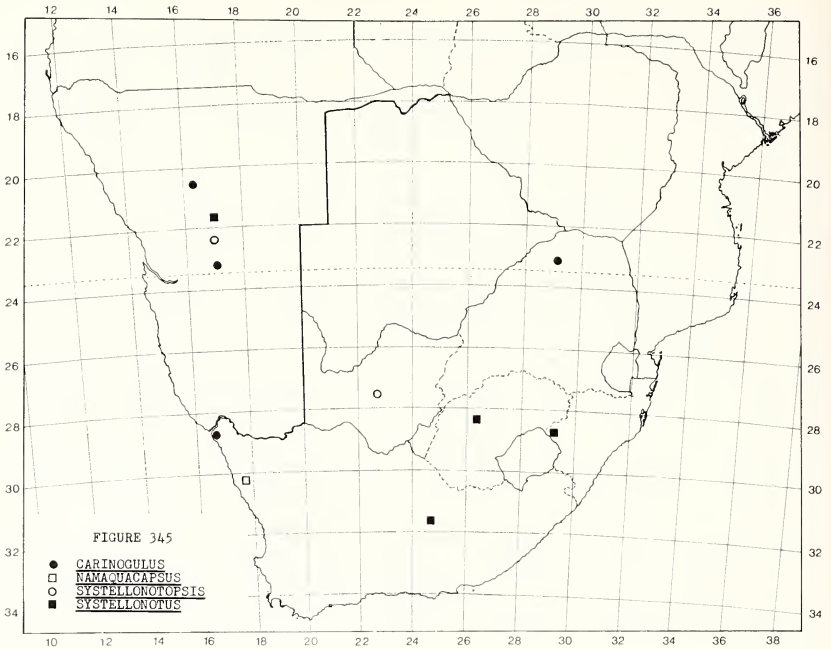


FIG. 345. Distribution of four genera of the Miridae in South Africa (see text for explanation).

Carinogulus, *Namaquacapsus*, and *Systellonotopsis*, which constitute 6% of the fauna. Both *Carinogulus* and *Namaquacapsus* show relationships with groups that occur primarily in the Horn of Africa or the Mediterranean. There are many examples of groups whose distributions show close affinities between these areas (van Zinderen Bakker, 1969; Moreau, 1966). *Systellonotopsis* is probably endemic to the dry areas of southern Africa, but its relationship to other groups is too poorly understood to speculate on the possible significance of its distribution (see Figure 345).

5) About 15% of the South African genera have a strictly tropical distribution roughly delimited by the 16° ET isoline. They are *Azizus*, *Halticus*, *Myombea*, *Nanniella*, *Pilophorus*, *Plagiognathidea*, *Pseudopilophorus*, and *Skukuza*. These genera are all restricted to the Mozambique coastal plain and to the Natal tropical corridor (Figure 346). They primarily belong to the tropical African element, but *Pilophorus* and *Halticus* are cosmopolitan.

Macrotylus hemizygiae and *Zanchius nigrolineatus* may also be

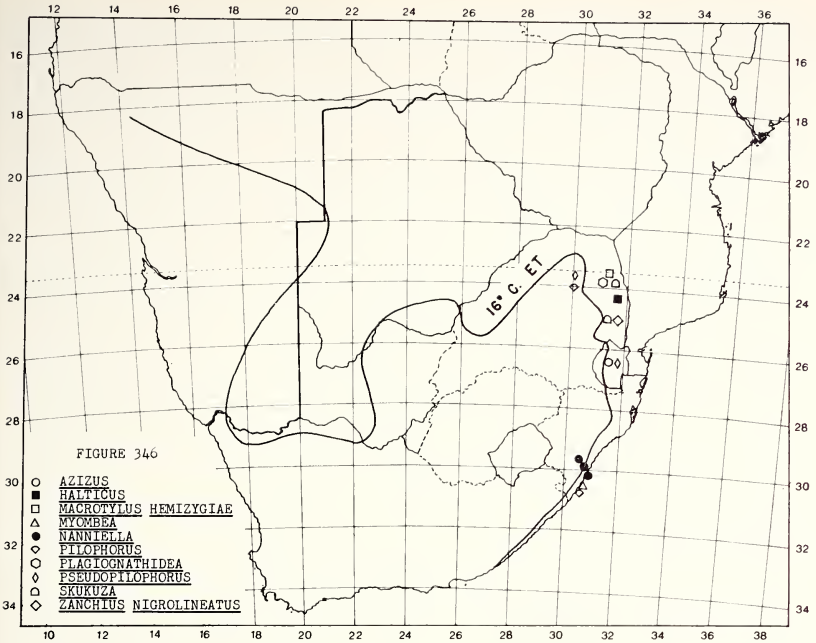


FIG. 346. Distribution of eight genera and two species of the Miridae in South Africa (see text for explanation).

species with tropical affinities (Figure 346). They are presently known only from the Kruger National Park. Other South African members of these two genera have distributions that are not strictly tropical, as discussed above.

Five genera, or 9% of the known fauna of South Africa, were not analyzed in the foregoing discussion. These include *Brachycranella*, *Sthenarus-Campylomma*, *Leptoxanthus*, *Psallus*, and *Orthotylus*.

My inability to identify specimens of *Brachycranella* and *Leptoxanthus* makes it impossible to discuss their distributions at the present time. Both genera are known only from South West Africa.

The *Sthenarus-Campylomma* group is represented in South Africa by approximately eight species. These are known primarily from the area with the more tropical fauna rather than from the areas of extreme endemism. This distribution is in agreement with that of *Campylomma* and *Sthenarus* as a whole, which are rather widely distributed in the Old World with only one introduced species of *Campylomma* presently recorded from the New World (Knight, 1941).

Approximately 10 *Psallus*-like species are present in collections from South Africa. They are known from all areas of the country. The extremely complex taxonomic problems involved with this genus make it impossible to determine at present the possible affinities of the South African fauna.

Orthotylus in South Africa presents an even more complex picture than *Psallus*. *Orthotylus* is currently recorded from all zoogeographic regions except South America. There are about 20 species occurring in South Africa, but they cannot be related to the faunas of other areas at present because of the paucity of knowledge on the genus as a whole except for those of the Palearctic.

PART 2. A PHYLOGENETIC ANALYSIS OF THE ANTMIMETIC TRIBES OF THE ORTHOTYLINAE AND PHYLINAE FOR THE WORLD

HISTORY OF THE CLASSIFICATION OF THE MIRIDAE

The phylogeny of the Miridae has not received great attention since the exhaustive treatments of Reuter (1905a; 1910a). Van Duzee (1916), Knight (1923; 1941) and Carvalho (1952a) have reviewed or revised the classification; Slater (1950) and Kelton (1959b) examined the female and male genitalia, respectively, and made many valuable suggestions relative to the classification and phylogeny of the family; and, Wagner (1955) and Leston (1961) presented phylogenetic analyses of the Miridae with useful discussions, but unfortunately their works were based almost solely on Palearctic genera.

Distant (1904c: 412–413) stated: ". . . at present the classification of the family is more reflective of personal opinion, and contrived for purposes of entomological arrangement, than exhibiting an evolutionary or philosophical conception. The Capsidae are a very difficult group to study, their affinities are of the most difficult description, and for the present we must be satisfied with a somewhat artificial or cabinet arrangement." Distant went on to say that he did not understand the system of Reuter and therefore did not follow it. This statement by Distant precipitated Reuter's (1905a) publication of the polemical "Hemipterologische Spekulationen. I. Die Classification der Capsiden" in which he accused Distant of making only superficial observations on the Miridae and therefore producing results of little or no value. Most mirid taxonomists since Reuter have more or less adopted his excellent classification. Even the

world classification of Carvalho (1952a) added little new morphological information to that which Reuter (1905a; 1910a) presented.

Reuter (1905a) included a dendrogram with his phylogeny of the Miridae. He considered the absence of a pronotal collar to be primitive. Reuter therefore placed the "Isometopidae," which possess ocelli, but lack a pronotal collar, at the very base of his phylogenetic tree and grouped the Plagiognatharia, Oncotylaria, etc. (Phylinae) and the Cyllocoraria, Laboparia, etc. (Orthotylinae) together on one side of the dendrogram with the Phylinae nearer the base because of the hair-like parempodia (considered to be "poorly developed arolia" by Reuter). He derived the Dicypharia (Dicyphinae) and Cylaparia and Fulviaria (Cylapinae) from near the Orthotylinae. Reuter considered the Bryocoraria (Bryocorinae) and Clivenemaria (Deraeocorinae) to be somewhat isolated but relatively closely related to one another and placed them by themselves near the base of the tree. He placed the Miraria, Capsaria, etc. (Mirinae) at the top of the dendrogram above the Orthotylinae. Reuter (1910a), in his later work, did not give a phyletic dendrogram for the Miridae but presented a scheme of classification similar to that discussed above. In this paper he grouped the Miridae into subfamilies whereas in the previous paper he recognized only divisions (tribes).

Knight (1923; 1941) obviously modified his own dendrogram from that of Reuter but gave little supporting discussion regarding subfamily relationships. Both Reuter and Knight considered the Phylinae to be among the most primitive members of the Miridae, whereas I consider them to be among the most highly derived (see below).

Wagner (1955) considered the Orthotylinae-type of male genitalia to be primitive in the family. He presented the Bryocorinae, Cylapinae, Pilophorini-Phylinae, and Halticini-Mirinae-Dicyphinae-Deraeocorinae, in that order, as separate evolutionary lines branching off the main orthotyline stem at successively higher levels. This scheme was based on the male genitalia and did not take into account the parempodia, pulvilli, or pronotal collar, all of which would have to be evolved more than once to correspond with Wagner's interpretation of the evolution of the male genitalia. Wagner considered the Orthotylinae and Phylinae to be closely related but also derived the Mirinae, Dicyphinae, Deraeocorinae, and Halticini in a single line of evolution from the main Orthotylinae stem. If the Orthotylinae male genitalia are considered as derived a much more parsimonious system can be devised.

Leston (1961) presented a phylogenetic scheme based primarily

on the genitalic studies of Slater (1950) and Kelton (1959b) and on his own work on chromosomes, testis follicle numbers, and wing venation. He considered the Isometopinae to be the most primitive subfamily in the Miridae with the Bryocorinae somewhat more advanced, but still near the base of the mirid stem. Leston (1961) proposed a relationship between the Deraeocorinae and Mirinae and also a possible link between the Cylapinae and Deraeocorinae. He considered the Orthotylinae, Phylinae, and Dicyphinae to be the most advanced groups in the Miridae.

ANALYSIS OF CHARACTERS AND A REVISED CLASSIFICATION

Reuter (1910a) used the parempodia as the primary characters in the classification of the Miridae and was followed by Carvalho (1952a). Both authors recognized three basic types of parempodia and considered them more or less invariable. I have also found that the parempodia are extremely valuable in the classification of the Miridae; however, some confusing variation exists in the different types, a situation which was first recognized by Wagner (1955). By interpretation of this variation and correlation with other characters, particularly those of the genitalia, the parempodia can be used to establish some primary divisions within the family. Kullenberg (1947b) raised the most serious doubts about the value of the parempodia in the classification of the Miridae, suggesting that they are highly adaptive. The previous studies of Reuter (1910a) and Knight (1922; 1923) and the subsequent work of Carvalho (1952a) and Wagner (1952; 1955) and this study all show, however, that the parempodia are the most useful single character in the classification of the family.

The other characters which are of greatest value in the systematics of the Miridae are the male and female genitalia, pronotal collar, wing dimorphism, pulvilli, feeding habits, presence or absence of ocelli, number of tarsal segments, ant-mimetic appearance, and possibly chromosome numbers and testis follicle numbers. Additional characters such as body form, punctation, pubescence, length of tarsal segments, and number of cells in the membrane are also important, but usually useful only below the subfamily and tribal levels. My use of characters in classifying the Miridae is more or less in agreement with previous authors except for differences in interpretation and increased emphasis on the male and female genitalia. In addition to the parempodia, Reuter (1905a; 1910a) used the structure of the pronotum, including the collar, tarsi, membrane

cell, hamus, prosternal xyphus, and lora in his classification. Knight (1923) considered the parempodia, genitalia, biology, and modifications of the thorax, in that order, to be of greatest importance in studying relationships within the family. I have not included the hamus, prosternal xyphus, or lora in developing the following classification of the Miridae, as I have found these structures to be of more limited value than the others listed above.

The genitalia have received only limited acceptance in the study of mirid phylogeny. The attitude of many workers is typified by Carvalho (1952a: 34) ". . . the claws and arolia are still the best characters to be used in the subdivision of the family into subfamilies and tribes. . . . The genitalia alone have been found to be misleading in many respects and their acceptance as a primary character would certainly cause some changes in the present classification."

The first author to use the male genitalia in the separation of mirid species was Reuter in 1883 (Kelton, 1959b). Knight (1941) emphasized that the vesica in the Phylinae was a fundamental character in classification. Wagner (1955) was the first author to use the male genitalia as an integrated unit in the classification of the family. The most comprehensive review of mirid male genitalia is that of Kelton (1959b); he suggested needed changes in the classification based on the vesica, but did not make them. I use the male genitalia extensively, including characters of the claspers, vesica, and phallotheca.

Mirid female genitalia received very little attention until the studies of Kullenberg (1947a) and Slater (1950). The former author was concerned primarily with the functional aspects of the morphology. Slater, however, examined them from the point of view of higher classification and laid the groundwork for subsequent studies. Wagner (1956) was the first author to base taxonomic changes in the Miridae on the structure of the female genitalia. I use the structure of the posterior wall primarily, and the sclerotized rings secondarily, in the classification of the family.

The possible value of wing dimorphism in classifying the Miridae was first alluded to by Reuter (1910a), but it has been used very little. In many Hemiptera (vis., Lygaeidae, semiaquatic families) reduction of the hemelytra occurs with more or less equal frequency in both sexes. In the Miridae two types of wing dimorphism exist, suggesting two independent mechanisms to account for the expression of the phenomenon. The Stenodemini and Halticini show the nonsex related type of wing dimorphism mentioned above. In the Phylinae and some Orthotylinae, however, wing dimorphism is almost always

sex related, the females being brachypterous, when short winged forms exist, and the males always being macropterous. A similar situation is thought to exist in the Schizopteridae (Emsley, 1969). Brinkhurst (1959) has established the mechanisms for determination of hemelytral types in the Gerridae, but this is not known for the Miridae. Presumably the mechanism of determination in the Stenodemini is hormonal and environmentally induced (Southwood, 1962), but in the Phylinae it is probably genetic.

Southwood (1962) and Sweet (1964) have proposed that brachyptery in the Hemiptera is a development related to environmental stability. This probably applies to the Phylinae (and other groups with a similar type of wing dimorphism), with the male as the active agent of genetic interchange between populations. The females are only very rarely macropterous and therefore contribute less to gene flow between populations than the males (see Brinkhurst, 1963). The retention of the female in the habitat of the host must confer a selective advantage. In the Hallodapini (and some Leucophoropterini, Orthotylini, and Nichomachini) an additional selective advantage may be conferred on the females in that they are generally much more ant-like than the males.

Carvalho (1952a) used ant-mimetic appearance as a primary character in the classification of the Miridae. An important aspect of this study has been to assess the value of mimicry in analyzing the phylogeny of the family. Within limits I have found that mimetic appearance is very useful, particularly at the tribal level (e.g. Hallodapini). In some cases, however, higher taxa cannot be defined on mimetic facies. Kelton (1959b) for the Mirinae, and other workers, have emphasized this point. In all groups where ant-mimics exist, they certainly represent a derived condition. However, in many cases (e.g. the Pilophorini) mimetic genera retain primitive characters. The morphological modifications most commonly found in the ant-mimetic Miridae are: the presence of one or more light hemelytral maculae or fasciae that contrast with the dark background coloration of the forewings and body; the sinuation of the lateral hemelytral margins; and the constriction of the pronotum anteriorly, with the tendency toward the development of a flattened pronotal collar. Certain tribes in the Phylinae and Deraeocorinae have the pronotum constricted anteriorly and bearing two erect, cone-like structures dorsally. This structural modification also occurs in the genus *Saldoida* (Saldidae). Some genera (as yet undescribed) have the pronotum constricted medially so as to form an hour-glass shape. In certain undescribed genera in the Pilophorini and Leucophoropterini the

TABLE 1
Comparison of Nabidae and Miridae
(p—primitive; d—derived)

CHARACTER	NABIDAE	MIRIDAE
Feeding habits	predaceous (p)	primarily phytophagous (d)
Male genitalia (symmetry)	nearly symmetrical (p)	strongly asymmetrical (d)
Male genitalia (vesica)	membranous (p)	membranous or sclerotized (p – d)
Female genitalia (posterior wall)	poorly developed (p)	usually well developed (d)
Female genitalia (sclerotized rings)	poorly developed (p)	usually well developed (d)
Cuneus	absent (p)	present (d)
Ocelli	present (p)	usually absent (d)
Pronotal collar	present or absent (p – d)	present or absent (p – d)
Parempodia	hair-like (p)	hair-like or fleshy (p – d)

gula is carinate below the eye and gives the appearance of mandibles when viewed anteriorly. All of these structural characteristics have evolved more than once and are therefore indicative of the extreme adaptability of the Miridae to ant-mimic selection. The obvious convergence of several groups toward certain common mimetic facies for the most part precludes the definition of higher taxa within the Miridae on the basis of ant-like appearance alone.

The zoogeography of the Miridae has never been analyzed or used as a tool in the classification of the family. With the Carvalho Catalogue as a source of information the assessment of distributional patterns becomes much easier than before and the study of the phylogeny of the family can be greatly enhanced, a position in opposition to that taken by Leston (1961). In this study I have not been able to consider the distributions of all subfamilies of Miridae in detail. The distributional patterns of the Orthotylinae and Phylinae, however, suggest that zoogeographic analyses within the family, especially at the tribal level, are very useful in understanding the evolution of the Miridae.

Additional characters I have used in developing this classification are discussed below under the individual taxa.

TABLE 2

Comparison of subfamilies of Miridae
(p—primitive; d—derived)

	PRONOTAL COLLAR	VESICA	POSTERIOR WALL	SCLEROTIZED RINGS	NUMBER OF TARSAL SEGMENTS
ISOMETOPINAE	absent (d)	membranous (p)	well developed (d)	well developed (d)	2 (d)
CYLAPINE	present or absent (p – d)	membranous (p)	well developed (d)	well developed (d)	3 or 2 (p – d)
BRYOCORINAE	present (p)	membranous (p)	poorly developed (p?)	poorly developed (p?)	3 (p)
DICYPINAE	present (p)	membranous (p)	well developed (d)	well developed (d)	3 (p)
MIRINAE	present (p)	membranous (p – d)	well developed (d)	well developed (d)	3 (p)
DERAEOCORINAE	present (p)	membranous (p – d)	well developed (d)	well developed (d)	3 (p)
ORTHOTYLINAE	usually absent (d)	usually membranous (p)	well developed (d)	well developed (d)	3 (p)
PHYLINAE	absent (d)	sclerotized (d)	well developed (d)	well developed (d)	3 (p)

TABLE 2 (continued)

	FEEDING HABITS	OCELLI	PAREMPODIA	PULVILLI (OCCURRENCE)	PULVILLI (POSITION)
ISOMETOPINAE	predatory (p)	present (p)	hair-like (p)	absent (p)	———
CYLAPINAE	predatory (p)	absent (d)	hair-like (p)	absent (p)	———
BRYOCORINAE	phytophagous (d)	absent (d)	hair-like (p)	present (d)	inner surface of claw
DICYPHINAE	predatory & phytophagous (p – d)	absent (d)	hair-like (d)	present (d)	inner surface of claw
MIRINAE	generally phytophagous (d)	absent (d)	fleshy, divergent (d)	present (d)	ventral surface of claw
DERAEOCORINAE	predatory (d)	absent (d)	hair-like (d)	absent (d)	———
ORTHOTYLINAE	mixed diet (p – d)	absent (d)	fleshy, convergent (d)	present (d)	ventral surface of claw
PHYLINAE	mixed diet (p – d)	absent (d)	fleshy & convergent or hair-like (p – d)	present (d)	ventral surface of claw

In a phylogenetic or cladistic classification it is necessary to designate given states of a character as relatively primitive (plesiomorphic; ancestral) or derived (apomorphic) and monophyletic groups must be recognized only on the possession of shared derived characters (Hennig, 1966). The taxonomy of the Miridae is still so poorly known that it is difficult to determine for most characters what is the primitive and what is the derived state. By examining families related to the Miridae some comparative data can be assembled. Table 1 lists characters in the Nabidae and Miridae.

The Nabidae have the greatest number of what are probably plesiomorphic characters in the Cimicoidea, including predatory feeding habits, ocelli, presence of a pronotal collar, membranous vesica, nearly symmetrical male genitalia, and absence of pulvilli. The Anthocoridae and Miridae, which are derived relative to the Nabidae, have in common the cuneus and therefore form a natural group within the Cimicoidea; however, these two families represent individually specialized lines of evolution. The Anthocoridae are entirely predatory, retain ocelli, and show a trend toward development of the highly specialized method of traumatic insemination. The Miridae, with the exception of the Isometopinae, have lost the ocelli, have a tendency toward phytophagy, and have specialized genitalia, although along a much different line than found in the Anthocoridae.

Table 2 lists the subfamilies of Miridae and a number of characters that are important in the classification of the family. I am following Carayon (1958) and including the Isometopinae in the Miridae.

If the individual mirid subfamilies are compared with the Nabidae, which seems justified, it appears that the Isometopinae possess the greatest number of plesiomorphic characters, namely the presence of ocelli, predatory feeding habits, and the absence of pulvilli. The Cylapinae also appear relatively primitive in that they are predaceous, possess a pronotal collar, and lack pulvilli. The view that these groups are not secondarily predaceous is supported by the uniformity of feeding habits within each subfamily. Support for the predatory nature of the ancestral cimicoid stock can be found in the fact that the Nabidae, Microphysidae, Velocepedidae, and Anthocoridae and also Reduviidae (which are most closely related to the Cimicoidea [Cobben, 1968]), are all predatory. Only the Tingidae, Thaumastocoridae and Miridae are phytophagous. In that the Miridae are specialized within the Cimicoidea, lacking ocelli (except Isometopinae) and possessing a cuneus and specialized male and female

genitalia, it is probable that the predaceous habit is ancestral within the family and that phytophagy is a derived condition. The feeding habits of the Miridae are, however, rather poorly understood. Many groups may be secondarily predaceous and some are probably oligophagous.

The rounded pronotal collar is probably plesiomorphic in the Miridae, an hypothesis supported by the occurrence of the structure in most subfamilies, including the Cylapinae, Bryocorinae, Dicyphinae, Mirinae, and Deraeocorinae. It also occurs in the prostemmine Nabidae (although not in the Nabinae) and in the Anthocoridae, both of which possess a greater number of plesiomorphic characters than do the Miridae. The rounded pronotal collar is absent in the Isometopinae, Orthotylinae, and Phylinae, but this can probably best be attributed to secondary loss. If the rounded collar is considered to be derived in the Miridae it must be evolved independently at least 4 times, whereas it is only necessary that it be lost twice when it is considered to be plesiomorphic.

The genus *Psallops* Usinger should be considered here. Usinger (1946) placed this genus in the Phylinae, but subsequent examination of the male genitalia by Carvalho (1956b) revealed that *Psallops* is not a phyline, but has a membranous vesica more similar to all other Miridae than to the Phylinae. Carvalho (1956b) felt that someday *Psallops* would be placed in the Isometopinae, even though it does not possess ocelli. *Psallops* is in actuality probably most closely related to the Cylapinae. I have examined the female genitalia of an undescribed species of *Psallops* from South Africa. It has well developed sclerotized rings and a simple, sclerotized, plate-like posterior wall. Neither of these structures is highly specialized, but both are relatively primitive and similar to those found in the Cylapinae (personal investigation) and Isometopinae (Slater and Schuh, 1969). *Psallops* has only two tarsal segments. This condition is the rule in the Isometopinae, and also occurs in a few genera placed in other mirid subfamilies, including *Vannius* Distant and *Peritropis* Uhler in the Cylapinae and *Hemisphaerodella* Reuter in the Bryocorinae. The 2-segmented condition is almost certainly not ancestral in that the remainder of the Miridae, the Nabidae, and the Anthocoridae all have 3-segmented tarsi. Bergroth (1925) has noted that 2-segmented tarsi occur sporadically throughout the Heteroptera, and that those groups that possess them cannot be considered connecting links to other such groups. J. A. Slater (personal communication) has suggested that they possibly represent a neotenic condition, because of the nymphs of the Geocorisae which

all have 2-segmented tarsi. The Isometopinae and Cylapinae therefore cannot be related by the similar tarsal structure of some genera. *Psallops* also has only one membrane cell, a condition found in most, but not all Isometopinae (Bergroth, 1925), and lacks a pronotal collar, a structure which is also absent in all Isometopinae but present in most Cylapinae. *Psallops* looks much like many Isometopinae (see *Isometopidea*, in Slater and Schuh, 1969). This complex of characters suggests, but in no way confirms, a relationship between the Isometopinae and Cylapinae and may distinguish them as relatively primitive within the Miridae although they both possess many derived characters.

The Dicyphinae have a rounded pronotal collar, a simple posterior wall in the female and a membranous vesica in the male, all of which are probably plesiomorphic characters and occur in varying combinations in other mirid subfamilies. Cobben (1968) has suggested a relationship between the Dicyphinae and the *Helopeltis* group (Monalionini) of the Bryocorinae based on the structure of the eggs. The pulvilli of the Dicyphinae also relate them to the Bryocorinae. They are leaf-like and attached to the inner surface of the claw, whereas in all other Miridae, the pulvilli are minute and always attached to the ventral surface of the claw.[1]

The male and female genitalia of the Bryocorinae appear to be the most primitive in the Miridae although the condition may be secondarily derived (Kullenberg, 1947b). In this subfamily the phallus is very simple and in this sense resembles that of *Nabis;* it may not be divided into a vesica and conjunctiva as in other mirids (Kullenberg, 1947b). Also the posterior wall and ring glands of the female are very poorly developed in some tribes (Slater, 1950), as in *Nabis* (Kullenberg, 1947a), but more highly developed in others (see Schmitz, 1968). The Bryocorinae and most Isometopinae have only one membrane cell, whereas the rest of the Miridae have two, which also suggests a derived condition (see Leston, 1961). The genus *Bunsua* Carvalho, from Africa, which was originally placed in the Orthothylinae, is closely related to the Bryocorinae, and may have some characters which are intermediate between the Bryocorinae and other members of the Miridae, although there is no direct relationship to the Orthotylinae.

---

[1] Carvalho (1952a) considered the pulvilli of the Phylinae (including Dicyphinae) to arise from the "base or inner surface of the claw" and those of the Bryocorinae to arise from the ventral surface of the claw. I have interpreted the Phylinae-type to arise from the ventral surface of the claw and the Bryocorinae-type (including Dicyphinae) from the inner surface.

The question of the monophyletic nature of the Bryocorinae and the relationship of the Dicyphinae to the Monalionini needs careful investigation.

The Deraeocorinae lack pulvilli and have a rounded pronotal collar, both plesiomorphic conditions in the Miridae. They are, however, highly specialized in several respects and therefore are discussed below in relation to the Mirinae.

The Mirinae, Orthotylinae, and Phylinae all possess modified fleshy parempodia and pulvilli that are attached to the ventral surface of the claws. They therefore form a group within the Miridae. Leston (1961) considered this structural similarity to be a convergence.

The Mirinae possess several derived characters. The vesica of the male is of a highly developed membranous type similar to that found in the Deraeocorinae (Kelton, 1959b). The posterior wall and sclerotized rings are specialized but do not show an extremely close relationship to other subfamilies in the Miridae (Slater, 1950). This subfamily has a rounded pronotal collar which I consider to be an ancestral condition relative to the Orthotylinae and Phylinae, both of which lack a collar. The Stenodemini do not have a collar, except for the genus *Collaria* Provancher. Knight (1941) felt that the Stenodemini were probably primitive because of their host plants (grasses) and distribution. I disagree with Knight on morphological grounds and consider the pronotal type in the Stenodemini to be derived. Also the grasses may not be so primitive as thought by Knight. Distant (1904c) considered the sulcation of the head in the Stenodemini to be of great importance, and assigned the group subfamily rank; he placed the Isometopinae in a second subfamily within the Miridae and lumped all of the remaining members of the family into a third subfamily. The monophyletic nature of the Mirinae is supported by the female genitalia (Slater, 1950) and the male genitalia (Kelton, 1959b).

The Deraeocorinae, although possessing hair-like parempodia and lacking pulvilli, both of which are probably plesiomorphic characters in the Miridae, also possess a number of derived characters and probably show their closest relationship to the Mirinae, and may be derived from them. The vesica in the Deraeocorinae is similar to that found in the Mirinae and occurs nowhere else in the Miridae (Kelton, 1959b). The posterior wall is a simple sclerotized plate, which probably represents the plesiomorphic condition in the Miridae, but in the Deraeocorinae, when considered in light of other characters possessed by the subfamily, may represent a secondarily simplified

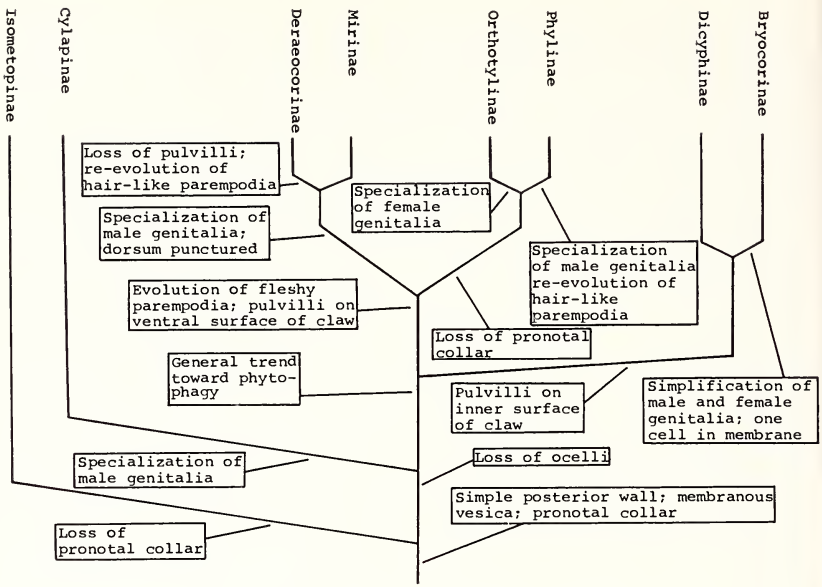


FIG. 347. Phylogeny of the Miridae.

condition (Slater, 1950). The general facies of the Deraeocorinae, particularly *Deraeocoris,* are very much like that of many Mirinae. The type of pronotal collar and the punctate dorsum are common to the two subfamilies; the latter character occures only sporadically in all other mirids, but is relatively common in the Mirinae and almost universal in the Deraeocorinae. The Deraeocorinae are often very specialized predators, suggesting a specialization of feeding habits rather than what is probably a generalized predatory habit in many ground living Cylapinae (e.g. *Fulvius*). These facts then indicate secondary loss of the pulvilli, reevolution of the hair-like parempodia (see also Orthotylinae-Phylinae discussion), and simplification by reduction of the female genitalia in the Deraeocorinae from the type found in the Mirinae.

A number of characters suggest that the Orthotylinae and Phylinae are closely related. These include 1) the absence of a rounded pronotal collar (a derived character relative to other Miridae, although it is secondarily evolved at least once in both subfamilies); 2) the presence of recurved, convergent parempodia in the Orthotylinae and some Phylinae (Pilophorini); 3) the tendency for infolding of the lateral margins of the sclerotized rings in both sub-

families with a great accentuation of this condition in the Orthotylini; and 4) a tendency towards sclerotization of the vesica.

Figure 347 presents a possible evolutionary scheme for the Miridae. The Isometopinae probably diverged early as an isolated line which retained the ocelli. The Cylapinae also probably arose relatively early, in that they are predatory, primarily ground living, have relatively primitive male and female genitalia, lack pulvilli, and possess hair-like parempodia. The Cylapinae also possess several characters that are probably derived, including the form of the head, but none of these seems to relate them to other subfamilies.

The Dicyphinae and Bryocorinae (Monalionini) may be related as suggested by Cobben (1968). If these two groups were placed in a single subfamily they would still be related to the remaining members of the Bryocorinae through the Monalionini by the pretarsal structures and the single cell in the membrane (which also occurs in some Isometopinae, but this is probably a convergence [Leston, 1961]). The male and female genitalia of the Bryocorinae may appear primitive as a result of reduction (Kullenberg, 1947b; Slater, 1950). If they are considered as primitive within the Miridae as a whole, it necessitates the loss of the ocelli twice or reevolving the ocelli in the Isometopinae. I have therefore derived the Bryocorinae-Dicyphinae above the level of the Isometopinae but below the level of the remaining subfamilies, based primarily on the structure of the male and female genitalia in the Dicyphinae.

The Mirinae (including Deraeocorinae)-Orthotylinae-Phylinae line is probably the most advanced in the Miridae. The Mirinae are primarily phytophagous. The Deraeocorinae, although predatory, are often very highly specialized and in many cases resemble the Mirinae and are probably most closely related to them. I have therefore derived them from a common stem. The Orthotylinae and Phylinae are related to the Mirinae by the pretarsal structures but differ from them in lacking a rounded pronotal collar. They are related to one another by the structure of the parempodia, the male and female genitalia, the absence of a rounded pronotal collar, and possibly by their mixed feeding habits (Leston, 1961). The tremendous diversity in the Mirinae, Orthotylinae, and Phylinae in most zoogeographic regions suggests an active evolution with little extinction, and therefore probably an advanced position in the evolution of the family.

The subfamily Palauocorinae (Carvalho, 1956b) was not discussed above because so little is known about it. Erected for a single genus and species from Micronesia, this unique insular subfamily has many

specialized features, but may not deserve such high taxonomic rank. It is probably specialized through great isolation in an island environment. Further information will be necessary to determine the correct placement for this taxon within the Miridae.

THE RELATIONSHIPS OF THE ORTHOTYLINAE AND PHYLINAE

Three types of parempodia exist within the Orthotylinae and Phylinae: 1) distinctly fleshy, convergent apically, recurved (lyre-shaped), and flattened laterally; 2) hair-like and parallel; and 3) fleshy, rod-like, of nearly uniform diameter, and weakly convergent apically. Types 1 and 3 were placed together as a single type in the Reuter and Carvalho systems of classification. Knight (1923) realized that there was classificatory confusion in groups with convergent parempodia and made some generic changes, but it was Wagner (1961) who first pointed out the distinctive nature of types 1 and 3. Excellent figures of all three types of parempodia are available in the current literature (see Carvalho, 1955a; Knight, 1923, 1941, 1968; Wagner, 1961).

All genera of Orthotylinae and Phylinae with parempodia types 2 and 3 have male genitalia of the phyline-type, i.e., with a rigid, sclerotized vesica and characteristic left clasper and phallotheca. Miridae with type 1 parempodia have two types of male genitalia —most genera have a membranous vesica, which may or may not possess sclerotized spiculi (orthotyline-type); a much smaller number has the phyline-type.

The phyline-type male genitalia are structurally distinct from all others found in the Miridae. They also possess a unique and complex functional relationship. It is almost inconceivable that such a combination of structure and function could have evolved independently more than once and therefore all taxa possessing it must be placed in a single, derived group. The phyline-type of male genitalia probably evolved from the less specialized orthotyline-type (Singh-Pruthi, 1925) which resembles that of the other subfamilies of mirids more closely than it does the phyline-type. Since type 1 recurved convergent parempodia occur in taxa with and without phyline-type male genitalia, it seems logical to believe that of the parempodial types discussed above, type 1 is the ancestral condition and types 2 and 3 represent derived states which arose from ancestors with type 1 parempodia and phyline-type male genitalia.

All previous authors have defined the Orthotylinae as those Miridae with apically convergent parempodia. As can be seen from the

above discussion, this definition does not recognize the different types of convergent parempodia (types 1 and 3) and therefore brings together mirids with two types of male genitalia. Because the phyline-type male genitalia are derived, all of those genera possessing them must be placed in one higher category to form a monophyletic group. I am therefore redefining the Orthotylinae to include only those genera with type 1 parempodia and orthotyline-type male genitalia. This definition excludes the Pilophorini, which were placed in the Orthotylinae by all previous authors, and also several genera which have type 3 parempodia; all of these excluded taxa belong to the Phylinae. As redefined, the Phylinae now include all genera with the derived phyline-type of male genitalia but with all three types of parempodia discussed above.

SUBFAMILY ORTHOTYLINAE

DIAGNOSIS: Facies, coloration, and vestiture variable; sometimes ant mimetic; females occasionally and males less often brachypterous; pronotum sometimes with a flattened or rounded collar; parempodia fleshy, convergent apically, recurved (lyre-shaped), and flattened laterally; pulvilli minute, attached to ventral surface of claws; vesica membranous, inflatable to at least a limited degree, sometimes with long sclerotized spiculi apically; phallotheca fixed to phallobase, claspers variable, left usually larger than right; female with posterior wall varying from a simple sclerotized plate to a highly modified form with K-structures (Figure 109); sclerotized rings ranging from nearly flat to highly infolded on lateral margins.

DISCUSSION: All Orthotylinae have apically convergent, recurved parempodia. The male genitalia have a membranous vesica with or without sclerotized spiculi. The claspers show some tribal characters, but in general the male genitalia are not indicative of distinct phyletic trends within the subfamily.

The female genitalia in the Orthotylinae present a somewhat different evolutionary picture than those of the male and are very useful in recognizing phyletic lines within the subfamily. There are two basic types: 1) those with the posterior wall usually relatively simple and plate-like and with the sclerotized rings varying from flat to somewhat upturned laterally; and 2) those with a highly specialized posterior wall possessing K-structures and with the sclerotized rings strongly upturned laterally.

The simple plate-like posterior wall (type 1 above) probably represents the plesiomorphic condition in the Miridae because it is present in some of the Orthotylinae and in at least five other sub-

TABLE 3
Characters used in tribal classification of Orthotylinae

CHARACTER	PRIMITIVE	DERIVED
Parempodia fleshy, convergent apically, recurved	all genera	———
Posterior wall	without K-structures: Halticini, Nichomachini	with K-structures: Orthotylini
Vesica	membranous: Halticini, Nichomachini	often with sclerotized spiculi: Orthotylini
Pronotal collar	absent: many Orthotylini	present: *Falconia*, *Nanniella*
Lateral corial margin	convex or straight: most genera	sinuate: Nichomachini, *Pseudopilophorus*, *Sericophanes*-group
Punctations on dorsum	absent in most genera	present: *Nanniella*, *Falconia*
Body form	robust: most genera	very elongate: *Aetorrhinella*, *Felisacodes*
Vestiture	setiform hairs: most genera	scale-like hairs: *Melanotrichus*
Wing dimorphism	both sexes macropterous: most Orthotylini	females brachypterous: *Sericophanes*, *Nichomachus*; both sexes brachypterous: many Halticini, *Laurinia*

families. The posterior wall with K-structures is without question a derived condition as it occurs in only a limited group of mirids (Orthotylini), all of which possess type 1 parempodia. The Pilophorini, which I am placing in the Phylinae (see above and also tribal discussion), have type 1 parempodia which relate them to the Orthotylinae; they also have a relatively simple posterior wall, as in some Orthotylinae, but have highly specialized male genitalia. Therefore, the ancestral orthotyline stock must have had a simple posterior wall and type 1 parempodia. The Phylinae must have diverged from this line relatively early and the posterior wall became specialized within the Orthotylinae subsequently.

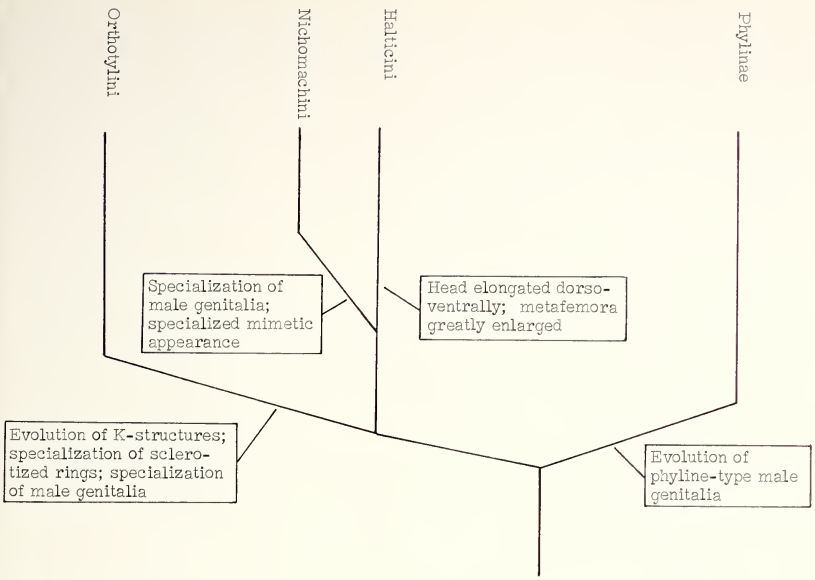


FIG. 348. Phylogeny of the Orthotylinae.

Variation in the posterior wall in the Orthotylinae is greater than in the remainder of the Miridae. The great dissimilarity in type of female genitalia in those mirids with type 1 parempodia, particularly in the structure of the posterior wall, suggests that a case can be made for placing the genera with K-structures (Orthotylini) in a distinct subfamily apart from the remaining genera. Based on the stability of the parempodia and male genitalia, however, I prefer to treat the Orthotylinae as a monophyletic group of subfamilial rank.

I recognize three tribes within the Orthotylinae—Halticini, Nichomachini, and Orthotylini. All of the Nichomachini and some Halticini and Orthotylini are ant mimetic.

Table 3 lists characters important in the tribal classification of the Orthotylinae. They are categorized as primitive and derived. Where a character state has evolved independently more than once, several unrelated genera that posses the character are noted. A proposed phylogeny of the subfamily is given in Figure 348.

ZOOGEOGRAPHY: The Orthotylinae appear to be nearly cosmopolitan in distribution in the Carvalho system of classification. With the revised tribal classification presented below, certain definite dis-

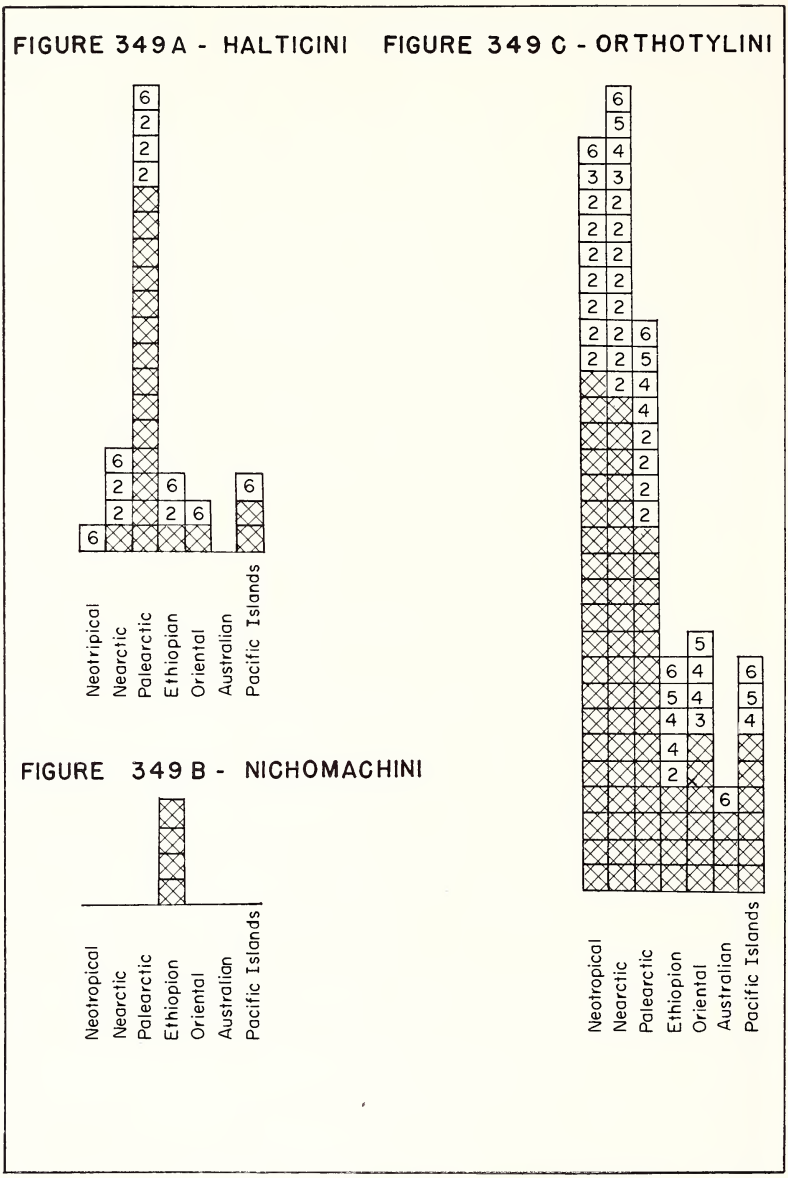


FIG. 349. Distribution of the Halticini, Orthotylini, and Nichomachini (see text for explanation).

tributional patterns emerge. The removal of the Pilophorini to the Phylinae is significant in this respect.

The most distinctive feature of the zoogeography of the Orthotylinae is the preponderance of advanced genera (Orthotylini) in the New World, including nearly all of the ant-mimetic genera in the subfamily (Figure 349c). A much smaller number of advanced orthotylines occurs in the Old World, but the relatively primitive groups in the subfamily (Halticini and Nichomachini) are virtually restricted to the Eastern Hemisphere. Australia has a number of rather interesting genera, the most notable of which is *Myrmecoroides* Gross, 1963, which by virtue of its bizarre morphology, especially of the head, shows a probable long isolation in Australia. When better known *Myrmecoroides* will probably be placed in a new tribe. The occurrence of *Myrmecoroides* and other isolated genera in Australia indicates that that faunal region may be of particular interest in understanding the evolution of the Orthotylinae.

TRIBE HALTICINI

DIAGNOSIS: Usually black or dark colored, sometimes with lighter markings; body usually robust, sometimes elongate; dorsum usually smooth, often polished and shining, seldom with heavy punctures; vestiture variable, occasionally dense and very long; head usually dorsoventrally elongated, height of gena greater than height of eye; pronotum and scutellum seldom highly modified (except in *Myrmecophyes*); often brachypterous (sometimes males as well as females); metafemora often greatly enlarged; vesica membranous, without spiculi; left clasper usually elongate with small hook apically; right clasper flattened and expanded apically, usually spoon-shaped or club-shaped; posterior wall of female without K-structures, although sometimes specialized (*Labops*); sclerotized rings variable; other structural features as in Orthotylinae.

DISCUSSION: The most useful structures for recognizing the Halticini are: 1) the recurved convergent parempodia; 2) an apically enlarged right clasper; 3) a posterior wall lacking K-structures; 4) the elongated genae; and 5) the enlarged metafemora. Although the Halticini are often difficult to separate from the Orthotylini on external characters, the posterior wall will always distinguish the two groups (Wagner, 1956), as will usually the right clasper. Reuter (1910a) and Carvalho (1952a) did not include these genital characters in their definition of the tribe and consequently certain genera were either incorrectly excluded from (e.g. *Myrmecophyes*) or included in (e.g. *Slaterocoris* Wagner) the Halticini.

Much recent discussion has centered around the possible polyphyletic character of the Orthotylinae and particularly the Halticini (Slater, 1950; Leston, 1961). The variability of the posterior wall has been the major cause for this concern. I consider the relative uniformity of the head, with its elongate genae, and the peculiar club-shaped right clasper as apomorphic characters that bind the Halticini together. The posterior wall can be viewed as an inherently variable structure within the Halticini which gave rise to the highly derived K-structures in the Orthotylini.

The Halticini are morphologically somewhat isolated in the Orthotylinae with their peculiar head structure, greatly enlarged metafemora, and generally jet black coloration. Even though they possess these specialized features, they are probably still primitive within the subfamily as judged primarily on the simplicity of the posterior wall and sclerotized rings in most genera. The Halticini are most closely related to the Nichomachini, which have a simple posterior wall (Figure 98), but very peculiar sclerotized rings (Figure 99). The ancestral stock of the tribe probably originated early in the evolution of the Orthotylinae and became specialized subsequently.

Only the genus *Myrmecophyes* Fieber is ant mimetic.

ZOOGEOGRAPHY: The Halticini are most diverse in the Palearctic (Figure 349a), particularly in the Mediterranean region, but lack of modern generic definitions may misrepresent the actual number of genera involved. The cosmopolitan *Halticus* occurs in both tropical and temperate regions, including areas of high rainfall, and is the only genus that is widespread. Most other halticines are adapted to areas of Mediterranean climate which are relatively dry. The tribe is not well represented in many areas of the world with a Mediterranean climate, which suggests low dispersal ability and limited adaptibility or possible replacement by more advanced groups.

DISCUSSION OF INDIVIDUAL GENERA.

Myrmecophyes Fieber, 1870.

Carvalho (1952a; 1958b) placed *Myrmecophyes* in the Pilophorini because of its ant-mimetic facies and convergent parempodia. Wagner (1952; 1955) recognized the halticine character of the head and male genitalia and moved the genus to the Halticini. Approximately 16 species are described, primarily from the Eastern Mediterranean.

* *Strongylocoris* Blanchard, 1840 (in part), see *Slaterocoris* Wagner (Orthotylini).

NICHOMACHINI, NEW TRIBE

DIAGNOSIS: Ant mimetic; dark colored; males usually macropterous, elongate with very slender abdomen, in brachypterous forms abdomen similar to females; hemelytra with two or three partial, light, transverse fasciae; females brachypterous, abdomen strongly constricted basally and swollen medially, hemelytra greatly reduced, covering only two basal abdominal segments; head nearly vertical, concave behind, including eyes, posterior margin of vertex usually carinate; antennal segments 3 and 4 equal to or slightly greater in diameter than segment 2; pronotum usually with distinct anterior and posterior lobes or with anterior lobe only poorly differentiated, posterior lobe in macropterous forms tumid; scutellum elevated, bluntly conical or only convex; hemelytra in macropterous forms exceeding apex of abdomen; lateral corial margins weakly to rather strongly sinuate; membrane with two cells; vesica membranous (Figure 94) or with sclerotized bands (see Wagner, 1957b); left clasper with spine-like group of stiff hairs on basal lobe, shaft slender, apex barbed (Figure 95); right clasper greatly reduced; posterior wall of female simple, lacking K-structures (Figure 98); sclerotized rings very small, contorted (Figure 99).

DISCUSSION: The African genera *Nichomachus* Distant, *Pseudonichomachus* Schuh, and *Laurinia* Reuter, form a distinct group, based on the structure of the claspers, the simple posterior wall, the peculiar sclerotized rings, general mimetic facies, and profound sexual dimorphism. I am therefore placing them in a new tribe. *Eucompsella* Poppius and *Kuomocoris* Odhiambo, both from Madagascar, probably belong in the Nichomachini, but the genitalia have not been examined for either genus.

Wagner (1957b) placed *Laurinia* in the Orthotylini because of the parempodial structure and the form of the male genitalia; he related the genus to *Globiceps* LePeletier and Serville. Additional characters provided by examination of the female genitalia of *Nichomachus*, viz., the simple posterior wall and the very small, anomalous sclerotized rings, do not confirm this relationship, because *Globiceps* is a typical member of the Orthotylini and has well developed K-structures.

The Nichomachini are probably most closely related to the Halticini, where the posterior wall also lacks K-structures and is generally much simpler than in the Orthotylini (although see Slater, 1950; Wagner, 1955, 1956). The male genitalia of the Nichomachini can be derived from those of the Halticini, and are a specialization of the

halticine-type. The right clasper in the Nichomachini is greatly reduced, a situation found in very few Orthotylinae. The Nichomachini have become very highly specialized in many features but represent an old (and possibly relict) stock within the Orthotylinae that diverged from the main line of evolution before the development of K-structures.

ZOOGEOGRAPHY: At present the Nichomachini are known only from the Ethiopian Region, including Africa and Madagascar (Figure 349b). Their greatest diversity is in South Africa. All known species are ground living and probably adapted to dry areas.

DISCUSSION OF INDIVIDUAL GENERA.

Eucompsella Poppius, 1914a.

Eucompsella is related to the Nichomachini by 1) the structure of the pulvilli; 2) the structure of the head and pronotum; 3) the number of hemelytral fasciae; and 4) the distribution. Poppius (1914a) stated that he examined three male specimens of *Eucompsella elegantula* Poppius and that they were deposited in the Paris Museum. I was unable to locate these specimens in Paris, but at least one is in the Helsinki Museum and I am designating it as the lectotype of the species. It bears the following labels: "Museum Paris, Madagascar, Tananarive, Coll. Noualhier 1898"; "*Eucompsella elegantula* n. gen. et sp., B. Poppius det."; "Mus. Zool. H: fors, Spec. typ. No. 7777, *Eucompsella elegantula* Popp."; and "LECTOTYPE, *Eucompsella elegantula* Poppius, det R. T. Schuh". Poppius' (1921) dorsal view drawing is not accurate (see also discussion under *Kuomocoris*).

Kuomocoris Odhiambo, 1967, pp. 1683–1687.

Kuomocoris was placed in the Pilophorini with considerable reservation by Odhiambo (1967). He noted that the male genitalia were not phyline, but did not illustrate or describe them. After examining the holotypes of *K. rabalus* Odhiambo and *K. rubellus* Odhiambo, I believe they are closely related to the Nichomachini. This placement is strengthened by the structure of the head, pronotum, and hemelytra, including the transverse fasciae, the narrow, basally constricted abdomen, and the form of the parempodia. The scutellum is only convex and not conical as in *Nichomachus* and *Pseudonichomachus*. The male genitalia are missing from the holotype of *K. rubellus* and those of *K. rabalus* have not been dissected. *Kuomocoris* is known only from Madagascar and is very closely related to *Eucompsella*.

Laurinia Reuter, 1884.

Carvalho (1952a) placed *Laurinia* Reuter in the Herdoniini (Mirinae) and *Formicocoris* Lindberg in the Pilophorini (Orthotylinae). Lindberg (1956) synonymized the two genera. Wagner (1957b) reviewed the systematic position of *Laurinia* and on the structure of the parempodia and male genitalia related it to *Globiceps* in the Orthotylini. The male and female genitalia in the Nichomachini are unique and do not show the close relationship to the Orthotylini that was suggested by Wagner (1957b).

Only a single species is presently included in *Laurinia*, *L. fugax* Reuter, from North Africa (see Wagner, 1957b).

Nichomachus Distant, 1904a, see page 29.

Pseudonichomachus Schuh, new genus, see page 35.

TRIBE ORTHOTYLINI

DIAGNOSIS: Facies, coloration, and vestiture variable; sometimes ant mimetic; females occasionally brachypterous; dorsum seldom punctured heavily; pronotum occasionally with flattened collar, less often with rounded collar; cuneal fracture very rarely absent (*Sulamita* Kirkaldy); male genitalia with an inflatable membranous vesica, with or without long sclerotized spiculi; left clasper usually larger than right; female genitalia with K-structures (Figure 109); lateral margins of sclerotized rings usually strongly infolded (Figure 112); other structural features as in Orthotylinae.

DISCUSSION: The single most distinctive feature uniting the Orthotylini is the presence of K-structures on the posterior wall of the female genitalia. The strong infolding of the lateral margins of the sclerotized rings is also useful, but this condition occurs in an almost equally advanced state of development in some Phylinae. Characters helpful in separating generic groups within the tribe are: 1) the presence or absence of spiculi on the vesica; 2) the presence or absence of a pronotal collar; 3) the ant-mimic facies; 4) the length of the ovipositor; 5) the presence or absence of punctation on the dorsum; and 6) the hyaline or opaque hemelytra. The variability of all of these characters is very poorly understood. Therefore, a generic revision of the tribe including the use of those characters listed above, as well as a search for new characters, is badly needed. This becomes obvious in the following generic group analysis.

There have probably been several independent evolutions of ant mimicry within the Orthotylini, but the phenomenon is still very

poorly understood from a phylogenetic viewpoint, primarily because of the lack of material from the New World tropics where the greatest number of Orthotylini ant-mimic genera occur. The *Sericophanes* group (see below) is the only evolutionary line in the tribe in which all members are ant mimetic.

The Orthotylus group. This group, the largest in the Orthotylini, includes genera that can be most easily distinguished by well developed, long, heavily sclerotized spiculi on the vesica. Other characters, including the claspers, labial length, pubescence, and color, are all extremely variable. Most of the genera have an *Orthotylus*-type facies, but a few, primarily from the Palearctic, are ant mimetic. Included genera are (genera in parentheses have not been dissected, but appear very close to genera that have been): *Aetorhinella* Noualhier, *Aserymus* Distant, *Bifidungulus* Knight, *Blepharidopterous* Kolenati, *Brachynotocoris* Reuter, *Canariocoris* Lindberg, *Cyllecoris* Hahn, *Cyrtorhinus* Fieber, *Cyrtotylus* Bergroth, *Diaphnidia* Kelton, *Dryophilocoris* Reuter, *Erythrocorista* Lindberg, *Excentricus* Reuter, *Ficinus* Distant, *Fieberocapsus* Carvalho and Southwood, *Globiceps* LePeletier and Serville, *Hadronema* Uhler, *Heterocordylus* Fieber, *Heterotoma* LePeletier and Serville, *Hyoidea* Reuter, *Ilnacora* Reuter, *Ilnacorella* Knight, (*Kalania* Kirkaldy), (*Kamehameha* Kirkaldy), (*Koanoa* Kirkaldy), *Labopidea* Uhler, *Lopidea* Uhler, *Maralauda* Distant, *Mecomma* Fieber, *Orthotylus* Fieber, *Pachylops* Fieber, *Parthenicus* Reuter, *Platycranus* Fieber, *Pseudambonea* Schuh, *Pseudoclerada* Kirkaldy, *Pseudoloxops* Kirkaldy, *Pseudopilophorus* Schuh, *Pseudopsallus* Van Duzee, *Reuteria* Puton, and (*Thermus* Distant).

A number of tribes have been proposed for groups of genera that I am including in the *Orthotylus* group. The most important from a phylogenetic viewpoint are discussed below.

Zimmerman (1948) proposed the tribe Pseudocleradini for the endemic Hawaiian genus *Pseudoclerada.* Although *Pseudoclerada* has a peculiar facies, the male and female genitalia are clearly of the type found in the *Orthotylus* group. This superficially unique island genus certainly represents only a morphologically specialized segment of the main Orthotylini stem. Although the head and body shape are unlike that of most other members of the tribe, but resemble closely the predatory lygaeid *Clerada*, the K-structures of the female and the vesical spiculi relate *Pseudoclerada* closely to *Orthotylus* and its congeners. *Pseudoclerada* is very similar to *Maralauda* from the Seychelles, and may be closely related to it.

Zimmerman (1948) also proposed the tribe Kalaniini for the

endemic Hawaiian genus *Kalania*. He placed it in the Bryocorinae. I have followed Carvalho (1952a) in considering *Kalania* an orthotyline. Examination of the type female suggests that the morphological attributes of *Kalania hawaiiensis* Kirkaldy, the only species in the genus, are the result of extreme isolation in the Hawaiian Islands and that the genus is certainly derived from the main Orthotylini stem.

Ant mimicry within the *Orthotylus* group is limited to a few genera, such as: *Cyllecoris*, *Dryophilocoris*, and *Globiceps* from the Palearctic; *Pseudoxenetus* from the Nearctic; *Ficinus* from Mexico; and *Pseudopilophorus* from South Africa. The disjunct distribution of these genera suggests multiple independent evolutions of ant mimicry, but verification of this must await a thorough morphological study of the *Orthotylus* group.

The Falconia group. This small assemblage of genera can be recognized by the rounded pronotal collar, heavily punctured dorsum, vesica without spiculi, and extremely short ovipositor. Included genera are: *Adfalconia* Carvalho, *Falconia* Distant, *Falconiodes* Reuter, and *Solanocoris* Carvalho from the Neotropical Region, and *Sulamita* from the Hawaiian Islands. It is probably most closely related to the *Zanchius* group, the most obvious difference being that all *Falconia* group genera are heavily punctured and those of the *Zanchius* group are not. *Sulamita* was placed in the tribe Sulamitini (Sulamitaria Kirkaldy) by Zimmerman (1948) in the subfamily Bryocorinae; Carvalho (1952a) later moved the genus to the Orthotylini. The basic structure of members of the genus is very similar to *Falconia*. I have dissected the females of both *Falconia* and *Sulamita* and confirmed the presence of K-structures. The cuneus is fused with the corium in *Sulamita*, a secondary development, which accentuates the coleopteroid appearance found in all members of the *Falconia* group.

The Zanchius group. Diagnostic features of the group are: 1) the flattened appearance; 2) the very delicate body structure; 3) the usually hyaline hemelytra; and 4) the vesica without spiculi. Included genera are: *Brasiliomiris* Carvalho, *Felisacodes* Bergroth, *Hyalochloria* Reuter, *Itacoris* Carvalho, *Jobertus* Distant, *Malacocoris* Fieber, *Parachius* Distant, *Paraproba* Distant, *Pliniella* Bergroth, *Zanchius* Poppius, and *Zanchiella* Schuh (also probably *Zonodorellus* Poppius and *Zonodoropsis* Poppius). The distribution of the *Zanchius* group is more or less pantropical with the greatest diversity occurring in the Neotropics. Generic limits appear to be

poorly understood. It is very difficult to find definitive characters on which to base genera, a situation which results mainly from the very delicate body structure and small size of the members of the group.

The Sericophanes group. This group forms the major ant-mimic complex within the Orthotylinae. It can be recognized by the presence of a more or less well developed pronotal collar, at least some degree of ant resemblance (females often brachypterous and much more ant-like than macropterous males), spiculi usually absent from the vesica, and ordinarily some type of hemelytral maculae or fascia. Included genera are: *Borgmeierea* Carvalho, *Ceratocapsus* Reuter, *Eucerella* Poppius, *Hallodapoides* Carvalho, *Laemocoridea* Poppius, *Lepidotaenia* Poppius, *Pamilia* Uhler, *Pilophoropsis* Poppius, *Renodaeus* Distant, *Schaffneria* Knight, *Sericophanoides* Carvalho, *Sericophanes* Reuter, and *Tuxenella* Carvalho.

The genera *Ceratocapsus*, *Pamilia*, *Pilophoropsis*, and *Schaffneria*, were placed in the tribe Ceratocapsini by Knight (1968). Carvalho (1952a) placed *Ceratocapsus* and *Pamilia* in the Orthotylini and *Pilophoropsis* in the Pilophorini. Kelton (1959b) showed that *Ceratocapsus* lacks vesical spiculi and is therefore very similar to *Sericophanes*, which Carvalho (1952a) and Knight (1968) placed in the Pilophorini. Kelton (1959b) also showed that the vesica of *Pamilia* has spiculi and that it is therefore closely related to *Hadronema*, *Slaterocoris*, and other members of the *Orthotylus* group, and thus its resemblance to *Sericophanes* may be one of convergence. I have not examined the male genitalia of *Pilophoropsis* (and I have not seen *Schaffneria*), but externally *Pilophoropsis* appears very closely related to *Sericophanes*. The females of *Sericophanes* are brachypterous and ant-like whereas those of *Ceratocapsus* are macropterous and much less ant-like. The placement of *Pamilia* and *Ceratocapsus* in the Orthotylini by Carvalho (1952a) is evidence of the subjective character of tribes defined on ant-mimetic facies alone, because *Pamilia behrensi* Uhler (and certain *Ceratocapsus* species) are nearly as ant-like as some species of *Sericophanes*, which Carvalho (1952a) placed in the Pilophorini.

The type of ant mimicry found in the *Sericophanes* group is not as morphologically sophisticated as in many hallodapine genera (Phylinae), particularly in that no Orthotylini genera have the head convex behind (as in the *Formicopsella* group of the Hallodapini), but always concave and contiguous with the anterior margin of the pronotum. In some genera, e.g. *Renodaeus*, the general body form

is extremely similar to that of *Pilophorus*, showing a remarkable convergence between the Orthotylinae and Phylinae.

The *Sericophanes* group is the only unit in the Orthotylini which exhibits pronounced brachyptery similar to the type found in the Phylinae, where the males are always macropterous and the females brachypterous (if short winged individuals exist). Most genera are not well known, but in *Sericophanes,* for example, it appears that the females are always brachypterous and much more ant-like than the males.

This group is primarily Neotropical with a limited representation in the eastern and southwestern United States. Carvalho (1952a) synonymized *Xenofulvius* Bergroth from Luzon, Philippines, with *Ceratocapsus.* This action needs verification as no others members of the group are known from outside the Western Hemisphere.

Genera placed in the Orthotylini by Carvalho and subsequent authors that I have not examined or for which adequate information is lacking to determine subfamily placement include: *Acroderrhis* Bergroth, *Campylotropis* Reuter, *Compsoscytus* Reuter, *Cysteorracha* Kirkaldy, *Deleapidea* Knight, *Dichaetocoris* Knight, *Druthmarus* Distant, *Hadronemidea* Reuter, *Hyporhinocoris* Reuter, *Lopidella* Knight, *Macrotyloides* Van Duzee, *Melanostictus* Reuter, *Mesotropis* Reuter, *Noctuocoris* Knight, *Pseudoneoborus* Knight, *Rhinocapsidea* Reuter, *Squamocoris* Knight, *Sthenaridea* Reuter, and *Uleana* Carvalho.

ZOOGEOGRAPHY: The Orthotylini show a marked concentration in the New World (Figure 349c). The *Falconia* group and the *Sericophanes* group are primarily restricted to the neotropics. The *Zanchius* group is pantropical and widely distributed in the Pacific Islands, suggesting great dispersal ability. The *Orthotylus* group is the most generally distributed in the Orthotylini and it is also probably the least specialized morphologically.

Although the Orthotylini have radiated as ant mimics in the neotropics, and to a lesser extent in the Nearctic, mimetic forms are virtually absent in the Old World tropics. The opposite situation obtains in the Pilophorini (except for North America), Leucophoropterini, and Hallodapini, which are essentially absent from the New World, but diverse in the Old World. Based on the mimics in particular, it appears that the Orthotylini have undergone long isolation in the neotropics and that even though the tribe is represented in the Old World (primarily by nonmimetic forms) the earlier mimetic radiation of the Phylinae in the Old World precluded radiation of

the Orthotylini as ant mimics in the Eastern Hemisphere (see also discussion under Phylinae).

DISCUSSION OF INDIVIDUAL GENERA.

Many genera included in the Orthotylini by Carvalho do not belong there and must be moved to other tribes and subfamilies. Also many genera placed in the Pilophorini by Carvalho are correctly placed in the Orthotylini.

Borgmeierea Carvalho, 1956c, pp. 235–237.

When he described *Borgmeierea* from Natal, Brazil, Carvalho (1956c) related it to *Lepidotaenia*, *Renodaeus*, and *Pilophoropsis*. He placed the genus in the Pilophorini. Although Carvalho did not illustrate the genitalia, his dorsal view drawings indicate a relationship of *Borgmeierea* to *Sericophanes*, as well as to the above mentioned genera. The type of parempodia, general facies, and occurrence in South America strengthen the probable affinities of this genus even though the genitalic information is not available. Under my redefinition of the tribes of the Orthotylinae, *Borgmeierea* is a member of the Orthotylini. The genus is known only from a single species from Brazil.

* *Bunsua* Carvalho, 1951b, Bryocorinae, see misplaced genera.

Coriodromus Signoret, 1862.

This genus closely resembles *Nesidorchestes* Kirkaldy from Hawaii, which was placed in the Halticini by Carvalho (1952a). Study of the male and female genitalia is needed to determine of these two genera are closely related and to which tribe *Coriodromus* actually belongs. *Coriodromus* occurs only in the Southwest Pacific and Australia.

* *Ellenia* Reuter, 1910a, Phylini, see page 157.

Erythrocorista Lindberg, 1958, pp. 107–109.

Erythrocorista Lindberg was incorrectly placed in the Phylinae by Lindberg (1958). The parempodia are plainly fleshy, convergent, and recurved and the male genitalia are not of the phyline-type but of the orthotyline-type. Lindberg (1958) designated *E. echii* Lindberg as the type species of the genus. I have examined specimens from the Helsinki Museum labeled as holotype (Type No. 11109) and allotype (Type No. 11110) of *echii*. Each pin bears three specimens with no indication as to which specimen is the type. It is therefore necessary to designate a lectotype. The situation is additionally

confused because the pin bearing the holotype label has two males and one female on it; Lindberg (1958) indicated that the holotype was a male. Therefore I have placed a male specimen with the original locality label of Lindberg, a "holotypus" label, and the identification label on a separate pin and labeled it "LECTOTYPE *Erythrocorista echii* Lindberg, det. R.T. Schuh" and relabeled the remaining specimens.

Eucerella Poppius, 1921.

The structure of the parempodia and its occurrence in South America strengthen the placement of this genus in the Orthotylini, rather than in the Pilophorini as by Carvalho (1952a). The structure of the head (concave behind), narrow flattened pronotal collar, and mimetic facies ally *Eucerella* at least provisionally, with the *Sericophanes* group. *Eucerella* is known only from Bolivia.

The holotype of *Eucerella hirtipes* Poppius, the only available specimen for the genus, is not in the Paris Museum, as stated by Poppius (1921), but in the Helsinki Museum (Type No. 7781).

Hallodapoides Carvalho, 1951a.

In his original description, Carvalho (1951a) referred *Hallodapoides* to the Pilophorini. Subsequently he moved it to the Hallodapini (Carvalho, 1958a), but gave no explanation for this action. Carvalho's (1951a) illustrations of the male genitalia indicate that *Hallodapoides* is most closely related to *Sericophanes* and allied genera. This relationship is confirmed by the structure of the parempodia, the general facies, and the distribution. *Hallodapoides* contains only a single species, *H. guaraniensis* Carvalho, from Paraquay.

* *Hypseloecus* Reuter, 1891, see Pilophorini.

* *Idiomiris* China, 1963, see genera *incertae sedis*.

Kirkaldyella Poppius, 1921.

I have examined the male genitalia and parempodia of *Kirkaldyella rugosa* Poppius, and place *Kirkaldyella* in the Orthotylini, based on these characters. Carvalho (1952a) considered the genus to be in the Pilophorini. The general appearance is not particularly antlike.

A male of *K. rugosa* from Sydney, New South Wales, Australia, is deposited in the Helsinki Museum (Type No. 12106). Poppius (1921) indicated that there is also a male in the Hungarian Museum. This latter specimen will have to be examined before a lectotype can

be designated. I have also seen an undescribed species of *Kirkaldyella* from Borneo.

Laemocoridea Poppius, 1921.

Laemocoridea is most closely related to the *Sericophanes* group based on the flattened pronotal collar, male genitalia, and general facies. I have examined the holotype male of *L. quadrimaculata* Poppius, which is deposited in the Helsinki Museum (Type No. 7784), rather than in the Paris Museum, as indicated by Poppius (1921).

Lepidotaenia Poppius, 1921.

Lepidotaenia is probably most closely related to *Tuxenella*, based on the upturned, carinate anterior margin of the pronotum, and the male genitalia of *L. bergrothi* Poppius. This species has two transverse bands of lepidote hairs on the hemelytra, similar to the type found in *Pilophorus*. The pronotum in *bergrothi* is constricted medially, forming a distinct anterior and posterior lobe. Two species of *Lepidotaenia* are known from Bolivia.

I have examined the holotype male of *L. bergrothi,* which is deposited in the Helsinki Museum (Type No. 7779), rather than in the Paris Museum as stated by Poppius (1921).

* *Millerimiris* Carvalho, 1951b, see Phylini.

* *Nanniella* Reuter, 1904, Halticini, see page 28.

* *Orthotylellus* Knight, 1935, see *Paramixia* Reuter, Pilophorini, see page 210.

Pamilia Uhler, 1887, see discussion under *Sericophanes* group.

Five species of *Pamilia* are known from the eastern and southwestern United States.

* *Parasthenaridea* Miller, 1937, see Pilophorini.

Pilophoropsis Poppius, 1914c, see discussion under *Sericophanes* group.

Three species of *Pilophoropsis* are known from Arizona.

* *Platyscytus* Reuter, 1907a, see Phylini.

Pseudoxenetus Reuter, 1909.

The female genitalic studies of Slater (1950) and male genitalic studies of Kelton (1959b) correctly established the position of *Pseudoxenetus* in the Orthotylini, rather than in the Pilophorini, as

placed by Carvalho (1952a). Two species of *Pseudoxenetus* are known from the eastern United States.

Renodaeus Distant, 1893.

Although the general facies of *Renodaeus* are very much like those of *Pilophorus*, the male genitalia (see Carvalho and Becker, 1959) confirm that the genus belongs to the Orthotylini and is a member of the *Sericophanes* group. Three species are known from Texas, Guatemala, and Guyana.

Distant (1893) described *Renodaeus ficarius* from two female specimens. I have designated as the lectotype a specimen in the British Museum (Natural History) bearing the labels: "Cerro Zunil, 4–5,000 ft., Champion"; "sp. figured"; "*Renodaeus ficarius* Dist."; and "LECTOTYPE *Renodaeus ficarius* Distant, det. R.T. Schuh."

Schaffneria Knight, 1966, see discussion under *Sericophanes* group.

One species is known from Texas.

* *Semium* Reuter, 1876a, see Phylini.

Sericophanes Reuter, 1876a.

Kelton (1959b) confirmed the relationship of *Sericophanes* to the Orthotylinae on the basis of the male genitalia which he considered as related to *Ceratocapsus*. I have examined the female genitalia of *S. heidemanni* Poppius, which has well developed K-structures; therefore the genus must be placed in the Orthotylini (see also discussion under *Sericophanes* group). *Sericophanes* presently includes 20 species, all from the New World, and shows its greatest radiation in the tropics (Maldonado, 1970).

Sericophanoides Carvalho and Fonseca, 1965, pp. 53–57.

Although placed in the Pilophorini by Carvalho and Fonseca (1965), *Sericophanoides* is closely related to *Sericophanes* by the general facies, and the form of the male genitalia and belongs to the Orthotylini. Two species are known from South America.

Slaterocoris Wagner, 1956, pp. 277–281.

Primarily on characters of the female genitalia, Wagner (1956) recognized the distinctive nature of the North American species previously placed in *Strongylocoris*. He erected for them the new genus *Slaterocoris*, belonging to the Orthotylini. This was the first taxonomic use of the K-structure, the importance of which was pointed out by Slater (1950).

Sulamita Kirkaldy, 1902a, see *Falconia* group discussion.

Tuxenella Carvalho, 1952d.

Carvalho and Dutra (1959) illustrated the male genitalia of *Tuxenella* which confirm the placement of the genus in the Orthotylini, although Carvalho (1952a, etc.) placed the genus in the Pilophorini. This genus probably belongs to the *Sericophanes* group, but it does not have the well developed pronotal collar of most genera in that group and has a more complex vesica with spiculi. Nine species are known from Chile.

SUBFAMILY PHYLINAE

DIAGNOSIS: Facies, coloration, and vestiture variable; sometimes ant mimetic; males always macropterous, females often brachypterous; pronotum sometimes with a flattened collar; parempodia either 1) fleshy, convergent apically, recurved (lyre-shaped) and flattened laterally, 2) fleshy, rod-like, of nearly uniform diameter, and weakly convergent apically, or 3) hair-like and parallel; pulvilli usually minute, always attached to ventral surface of claw, sometimes enlarged and either attached only at base or over entire ventral surface of claw; male genitalia distinctive; vesica elongate, sclerotized, rigid (Figure 228); gonopore variable, phallotheca not fixed to phallobase; left clasper always larger than right, trough-like and receiving apex of phallotheca in repose (Figure 222); right clasper flattened, leaf-like (Figure 234); female genitalia with simple undifferentiated posterior wall, sometimes with posterior margin evaginated (Figure 316); sclerotized rings usually slightly to rather strongly infolded laterally.

DISCUSSION: Carvalho (1952a) defined the Phylinae as those mirids with hair-like parallel parempodia and with the pulvilli attached to the inner surface of the claws (see discussion on page 264). He recognized three tribes within the subfamily—Phylini, Hallodapini, and Dicyphini. Kelton (1959b) showed that on the basis of the male genitalia the Dicyphinae are unrelated to the Phylinae and that the Pilophorini are much more closely related to the Phylinae than to the Orthotylinae, where they were placed by Carvalho (1952a; 1958b).

The hair-like parempodia of the Phylinae are derived from the convergent parempodia of the Orthotylinae (see above). The parempodia of the Dicyphinae, although similar to those of the Phylinae, are of an independent origin and may be the ancestral type in the Miridae. This view is supported by the dicyphine male genitalia which have a membranous, inflatable vesica, more similar to

that of other mirids than to the Phylinae. Considering the Dicyphinae as closely related to the Phylinae requires the derviation of of the dicyphine-type male genitalia from the phyline-type or vice versa. The former situation requires a reevolution of the generalized dicyphine-type from the highly specialized phyline-type; the latter requires the independent evolution of convergent recurved parempodia in both the Pilophorini and Orthotylinae *sensu novo* and the evolution of the phyline-type male genitalia from the dicyphine-type. Both of these alternatives are less parsimonious and require more unlikely evolutionary events than does acceptance of the dicyphine and phyline parempodia as independently evolved. Kelton (1959b) indicated no relationship between the Dicyphinae and Phylinae on the basis of the vesica, but proposed an affinity of the Dicyphinae with the Deraeocorinae and Cylapinae. Evidence of this relationship is further strengthened by the presence of a rounded pronotal collar (which is absent in the Phylinae) and hair-like parempodia; the Deraeocorinae and Cylapinae lack pulvilli, which the Dicyphinae have, however. Slater (1950) related the Dicyphinae to the Phylinae on the structure of the female genitalia. This relationship, however, is based on what I consider to be primitive characters, since the simple plate-like posterior wall of the Dicyphinae also occurs in the Isometopinae, Cylapinae, Deraeocorinae, and Phylinae. Therefore, the Dicyphinae are not closely related to the Phylinae and must be placed in a separate subfamily. This is the status given the group by Knight (1941; 1968) and other authors. The Dicyphinae are possibly related to the Monalionini (Bryocorinae) as noted above.

The convergent recurved parempodia of the Pilophorini relate them to the Orthotylinae, but, as discussed above, the Pilophorini have the unique phyline-type male genitalia. I therefore place them in the Phylinae and consider them to be among the most primitive members of the subfamily. The female genitalia of the pilophorines are specialized relative to the rest of the Phylinae, an evolutionary event which must have taken place subsequent to the divergence of the nonpilophorine Phylinae.

The type 3 rod-like convergent parempodia (see above) have apparently evolved independently several times in the Phylinae and represent a specialized condition within the subfamily. The derived nature of the type 3 parempodia relative to type 2 (hair-like), can be established with some certainty because they occur in all tribes and often in genera that possess many derived characters. The type 2 parempodia could also be considered intermediate between types

TABLE 4

Characters used in tribal classification of Phylinae

CHARACTER	PRIMITIVE	DERIVED
Head behind	concave: all Pilophorini, most Leucophoropterini	convex: many Phylini, some Hallodapini
Antennae	segments 3 and 4 slender: most genera	segments 3 and 4 enlarged: some Hallodapini and Leucophoropterini
Labium	long: most genera	short: some genera in all tribes
Frons	with transverse rugosities: most genera	without transverse rugosities: some genera, all tribes
Eyes	glabrous: genera in all tribes	hairy: genera in all tribes
Anterior margin of pronotum	finely carinate: Phylini, Pilophorini, some Leucophoropterini	flattened collar: all Hallodapini, some Leucophoropterini
Pronotum	constricted anteriorly: most genera in all tribes	hour-glass shaped: some genera in Pilophorini and Leucophoropterini
Scutellum	flat: all tribes except Hallodapini	protuberant or spiniform: some Hallodapini
Lateral corial margins	straight or convex: all Phylini, most Pilophorini, some Leucophoropterini	sinuate: most Hallodapini and Leucophoropterini, some Pilophorini
Wing dimorphism	both sexes macropterous: all(?) Pilophorini, most Phylini	females brachypterous: many Hallodapini and Leucophoropterini, some Phylini
Vestiture	setiform hairs: all Hallodapini, some genera in all tribes	wooly or scale-like hairs: some Phylini, Leucophoropterini, and Pilophorini
Rows of minute tibial spines	present: most genera in all tribes	absent: some genera in all tribes
Length tarsal segment 1	shorter than segments 2 and 3: nearly all genera	longer than segments 2 and 3: *Cremnocephalus* and *Myrmicomimus*

TABLE 4 (continued)

CHARACTER	PRIMITIVE	DERIVED
Pulvilli	minute: most genera in all tribes	enlarged: *Macrotylus*, *Eminoculus*, *Coquillettia*, etc.
Parempodia	fleshy, convergent apically, recurved: Pilophorini	hair-like: most genera of Phylini, Hallodapini, and Leucophoropterini; sometimes weakly fleshy and convergent apically
Abdomen	broad: all Phylini, most Pilophorini	slender, constricted basally: most Hallodapini and Leucophoropterini
Vesica	U-shaped, not twisted: all Pilophorini, some Leucophoropterini	S-shaped, twisted: some Leucophoropterini, all Phylini and Hallodapini
Phallotheca	straight, opening terminal: all Pilophorini except *Paramixia*	L-shaped: all Leucophoropterini, Phylini, and Hallodapini
Posterior wall	simple plate, posterior margin not evaginated: all tribes except Pilophorini	simple plate, posterior margin evaginated: Pilophorini
Sclerotized rings	more or less elliptical: most genera in all tribes	shaped otherwise: *Acrorrhinium*

1 and 3, but this does not appear to be the case in the majority of the genera possessing them.

I am recognizing four tribes within the Phylinae—Pilophorini, Phylini, Leucophoropterini and Hallodapini. Some Pilophorini, and all Leucophoropterini and Hallodapini, are ant mimetic.

Table 4 lists characters that are important in the tribal classification of the Phylinae. For those characters in which the derived state has evolved more than once, several genera are listed. Figure 350 is a proposed phylogeny for the subfamily.

ZOOGEOGRAPHY: The most distinctive feature of the phyline

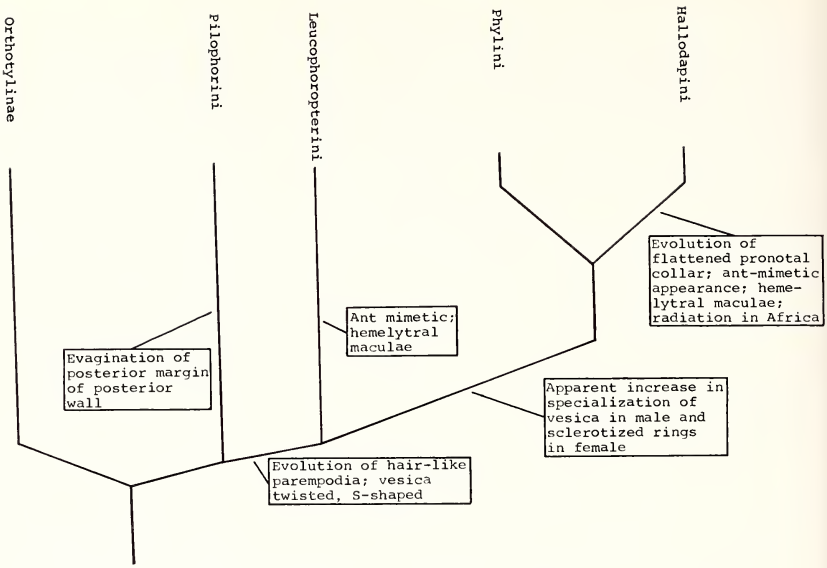


FIG. 350. Phylogeny of the Phylinae.

distribution is the concentration of tribes in the Old World (exclusive of Australia) (Figures 351a, b, c, and d). Of the four tribes, only the Phylini are at all well represented in the New World. The Hallodapini and Pilophorini are poorly represented (except for *Pilophorus,* which has speciated in the Nearctic) and the Leucophoropterini are absent from the Western Hemisphere. The Phylinae form a limited component of the ant-mimic mirid fauna in North America and are absent from the Neotropical Region, whereas they are the dominant mimetic mirids in the Old World. The Orthotylinae and Mirinae (Herdoniini) are the major mimetic mirid taxa in the New World.

The Phylinae appear to be extremely numerous and diverse in the Palearctic, but this may result from the advanced state of taxonomy in that region. In addition to being well collected and described, the Palearctic Phylinae are rather finely divided at the generic level, so that the actual number of genera might be somewhat reduced if the same generic concepts were applied in the Palearctic as currently exist in less well known regions.

The Phylinae are most diverse in temperate areas, including the Nearctic, Palearctic, and southern Africa, and much less so in tropical regions. This may be an adaptation to temperate floras, but

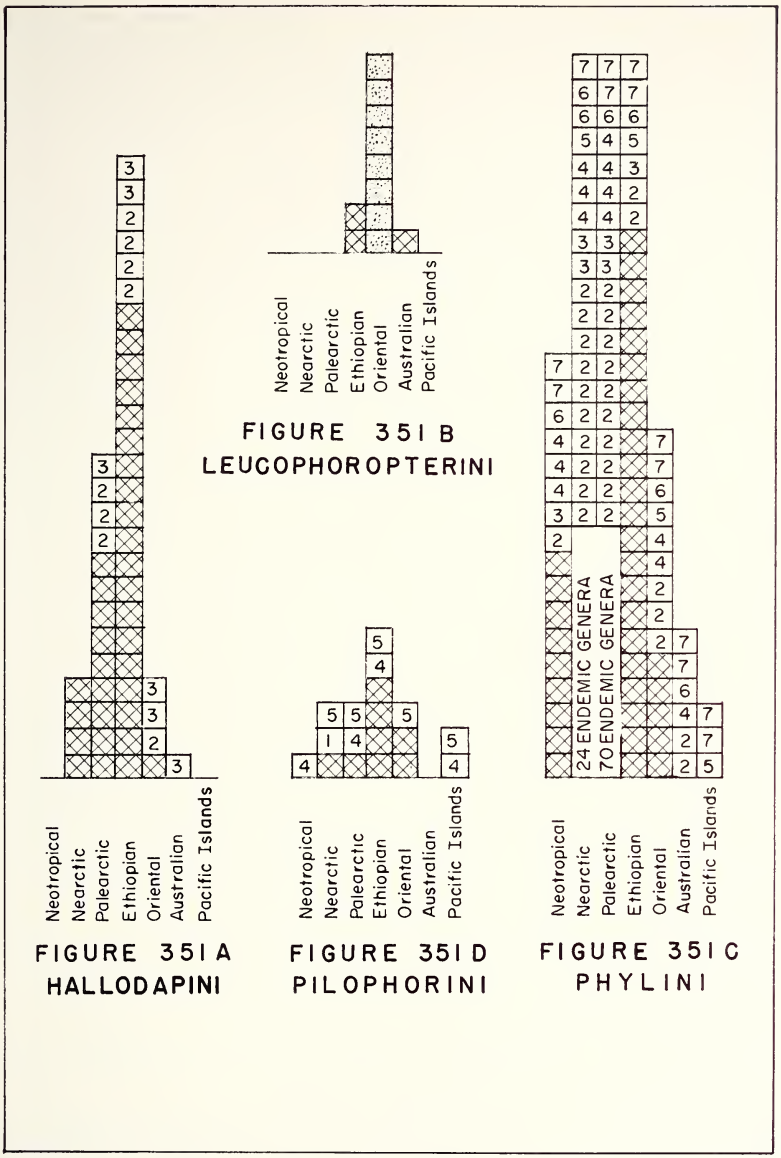


FIG. 351. Distribution of the Leucophoropterini, Hallodapini, Pilophorini, and Phylini (see text for explanation).

the evidence for this is not available. The pattern is particularly evident in the Phylini (Figure 351c), but is probably important in the Leucophoropterini also (Figure 351b). The Hallodapini and Pilophorini also have conspicuous temperate elements (see tribal discussions).

TRIBE HALLODAPINI

DIAGNOSIS: Ant mimetic; usually dark with contrasting light hemelytral maculae; pronotum always with well developed flattened collar (rounded in *Cremnocephalus* and *Myrmicomimus*); head usually convex behind, sometimes concave, eyes either contiguous with anterior margin of pronotum or removed from it by distance equal to nearly twice diameter of eye; pronotum always constricted anteriorly, sometimes forming a long neck; scutellum often tuberculate or occasionally spiniform; hemelytra either straight or sinuate laterally; abdomen usually constricted basally; parempodia hair-like, parallel (in *Cyrtopeltocoris* weakly fleshy and convergent apically); pulvilli usually minute, occasionally long and free or fused to claws; vesica always S-shaped or otherwise bent, sometimes very long (Figure 175); gonopore well developed, only rarely indistinct; left clasper always wedge shaped, trough-like; right clasper flattened and leaf-like; phallotheca always L-shaped; posterior wall a simple plate, never with evaginated posterior margin.

DISCUSSION: The Hallodapini are the largest ant-mimic group in the Miridae, consisting of about 41 genera. The morphological adaptations of the Hallodapini for ant mimicry are unexcelled in the Miridae, and probably the Insecta, and are equalled in the Miridae only by the Leucophoropterini and Nichomachini. Wagner (1952; 1970b), and other authors have given the hallodapines subfamily rank, a position that has little merit, because it is based only on the superficial uniqueness of the group.

The Hallodapini (Systellonotini and Cremnocephalaria of older authors) have generally included all Phylinae that are ant mimetic, have a flattened pronotal collar, and usually have light maculae on the hemelytra. To this definition must be added characters of the male genitalia and distribution, otherwise genera belonging to the Leucophoropterini will be included in the tribe.

The Hallodapini as a tribe possess several characters that are derived relative to other members of the Phylinae and therefore appear to represent a monophyletic unit within the subfamily. These characters include: 1) the ant-mimic facies; 2) the flattened pronotal collar; 3) the hemelytral maculae; and 4) the structure of the male genitalia.

The strongest indication that the Hallodapini are monophyletic is found in the flattened pronotal collar. Although the rounded pronotal collar, as found in the Mirinae and other subfamilies, probably represents the ancestral condition in the Miridae, the flattened collar in the Hallodapini is almost certainly derived. This idea is supported by the fact that the Pilophorini, which are probably the most primitive members of the Phylinae, do not possess a pronotal collar. Also, the mode of evolution of the flattened collar from a pronotum with a finely carinate upturned anterior margin (as found in the Pilophorini, some Leucophoropterini, and most Phylini) can be traced in the Leucophoropterini (see tribal discussion), and suggests a possible mechanism for the evolution of the flattened collar in the Hallodapini from a more primitive phyline in which the anterior margin of the pronotum was finely carinate and upturned. The flattened collar is known to occur in only two genera of Phylinae in addition to the Hallodapini. They are *Eminoculus* from South Africa and an undescribed genus from Southeast Asia belonging to the Leucophoropterini; both of these taxa are specialized and, on the basis of additional derived characters, are more closely related to other evolutionary lines within the subfamily than to the Hallodapini.

All hallodapine genera either possess hemelytral maculae or are obviously related to genera that do. Although maculae have evolved more than once in the Phylinae, they are of very limited occurrence outside the Hallodapini and Leucophoropterini (occurring, e.g. in *Auchenocrepis* in the Phylini; in *Pilophorus* in the Pilophorini a transverse fasica is formed by sericeous scale-like hairs), and those non-hallodapine stocks that possess them are related to other evolutionary lines in the subfamily by additional derived characters.

The male genitalia of the Hallodapini are very similar structurally to those of the Phylini and much less so to those of the Pilophorini and Leucophoropterini. The tribe retains its monophyletic unity when the male genitalia are considered in conjuction with the pronotal collar and hemelytral maculae.

As outlined below, several lines of evolution can be traced in the Hallodapini. Each of the generic groups shows a strong affinity with at least one other generic group within the tribe, and thus all genera can be related to one another through other genera. The geographic distribution of the Hallodapini also strengthens the argument for a monophyletic tribe, with the greatest diversity in Africa and the Palearctic and with only limited but obviously related elements occurring in Southeast Asia and North America.

The phylogenetic affinities of the Hallodapini within the Phylinae

are obscure because no intermediate types exist through which the tribe can be derived from other members of the subfamily. Now, the Leucophoropterini at least suggest a logical progression toward development of the flattened pronotal collar from a type that primitively had no collar; however, the Hallodapini are probably not evolved from the Leucophoropterini. They appear to be most closely related to the Phylini, but no known genus suggests itself as a possible ancestral type.

Six groups can be recognized within the Hallodapini.

The Aeolocoris group. Wagner (1970b) erected the tribe Aelocorini [sic] for the genera *Aeolocoris* Reuter and *Acrorrhinium* Noualhier. He based the tribe on what he felt was a significant difference in the structure of the male genitalia between these genera and the rest of the Hallodapini, namely that the phallobase was heavily sclerotized apically and lightly sclerotized basally and that it was not firmly attached to the genital capsule. Wagner (1959) first described this condition for *Saharocylapus vidali* Wagner from Morocco. At that time he proposed a relationship between the Cylapinae and the Hallodapini based on the apparent absence of pulvilli in *Saharocylapus* and the similarity between the male genitalia of the Hallodapini and Cylapinae, viz. *Saharocylapus* and *Parafulvius* Carvalho. Later Wagner (1970b) synonymized *Saharocylapus* with *Aeolocoris*, giving scant attention to his previous placement of the former genus in the Cylapinae. If the pulvilli are actually absent in *Aeolocoris vidali* this is a derived condition, in that all other known phylines have them. Wagner's idea that the Hallodapini are related to the Cylapinae by the structure of the male genitalia is based on the incorrect subfamily placement of *Parafulvius* by Carvalho (1954) (see Phylini discussion of individual genera).

Genera belonging to the *Aeolocoris* group are: *Acrorrhinium* Noualhier, *Aeolocoris* Reuter, *Azizus* Distant, *Kapoetius* Schmitz, *Marmorodapus* Schmitz, *Syngonus* Bergroth, and *Trichophorella* Reuter (and probably *Bibundiella* Poppius). These genera constitute the most primitive element in the Hallodapini based on the broad abdomen (narrowed in *Trichophorella* and *Marmorodapus*), the absence of hemelytral fasciae (except in some species of *Acrorrhinium* and an undescribed species of *Syngonus*), the relatively non-ant-like appearance, and the absence of brachyptery (except in some species of *Acrorrhinium*). Although the group as a whole appears to have many primitive features, some included genera possess several derived characters, e.g. the spiniform frons and specialized vesica in *Acrorrhinium*.

The *Aeolocoris* group is held together by the presence of peculiar peg-like hairs on the dorsum and first antennal segment of most genera and the generally marmorate color pattern. Also, in certain genera, including *Aeolocoris, Azizus*, *Marmorodapus* (?), and *Trichophorella,* the eyes of the males are very much larger than those of the females. Although male Miridae generally have slightly larger eyes than the females, in *Aeolocoris* and the other genera, and also in some members of the *Hallodapus* group (see below), this dimorphism is extreme.

The *Aeolocoris* group is most diverse in tropical Africa, with all of the known genera occurring there. Only *Azizus* and *Acrorrhinium* are represented in Southeast Asia (the latter also occurring in northern Australia). The distributional pattern of the group agrees closely with that of the Hallodapini as a whole.

The Hallodapus group. The following genera form a distinct group based on uniform habitus, type of hemelytral fasciae, and other characters discussed below: *Boopidella* Reuter, *Eremachrus* Lindberg, *Hallodapus* Fieber, *Laemocoris* Reuter, *Paralaemocoris* Linnavuori, *Ribautocapsus* Wagner, and *Trichophthalmocapsus* Poppius (and probably *Omphalonotus* Reuter). All species are relatively small and ground living in those cases where the habits are known.

This group possesses the first stridulatory mechanism recorded in the Miridae, although they are well known in other families of Heteroptera (see Leston, 1957; Ashlock and Lattin, 1963). It exists in *Trichophthalmocapsus*, *Laemocoris*, and some species of *Hallodapus* (I have not examined specimens of *Ribautocapsus*, *Eremachrus*, and *Paralaemocoris* for this structure). The stridulatory device consists of a stridulitrum of fine teeth on the lateral corial margin and a plectrum of varying structure on the inner surface of the metafemur. In all species known to have the stridulatory mechanism both sexes possess it. In *Trichophthalmocapsus* and *Laemocoris* all of the species I have examined are apparently capable of stridulation. These highly derived genera probably arose from the more generalized genus *Hallodapus* in which only a limited group of species possess the structure. The stridulatory mechanism is absent in *Boopidella*, which otherwise appears most closely related to *Trichophthalmocapsus.*

Trichophthalmocapsus (and probably *Boopidella*, although no females have been available for examination) has strongly sexually dimorphic eyes. The eyes of the males are much larger than those of the females, a situation also found in certain genera of the *Aeolocoris* group.

All genera of the *Hallodapus* group occur in Africa and are usually most diverse there. *Hallodapus* is well represented in the Palearctic and Southeast Asia, but it is not known from New Guinea or Australia. This distribution agrees with the Hallodapini as a group, showing a major radiation in Africa with a more limited representation in the Palearctic and Southeast Asia. *Hallodapus albiceps* (Lethierry) from Guadaloupe Island in the Lesser Antilles (Carvalho, 1958a) is not a phyline (see page 92).

The Systellonotus group. This group includes a relatively large number of genera. Although the basic facies are quite variable, certain structures of the head, scutellum, and male genitalia suggest close relationships. Included genera are *Carinogulus* Schuh, *Cyrtopeltocoris* Reuter, *Diocoris* Kirkaldy, *Gampsodema* Odhiambo, *Glaphyrocoris* Reuter, *Hypomimus* Lindberg, *Mimocoris* Scott, *Pangania* Poppius, *Systellonotopsis* Poppius, and *Systellonotus* Fieber. *Carinogulus*, *Diocoris*, *Gampsodema*, and *Pangania* all possess projections either dorsally or laterally on the phallotheca (the male genitalia of *Systellonotopsis*, *Mimocoris*, and *Hypomimus* are not known). The phallothecal projection in *Pangania* is much more highly developed than in the other three genera. The dorsal phallothecal projection also occurs in *Hallodapus similis*, the only species in the *Hallodapus* group known to possess the structure. This suggests a close relationship between the genera placed in the *Hallodapus* group and some members of the *Systellonotus* group, if in fact the dorsal phallothecal projection is homologous in all species in which it occurs. Further study of the male genitalia of the Hallodapini will be necessary to determine the phylogenetic significance of this structure. *Glaphyrocoris*, *Hypomimus*, *Carinogulus*, and *Cyrtopeltocoris* have affinities with one another based on the tuberculate scutellum and also the head, which is concave behind (except in some species of *Carinogulus*). Most of the genera in this group are ground living. *Pangania*, however, is arboreal, but may be secondarily adapted to this habit. The habits of *Diocoris* are unknown.

Pangania, *Diocoris*, and *Gampsodema* are more or less restricted to tropical Africa. The remaining genera are distributed primarily in the Mediterranean Region with a limited representation in South Africa. *Cyrtopeltocoris* is endemic to North America, and most diverse in the arid southwestern United States. The *Systellonotus* group appears to be adapted to relatively dry areas with its greatest evolution in the Mediterranean, with a possibly wider distribution across Africa in the past and an invasion of North America by the ancestor of *Cyrtopeltocoris* (see also *Coquillettia* group).

The Formicopsella group. This group contains the morphologically most ant-like genera in the Hallodapini. Included genera are *Alloeomimus* Reuter, *Aspidacanthus* Reuter, *Formicopsella* Poppius, *Malgacheocoris* Carvalho, *Myombea* China and Carvalho, *Skukuza* Schuh, and *Sohenus* Distant.

The most distinctive structural feature of the *Formicopsella* group is the head, which is dorsoventrally elongated and narrowed posteriorly, forming a neck; the eyes are far removed from the anterior margin of the pronotum. Hemelytral markings consist of a white fascia at the base of the cuneus as well as medially on the corium. The vesica is long, strap-like, and usually bent several times (Figures 160, 182) (the male genitalia are imperfectly known for *Alloemimus*, *Malgacheocoris*, and *Aspidacanthus*). An interesting morphological specialization in *Aspidacanthus* and *Myombea* is the presence of a thin, erect spine on the scutellum. *Laemocoris* in the *Hallodapus* group shows a similar but presumably independent development.

The *Formicopsella* group is probably primarily ground living, although at least one genus, *Formicopsella*, is arboreal. The greatest diversity is in tropical Africa, but the range includes the southern Mediterranean, Madagascar, and India.

The Cremnocephalus group. Wagner (1970b) erected the tribe Cremnocephalini *sensu* Wagner to receive the genera *Cremnocephalus* Fieber, which contains two European species, and *Closterocoris* Uhler, which contains a single North American species (see discussion under misplaced genera). He substantiated the creation of this new taxon on the possession of long first tarsal segments and peculiar hemelytral markings in the included genera, and also the form of the right clasper in *Cremnocephalus*. Wagner specifically excluded *Myrmicomimus* Reuter, from southern Europe, the only other hallodapine genus with a long first tarsal segment, because it has a complete, narrow, light, transverse fascia on the anterior third of the corium and clavus, rather than the series of light lines parallel to the claval suture found in *Cremnocephalus*. Both *Cremnocephalus* and *Myrmicomimus* have a rounded pronotal collar that is unlike the flattened structure found in all other Hallodapini. Wagner (1970b) stated that *Cremnocephalus* is not ant mimetic, citing Kullenberg (1944), and that it is arboreal, whereas the Hallodapini *sensu* Wagner are ground living. He felt this supported a more distant relationship from the remaining hallodapines. However, several genera in the Hallodapini are arboreal (see *Pangania* and *Formi-*

copsella), and some are not less convincingly ant-mimetic than *Cremnocephalus* (e.g. *Orectoderus*).

The long first tarsal segment and peculiar hemelytral markings of *Cremnocephalus* occur nowhere else in the Phylinae and are of only very limited occurrence in the Miridae as a whole. This suggests that they are probably apomorphic characters. These characters set off *Cremnocephalus* as (part of) a distinct evolutionary unit, but one not significantly different from the remainder of the Hallodapini to merit tribal status. Furthermore, hemelytral markings are variable in the Hallodapini, at least much more so than the length of the first tarsal segment. Therefore, if the Cremnocephalini were to be recognized, *Myrmicomimus* would have to be included with *Cremnocephalus* because they are very closely related by the general body form, the rounded pronotal collar, type of male genitalia, and long first tarsal segment. I consider these two genera to represent nothing more than a specialized evolutionary line within the Hallodapini *sensu lato*.

The Coquillettia group. The genera *Coquillettia* Uhler, *Orectoderus* Uhler, and *Teleorhinus* Uhler (and *Cyrtopeltocoris*, discussed under *Systellonotus* group) are the only Hallodapini that occur in the New World. Reuter (1910a) placed *Coquillettia* and *Orectoderus* in the Cremnocephalini and *Teleorhinus* in his *genera incerta*. Knight (1923) and Carvalho (1952a; 1958a) placed all three genera in the Hallodapini. Knight (1941; 1968) considered these genera to be related to *Macrotylus* (and other genera with long pulvilli) and placed them in the Phylini.

Although *Colquillettia* and *Orectoderus-Teleorhinus* form two rather distinct groups they can be related on a number of derived characters. These are: 1) the presence of a long carinate gula in the males (the gula is ecarinate in the females); 2) the type of brachyptery in the females; 3) the enlarged pulvilli; and 4) the absence of minute rows of spines on the tibiae (present in almost all other Phylinae).

In the *Coquillettia* group, as in the Leucophoropterini, there is what appears to be an independent evolution of two types of gonopores in the male genitalia. This is suggested by the fact that *Coquillettia* has an obscure poorly developed gonopore situated at the apex of the vesica, whereas in *Orectoderus* the gonopore is large, well developed, and situated subapically. The type found in *Coquillettia* is possibly primitive because the flattened pronotal collar is of the form found in most other Hallodapini, whereas in *Orectoderus* and *Teleorhinus*, it is greatly modified.

Coquillettia is related to *Systellonotus* by the general body form and structure of the vesica. The carinate gula found in the males of all *Coquillettia* group genera is not present in *Systellonotus*, although it does occur in both sexes of *Mimocoris* and at least in the males of *Carinogulus*. *Systellonotus* does not have the greatly enlarged pulvilli of this group, although at least in *S. triguttatus* they are distinctly larger than in most hallodapine genera.

Coquillettia is the least specialized of the three genera in the group. *Orectoderus* and *Teleorhinus* have diverged greatly from *Coquillettia*, losing the hemelytral fascia (in most species), having the pulvilli fused to the ventral surface of the claws (free in *Coquillettia*), having the pronotal collar greatly modified, and in *Teleorhinus* having a strongly clavate second antennal segment.

Based on morphological and distributional evidence it seems reasonable to assume that the ancestor of this group was similar to *Systellonotus* in many respects and that it invaded North America from the Palearctic. The genera belonging to the *Coquillettia* group are widely distributed in North America, but show their greatest diversity in the Western mountains. Van Duzee (1921) described *Coquillettia uhleri* from Pasadena, California. This species was incorrectly recorded from "Austria; n.m. Europe" by Carvalho (1958a).

ZOOGEOGRAPHY: The distribution of the Hallodapini as portrayed by the Carvalho Catalogue is cosmopolitan, with the greatest diversity in the Palearctic and Ethiopian Regions. I have excluded the genera *Amazonocoris* Carvalho, *Closterocoris* Uhler, *Glossopeltis* Reuter, *Hallodapoides* Carvalho, *Heidemanniella* Poppius, *Nicostratus* Distant, and *Tylopeltis* Reuter, which were included in the Hallodapini by Carvalho (1958a), and moved them to other subfamilies. The tribe is thus predominantly Old World, with only two very limited groups occurring in the Nearctic, and is totally absent from the Neotropics. The Hallodapini are most diverse in Africa and the Palearctic (Figure 351a) and the faunas of these two areas are very closely related.

Hallodapines are distinctive for their extensive adaptation to relatively dry areas of the Old World. This is exemplified by the large number of genera in the Mediterranean and Africa. At present the only genera known from Southeast Asia and Australia are *Hallodapus*, *Azizus*, and *Acrorrhinium*. In these regions the Leucophoropterini and Pilophorini are most abundant and probably replace the Hallodapini ecologically.

DISCUSSION OF INDIVIDUAL GENERA.

Acrorrhinium Noualhier, 1895, see page 66.

Aeolocoris Reuter, 1903, see page 121 and discussion under *Aeolocoris* group.

Alloeomimus Reuter, 1910b.

The male genitalia (as illustrated by Hoberlandt, 1953, for *Alloeomimus kurdus*), parempodia, pronotal collar, and facies confirm the placement of this genus in the Hallodapini. Two species are known from the Mediterranean.

* *Amazonocoris* Carvalho, 1952c, see genera *incertae sedis*.

* *Anapsallus* Odhiambo, 1959c, see Phylini.

Aspidacanthus Reuter, 1901.

The structure of the head and pronotum, hemelytral coloration, and general facies place this genus in the Hallodapini. The scutellar spine shows a very close relationship to *Myombea*. Two species are known from Senegal and Turkestan.

Azizus Distant, 1910a, see page 80.

Bibundiella Poppius, 1914a.

I have not examined specimens of this genus, but based on the original description, it belongs to the Hallodapini. The type specimen of *Bibundiella obscura* Poppius, is in the Helsinki Museum (personal communication, Martin Meinander, Helsinki Museum), although Poppius' (1914a) original description indicates that it was deposited in the Berlin-Humboldt Museum.

Boopidella Reuter, 1907b, see page 121.

Carinogulus Schuh, new genus, see page 81.

Chaetocapsus Poppius, 1914a.

I have not examined *Chaetocapsus binotatus* Poppius, the type species of the genus, but the original description indicates that it belongs to the Hallodapini. The holotype of *C. binotatus* is in the Helsinki Museum (personal communication, Martin Meinander, Helsinki Museum), although Poppius (1914a) indicated that it was deposited in the Berlin-Humboldt Museum.

* *Closterocoris* Uhler, 1890, Mirinae, see misplaced genera.

Coquillettia Uhler, 1890, see discussion under *Coquillettia* group.

Cremnocephalus Fieber, 1860, see discussion under *Cremnocephalus* group.

Cyrtopeltocoris Reuter, 1876a.

Reuter (1910a) placed *Cyrtopeltocoris* in the Cremnocephalaria and was followed by Van Duzee (1917) who placed the genus in the Hallodapini (Cremnocephalaria = Hallodapini); Knight (1968) later placed it in the Pilophorini, the position given the genus by Carvalho (1952a; 1958b). Kelton (1959b) noted that the male genitalia are of the phyline-type. The parempodia, which are weakly fleshy and slightly convergent apically, have created confusion as to proper tribal placement. The male and female genitalia, the flattened pronotal collar, the white transverse fascia on the hemelytra, and the general body form all confirm placement in the Hallodapini (see also discussion under *Systellonotus* group). At least 13 species are presently placed in *Cyrtopeltocoris*, most from the Southwestern United States (see Knight, 1968).

Diocoris Kirkaldy, 1902c, see page 122.

Eremachrus Lindberg, 1958, pp. 105–106.

Described from brachypterous specimens, and placed in the Hallodapini by Lindberg (1958), *Eremachrus* is extremely closely related to *Hallodapus*. Only a single species is known from the Cape Verde Islands.

* *Eucerella* Poppius, 1921, see Orthotylini.

Formicopsella Poppius, 1914a, see page 89.

Gampsodema Odhiambo, 1959c, pp. 648–649, see *Diocoris*, page 122.

Glaphyrocoris Reuter, 1903, see page 84.

* *Glossopeltis* Reuter, 1903, Deraeocorinae, see misplaced genera.

* *Hallodapoides* Carvalho, 1951a, see Orthotylini.

Hallodapus Fieber, 1858, see page 91.

* *Heidemanniella* Poppius, 1914c, Mirinae, see misplaced genera.

Hypomimus Lindberg, 1940, see discussion under *Carinogulus,* page 84.

Kapoetius Schmitz, 1969, pp. 72–81.

Kapoetius belongs to the *Aeolocoris* group. One species is known from the Sudan.

Laemocoris Reuter, 1879, see page 103.

* *Lissocapsus* Bergroth, 1903, see genera *incertae sedis*.

* *Makakix* Odhiambo, 1967, Deraeocorinae, see misplaced genera.

Malgacheocoris Carvalho, 1952b.

Malgacheocoris is probably most closely related to *Formicopsella* and *Myombea* from Africa. Only a single species is known from Madagascar.

Marmorodapus Schmitz, 1970, pp. 512–520.

Marmorodapus was described with a single included species, *M. spinulatus* Schmitz. Unfortunately, by what must have been an inadvertent error, no locality data or holotype designation was included with the original description. The genus is from Africa (Congo?) and belongs to the *Aeolocoris* group.

Mimocapsus Wagner, 1953.

Mimocapsus may be closely related to *Systellonotus*. One species is known from Egypt.

Mimocoris Scott, 1872.

See discussion under *Systellonotus* group. Two species are described from southern Europe and the Mediterranean. A third species, *Mimocoris scotti* Berg, from Argentina, is almost certainly placed in the wrong genus and subfamily.

Myombea China and Carvalho, 1951, see page 104.

Myrmicomimus Reuter, 1881, see discussion under *Cremnocephalus* group.

* *Myrmicopsella* Poppius, 1914a, see Leucophoropterini.

* *Nicostratus* Distant, 1904a, Deraeocorinae, see misplaced genera.

Omphalonotus Reuter, 1876b.

Omphalonotus is probably most closely related to *Hallodapus* and allied genera. Two species are known from Europe and North Africa.

Orectoderus Uhler, 1876, see discussion under *Coquillettia* group.

Pangania Poppius, 1914a, see page 104.

Paralaemocoris Linnavuori, 1964, pp. 326–328.

This genus is most closely related to *Laemocoris* and *Hallodapus*. Three species are known from the Middle East.

Ribautocapsus Wagner, 1962, p. 83.

This genus is most closely allied to *Laemocoris* and *Hallodapus*. One species is known from Spain and Algeria.

Sohenus Distant, 1910a.

Sohenus appears to be very closely related to *Formicopsella*, from Africa, by the structure of the head, pronotum, and hemelytra, and also the color pattern. Further study may reveal that the two are synonymous. The male genitalia of *S. uvarovi* Ballard are typical of the Hallodapini, the vesica being long, with several bends, and having a well developed subapical gonopore. Two species are known from India.

Syngonus Bergroth, 1926.

Originally described under the preoccupied name *Bibundia* (Poppius 1914a), this genus was renamed by Bergroth (1926). Poppius (1914a) stated that the holotype of *Syngonus nigra* (Poppius), the only described species in the genus, was deposited in the Berlin-Humboldt Museum. In fact it is in the Helsinki Museum (Type No. 11958). *Syngonus* is probably most closely related to *Acrorrhinium* and *Trichophorella*. It is peculiar in the Hallodapini in being black. An undescribed species from Ghana has a very broad white fasica medially on the hemelytra, whereas *nigra* has only a faint light marking on the corium. The former condition is not found in other members of the *Acrorrhinium* group. The head is missing from the holotype of *S. nigra*, from Cameroon.

Systellonotidea Poppius, 1914a, see *Diocoris* Kirkaldy, page 122.

Systellonotus Fieber, 1858, see page 112.

Teleorhinus Uhler, 1890, see discussion under *Coquillettia* group.

Trichophorella Reuter, 1905b, see page 114.

Trichophthalmocapsus Poppius, 1914a, see page 117.

* *Tylopeltis* Reuter, 1904, Deraeocorinae, see misplaced genera.

LEUCOPHOROPTERINI, NEW TRIBE

DIAGNOSIS: Usually ant mimetic; generally dark, often with contrasting light hemelytral maculae; head usually concave behind, eyes usually contiguous with anterior margin of pronotum; head sometimes convex behind, eyes well removed from pronotum; genae occasionally extremely hairy; pronotum usually with finely carinate

upturned anterior margin or with more or less well developed flattened collar; pronotum slightly to strongly constricted anteriorly or rarely constricted medially (hour glass shaped); scutellum always flat; hemelytra straight or weakly or strongly sinuate laterally; abdomen narrow; parempodia usually hair-like, parallel, very seldom fleshy, rod-like, and weakly convergent apically; pulvilli always minute; vesica occasionally U-shaped, weakly twisted (Figure 200), usually S-shaped, strongly twisted; male gonopore undeveloped, poorly developed, or rarely well developed; left clasper always wedge-shaped, trough-like; right clasper flat, leaf-like; posterior wall simple, posterior margin not evaginated.

NOTE: Many genera in the Leucophoropterini are undescribed and therefore cannot be given names in the following discussion.

DISCUSSION: Many genera in the Leucophoropterini are superficially very similar to members of the Hallodapini and Pilophorini. Fortunately, a distinct evolutionary sequence can be traced in the Leucophoropterini, for if this were not possible, at least some of the genera would be placed in the other two tribes. Two of the most primitive genera in this tribe (*Leucophoroptera* and *Karoocapsus*) have well developed light hemelytral maculae. The anterior margin of the pronotum in these genera is finely carinate and upturned and the head is concave behind, resembling structurally the situation found in the Pilophorini. *Tytthus*, which also appears to be relatively primitive, usually has a dark head and pronotum and light hemelytra; the head is convex behind and the anterior margin of the pronotum is similar to that of *Leucophoroptera*. Most of the derived members of the tribe have rather poorly developed hemelytral maculae and have the head and prontum variously modified from the structure found in *Leucophoroptera* and *Karoocapsus* (see discussion below).

The male genitalia of the Leucophoropterini are distinct from those of the Hallodapini, Phylini, and Pilophorini, although the differences are often small and difficult to categorize. The gonopore is either apical and not developed (*Karoocapsus* and *Tytthus*) or subapical and poorly developed. In an undescribed genus from the Philippines, the gonopore is very well developed, but this is almost certainly a convergence toward the form found in most Hallodapini, because all other characters of this genus agree closely with the Leucophoropterini. In *Karoocapsus* and *Tytthus* the vesica is U-shaped and only very slightly twisted, resembling the form found in the Pilophorini and emphasizing the plesiomorphic character of these genera. In all other genera the vesica is distinctly twisted

and S-shaped. The male genitalia are small relative to the total body size. In contrast to the Leucophoropterini, the Hallodapini almost always have a well developed subapical gonopore (exceptions include *Coquillettia*), a strongly twisted S-shaped or more elaborately bent vesica and genitalia that are relatively large in comparison to the total size of the insect. The female genitalia of the Leucophoropterini show only very minor differences from those of the Hallodapini and Phylini, and differ from those of the Pilophorini in not having the evaginated posterior margin of the posterior wall.

Two lines of evolution toward effective ant mimicry can be recognized in the Leucophoropterini. One involves the development of a head-pronotum combination similar to that found in *Formicopsella* in the Hallodapini. In this line there is a definite transition from the type of head and anterior pronotal margin found in *Karoocapsus* and *Leucophoroptera* to an anteriorly constricted pronotum with a flat collar and head "necked" behind the eyes (genera of this type are as yet undescribed). The other line of evolution involves accentuation of the head which is concave behind, again as in *Karoocapsus*, and at the same time specialization of the pronotum to conform to the outline of the posterior margin of the head. At its highest degree of specialization the pronotum is constricted medially into an hourglass shape; this type has also evolved independently in the Pilophorini (genera in neither tribe are as yet described, however).

Two convergences, in addition to those mentioned above, occur between the Leucophoropterini and other phyline tribes. In certain undescribed genera the gena is "carinate", forming a broad ridge below the eye. In frontal view this resembles the outline of mandibles, and its most advanced condition, includes the buccula as the apex of the mandible. A similar development occurs in at least one undescribed species of pilophorine, related to *Pilophorus,* from the Philippines. In another undescribed genus of Leucophoropterini from the Philippines the parempodia are fleshy, rod-like, and weakly convergent apically, a condition very similar to that found in some Phylini and Hallodapini.

ZOOGEOGRAPHY: Two of the most primitive genera in the Leucophoropterini, *Karoocapsus* and *Leucophoroptera*, occur in South Africa and Australia (and New Guinea) respectively. The more derived genera are found in New Guinea, New Ireland, the Solomon Islands, Borneo, and the Philippine Islands. Therefore the group probably evolved in temperate and subtropical areas of Australia (and South Africa) and subsequently spread to nearby tropical islands and became more highly specialized there. The paucity of

leucophoropterine genera in Africa (Figure 351b) suggest that either *Karoocapsus* is a relict or that the environmental conditions in tropical Africa were unsuitable for the evolution of the group. Also, competition from the Hallodapini may have been important in limiting the evolution of the Leucophoropterini in Africa. *Tytthus* appears to be in a somewhat distinct evolutionary position in the tribe. It is nonmimetic, has the head convex behind, and is cosmopolitan.

DISCUSSION OF INDIVIDUAL GENERA.

Bilirania Carvalho, 1956a, pp. 215–216.

Bilirania myrmecoides Carvalho, from the Philippines, was placed in the Pilophorini and related to *Leucophoroptera* by its author. Carvalho (1956a) did not illustrate the male genitalia, but the facies of *Bilirania* indicate that it probably belongs to the Leucophoropterini. The complex distribution of the Leucophoropterini and the Pilophorini in Southeast Asia and the great external similarity of the two groups makes it necessary to only tentatively assign *Bilirania* to the Leucophoropterini, until specimens can be examined and the male genitalia dissected.

Karoocapsus Schuh, see page 123.

Leucophoroptera Poppius, 1921.

Leucophoroptera was originally described from New South Wales, Australia, and New Guinea. I have examined an undescribed species from Queensland, Australia, in which the male genitalia are similar to those of *Karoocapsus*, but the vesica is more strongly S-shaped. The female genitalia of *L. quadrimaculatus* have a posterior wall consisting of a simple sclerotized plate.

Poppius (1921) described *L. quadrimaculatus*, the type species of the genus, from specimens from New South Wales, Australia, and New Guinea ("Ins. Deslacs"). I have examined a female from the Helsinki Museum from the latter locality. The other specimens are apparently in the Hungarian Museum and they must be studied before a lectotype can be designated.

Myrmicopsella Poppius, 1914a.

The holotype female of *Myrmicopsella nitidipenne* Poppius from Tananarive, Madagascar, is the only known representative of the genus. It almost certainly belongs to the Leucophoropterini, and is probably most closely related to *Karoocapsus*. Poppius (1914a) noted that this specimen was deposited in the Paris Museum, but in fact, it is in the Helsinki Museum (Type No. 7788).

Tytthus Fieber, 1864, see page 135.

TRIBE PHYLINI

DIAGNOSIS: Facies, coloration, and vestiture variable, never ant mimetic; females occasionally brachypterous; flattened pronotal collar absent (except in *Eminoculus*); dorsum very seldom heavily punctate; parempodia usually hair-like, parallel, occasionally fleshy, rod-like, of nearly uniform diameter, weakly convergent apically; pulvilli minute or enlarged, free or fused to ventral surface of claws; vesica always twisted (only very slightly in *Pseudosthenarus* and *Parapseudosthenarus*), gonopore usually subapical, well developed; left clasper always wedge shaped, trough-like (somewhat modified in *Pseudosthenarus*); posterior wall never with evaginate posterior margin.

DISCUSSION: The Phylini have traditionally been the tribe in the Phylinae which contained all nonmimetic and/or collarless genera. Until a thorough analysis of this large cosmopolitan group can be undertaken, I am defining the tribe as consisting of all nonmimetic, collarless genera without convergent recurved parempodia.

Tribes recognized by certain authors that I include in the Phylini are Cremnorrhini, Harpocerini, Camptotylini, Exaeretini, Tuponiini, and Semiini. A few additional tribes have been recognized, but these are of mostly historical interest.

The Oncotylini have been recognized by Reuter (1883; etc.), Van Duzee (1916), Knight (1923), and other authors to include genera with enlarged pulvilli (e.g. *Lopus* Hahn and *Macrotylus* Fieber). Although many genera with this tarsal condition are probably closely related, they do not appear to merit tribal status, when considered relative to the total variation of the pulvilli in the Phylini. Also, the condition has evolved independently in the Hallodapini (see *Coquillettia* group).

The Cremnorrhini have recently been recognized (Wagner and Weber, 1964) to include the single Eastern Mediterranean genus *Cremnorrhinus* with the single included species *C. basalis* Reuter; the Harpocerini (Wagner, 1952) to include *Harpocera* Curtis, from Western Europe and the Mediterranean; the Camptotylini and Exaeretini (Wagner, 1952; Wagner and Weber, 1964) to include the Mediterranean genera *Camptotylus* Fieber and *Exaeretus* Fieber, respectively; and the Tuponiini (Wagner, 1952, as a subtribe; Wagner and Weber, 1964, as a tribe) to include *Tuponia* Reuter and closely related genera. None of the above tribes is based on a com-

parative analysis of the world fauna, and for the most part they are founded on structures that vary throughout the Phylini *sensu lato*. The genitalia in *Camptotylus* (see Wagner and Weber, 1964) (and probably *Exaeretus*), are somewhat peculiar in the Phylinae, but in the form of the right clasper, a parallel to *Camptotylus* is found in *Pseudosthenarus* from South Africa, although the two are probably unrelated, based on the structure of the vesica. The Harpocerini and Cremnorrhini are defined on color characters (Wagner, 1952). The Tuponiini are separated from the Exaeretini (= Camptotylini) (Wagner and Weber, 1964) on the length and shape of the labium, a character I have found to be extremely variable (e.g., compare *Pseudosthenarus*, *Capecapsus*, and *Coatonocapsus* with one another and with other phylines). The tribe Semiini (Knight, 1923) was erected within the Orthotylini, but the only included genus, *Semium* Reuter, has since been transferred to the Phylini (Kelton, 1959a).

Several genera, in addition to those discussed above, are somewhat anomalous within the Phylini. *Reuteroscopus* Kirkaldy, from North and Central America, has a vesica quite distinct from all other known Phylinae (see Kelton, 1964). The coleopteroid females and stylate eyes of *Eminoculus*, from South Africa, are unique in the Phylinae, and resemble those of *Pachytomella* Reuter in the Halticini. Also *Eminoculus* is the only known Phylini genus with a flattened pronotal collar. This character might relate the genus to the Hallodapini, but otherwise *Eminoculus* bears no obvious relationship to that tribe, and the collar is probably independently evolved relative to the Hallodapini. The male genitalia of *Pseudosthenarus* and *Parapseudosthenarus* from South Africa, show no close relationship to any other known genera, although externally *Pseudosthenarus* closely resembles some species of *Sthenarus*.

Until the Phylini as a whole can be carefully studied, I do not consider it advisable to subdivide the tribe. Although the other tribes recognized within the subfamily may in some cases represent derivatives of the Phylini (especially the Hallodapini), it seems desirable to recognize individual phyletic lines of specialization, e.g. ant mimicry, within the Phylinae, rather than conceal them within an omnibus tribe. Subdivision of the Phylini along phyletic lines at the present time would, however, be nearly impossible.

I have not examined the following genera placed in the Phylini by Carvalho (1958a) and have not found references which will allow confirmation of subfamily or tribal placement: *Alloeotarsus* Reuter, *Boopidocoris* Reuter, *Capellanus* Distant, *Cephalocapsidea* Poppius, *Decomia* Poppius, *Demoplesia* Poppius, *Ectagela* Schmidt, *Ectenellus*

Reuter, *Ephippiocoris* Poppius, *Eucharicoris* Reuter, *Euderon* Puton, *Exaeretus* Fieber, *Hadrophyes* Puton, *Homolaner* Kiritschenko, *Ibiaris* Horvath and Reuter, *Leucodellus* Reuter, *Litoxenus* Reuter, *Myochroocoris* Reuter, *Nicholia* Knight, *Nyctidea* Reuter, *Oligobiella* Reuter, *Opisthotaenia* Reuter, *Pararagmus* Poppius, *Phoenicocapsus* Reuter, *Pleuroxonotus* Reuter, *Pronotocrepis* Knight, *Sceodamia* Poppius, *Sthenaropsis* Poppius, *Taeniophorus* Linnavuori, *Trevessa* China, and *Utopnia* Reuter.

ZOOGEOGRAPHY: The Phylini are the only tribe in the Phylinae that occur in the Neotropical Region (with the exception of one species of Pilophorini). Some records for South America are old and pertain to species placed in large, widely distributed genera, which may in fact be incorrectly assigned. The actual amount of endemism in the Neotropics cannot therefore be accurately determined.

Data for the Nearctic indicate that the fauna consists of two basic elements: 1) an endemic fauna; and 2) a fauna closely related to the Palearctic at the generic level (Figure 351c). The Palearctic phyline fauna is extremely large, but probably not as diverse as the data would indicate. As discussed above, Wagner (1952) and Wagner and Weber (1964) have divided the Palearctic Phylini into five tribes, but the majority of the genera are placed in one tribe, the Phylini. The one element of the Palearctic fauna that has received attention recently, particularly from Wagner (1957b; 1959; 1961; etc.) and Linnavuori (1961; 1964; etc.) is the Mediterranean. This region is very interesting and seems to hold most of the anomalous types in the Palearctic fauna as a whole.

With regard to the Ethiopian Region, my investigations on the Phylini of South Africa reveal some interesting facts. Several generic groups, based on the structure of the male genitalia, appear to exist within the Ethiopian fauna, even though the relationship of the genera is not obvious from general facies. For example, heavy punctations on the dorsum are extremely uncommon in the Phylini. *Lamprosthenarus*, which is heavily punctate, has a vesica very similar to that of *Coatonocapsus*, *Austropsallus*, *Odhiamboella*, and others, which are impunctate.

The genera of Phylini presently recorded from the Oriental region are mostly of wide distribution, occurring in several faunal regions (Fig. 351c). At present no endemic Phylini are known from Australia.

The Phylini are adapted primarily to temperate regions and probably to floras of those areas. This is suggested by the abundance of genera in the Palearctic and Nearctic and the paucity of genera in

tropical areas, a phenomenon that may be to some extent the result of inadequate collecting in the tropics. However, I have examined large collections of Miridae from Africa, and have found very few Phylini from areas other than the Mediterranean and South Africa. Examination of the known distributions of the Bryocorinae and Deraeocorinae, which are no more or less well known than the Phylini, reveals that they are primarily tropical, with only a very few representatives in temperate regions. This confirms that although absolute faunal compositions are not known, the relative diversity of mirid taxa in temperate and tropical areas is well enough known to make useful comparisons.

DISCUSSION OF INDIVIDUAL GENERA.

Anapsallus Odhiambo, 1959c, pp. 680–681.

Odhiambo (1959c) placed *Anapsallus* in the Hallodapini because of its wide pronotal collar. My examination of the holotype of *A. marmoratus* Odhiambo reveals that in fact there is no pronotal collar and that the genus belongs in the Phylini.

Ellenia Reuter, 1910a, see page 157.

Erythrocorista Lindberg, 1958, see Orthotylini.

Millerimiris Carvalho, 1951b.

Carvalho (1951b) placed *Millerimiris* in the Orthotyini, but his illustrations of the male genitalia indicate that it is actually a member of the Phylini. My examination of the holotype of *M. punctatus* Carvalho reveals that the parempodia are only weakly fleshy and similar to the type found in *Ellenia* and *Capecapsus*.

Parafulvius Carvalho, 1954.

This genus was placed in the Fulviini (Cylapinae) by Carvalho (1954), on the basis of the type of claws and male genitalia. Carvalho (1954) stated that *Parafulvius* resembles *Amblytylus* Fieber. In fact it is probably closely related to that genus. The genitalia as illustrated by Carvalho are definitely phyline, and the claws, although they may be long and slender, fit into the range of variation found in the Phylinae.

Paramixia Reuter, 1900, Pilophorini, see page 210.

Platyscytus Reuter, 1907a.

This genus has been assigned to the Orthotylini by Carvalho (1952a; 1958b). Examination of illustrations of the male genitalia of species of *Platyscytus* described by Carvalho (1953b) and Car-

valho and Fonseca (1965) and examination of specimens of the genus, indicate that it belongs to the Phylini. Also, the parempodia are hair-like and not of the type found in the Orthotylini.

Psallops Usinger, 1946, Cylapinae ?, see pages 263–264.

Semium Reuter, 1876a.

Placed in the Orthotylini by Carvalho (1958b), this genus was correctly moved to the Phylini by Kelton (1959a).

TRIBE PILOPHORINI

DIAGNOSIS: Elongate or robust, sometimes ant mimetic; seldom if ever strongly brachypterous or sexually dimorphic; head declivous to nearly vertical, concave behind, posterior margin of vertex usually carinate; pronotum usually broad and nearly flat, although sometimes highly modified with tubercles or strongly constricted medially; hemelytra usually without defined fasciae contrasting with background coloration; often with light transverse band on hemelytra formed by aggregations of sericeous scale-like hairs; parempodia fleshy, recurved, convergent apically; pulvilli minute; vesica simply curved, U-shaped, not twisted, without enlarged apical or subapical gonopore (Figure 318); phallotheca usually nearly straight, without right-angle bend (L-shaped); opening usually terminal (Figure 325); left clasper sometimes distinctly trough-like (*Paramixia*, Figure 334), usually splayed out, wing-like (Figure 320); right clasper small and leaf-like, typical of subfamily; female genitalia with sclerotized rings usually with moderate lateral infolding (Figure 317); posterior wall simple, lacking K-structures (Figure 315), but with evagination dorsally along posterior margin (Figure 316).

DISCUSSION: Most authors have defined the Pilophorini as those ant-mimetic mirids with convergent parempodia. Wagner (1952; 1955) was the first author to realize that the tribe, as so defined, was composed of unrelated genera and he redefined the group as those mirids with convergent recurved parempodia and Phylinae-type male genitalia.

In analyzing the Orthotylinae and Phylinae I have concluded that the convergent recurved parempodia are ancestral and that the hair-like parempodia found in the Phylinae are derived from them. I have reached this conclusion because, when convergent recurved parempodia are regarded as derived, as can be inferred from most classifications, it becomes necessary to evolve the phyline-type male genitalia twice. I am following Knight (1941) who regarded the complex structure of the phyline male genitalia as a fundamental

character in classification; I consider them to be derived and therefore (as previously discussed) place the Pilophorini in the Phylinae, rather than the Orthotylinae as all previous authors have done. I interpret the convergent recurved parempodia as primitive; thus the phyline-type male genitalia need to be evolved only once.

As members of the most primitive phyline tribe, *Pilophorus* and closely related genera (e.g. *Aloea*) have the simplest male genitalia in the subfamily. The vesica is a U-shaped, untwisted tube with a gonopore that is little more than a subapical opening in the wall of the vesica. The most complex pilophorine vesica is that of *Parasthenaridea* Miller. Although U-shaped and untwisted, the vesica is no longer a simple tube, but consists of what resemble two partially concentric sclerotized bands. Peculiar projections on the inner surface of the vesica are a unique feature of many pilophorine genera (e.g. *Pilophorus*, *Parasthenaridea*). The pilophorine phallotheca is also plesiomorphic in the Phylinae. It is not bent at a right angle (except in *Paramixia*) as in all other Phylinae, and is structurally closest to the orthotyline-type. As discussed above, the pilophorine posterior wall is advanced in the Phylinae and must have evolved subsequent to the split of the Phylinae into the Pilophorini and non-Pilophorini lines of evolution.

The Pilophorini apparently do not possess brachypterous forms, although they are common in all other phyline tribes. The greatest degree of wing modification or reduction in this tribe is what might best be called submacroptery, as found in females of *Aloea*. Even in the ant-mimetic genus *Pilophorus*, brachypterous females are unknown. Wing polymorphism is an adaptation to a specialized or stable environment (see Sweet, 1964) and therefore must be derived. The apparent absence of brachyptery in the Pilophorini is a further suggestion of their primitiveness in the Phylinae.

ZOOGEOGRAPHY: My redefinition of the Pilophorini on a world basis changes the zoogeographic picture from one of more or less equal distribution in all zoogeographic regions in the Carvalho classification to one of greatest diversity in the Old World tropics and virtual absence from the neotropics (Figure 351d).

Two relatively distinct groups of genera can be recognized in analyzing the distribution of the Pilophorini. The *Ambonea* group is not ant mimetic. It is restricted primarily to Africa, constituting almost the entire fauna there; the only nonmember of the *Ambonea* group found in Africa is a single species of *Pilophorus*. The *Pilophorus* group, which is distinctly ant mimetic, is most diverse in Southeast Asia, with limited representation in the Nearctic and Pale-

arctic. In North America *Pilophorus* has radiated extensively, but no studies have been undertaken to determine if the 50 or so described species from that region are all closely related or if they represent separate elements in the genus and therefore independent invasions of the continent. The limited generic representation of the tribe in North America indicates invasion of the area from Southeast Asia, possibly via the Bering Land Bridge, rather than migration from North America to Southeast Asia.

Paramixia, a morphologically somewhat anomalous genus in the *Pilophorini*, is pantropical, *P. carmelitana* (Carvalho) being the solitary neotropical pilophorine. *Parasthenaridea* Miller, a pilophorine with specialized male genitalia, but resembling the *Ambonea* group, is known only from Malaya.

Discussion Of Individual Genera

The incorrect subfamily placement and ant-mimic definition of the Pilophorini by Carvalho (1952a; 1958b) obscured the true relationships of the group as a whole and also of many included genera.

Alepidea Reuter, 1909.

Alepidea is very closely related to *Pilophorus* by the structure of the male genitalia (Kelton, 1959b) and by the structure of the female genitalia, in which the posterior margin of the posterior wall is evaginated.

Two species are known, both from the Eastern United States.

Alepidiella Poppius, 1914b.

This genus contains only a single species from the Eastern United States. It is very closely related to *Alepidea*.

Aloea Linnavuori (in press), see page 196.

Ambonea Odhiambo, 1960b, see page 201.

* *Anthropophagiotes* Kirkaldy, 1908, see genera *incertae sedis*.

* *Borgmeierea* Carvalho, 1956c, see Orthotylini.

* *Cyphopelta* Van Duzee, 1910, Mirinae, see misplaced genera.

* *Cyrtopeltocoris* Reuter, 1876a, see Hallodapini.

* *Dolichostenia* Poppius, 1921, see genera *incertae sedis*.

* *Eucerella* Poppius, 1921, see Orthotylini.

* *Eucompsella* Poppius, 1914a, see Nichomachini.

* *Hallodapoides* Carvalho, 1951a, see Orthotylini.

Hyseloecus Reuter, 1891.

The placement of *Hypseloecus* in the Pilophorini (Wagner, 1952) is verified by the structure of the parempodia and male genitalia.

A single species is known from the Palearctic.

* *Kirkaldyella* Poppius, 1921, see Orthotylini.

* *Laemocoridea* Poppius, 1921, see Orthotylini.

* *Lasiomimus* Poppius, 1914a, see genera *incertae sedis*.

* *Lepidotaenia* Poppius, 1921, see Orthotylini.

* *Leucophoroptera* Poppius, 1921, see Leucophoropterini.

* *Lutheriella* Poppius, 1913, see genera *incertae sedis*.

* *Myrmecophyes* Fieber, 1870, see Halticini.

* *Myrmecoridea* Poppius, 1921, see genera *incertae sedis*.

* *Myrmecozelotes* Berg, 1883, see genera *incertae sedis*.

Neoambonea Schuh, new genus, see page 204.

* *Nichomachus* Distant, 1904a, see Nichomachini.

* *Opistocyclus* Poppius, 1914a, Deraeocorinae, see misplaced genera.

Parambonea Schuh, see page 207.

Paramixia Reuter, 1900, see page 210.

Parasthenaridea Miller, 1937.

See Pilophorini tribal discussion. The female genitalia will help to confirm tribal placement of *Parasthenaridea*. Only a single species is known from Malaya.

* *Pilophoropsis* Poppius, 1914c, see Orthotylini.

Pilophorus Hahn, 1826.

Reuter (1910a) placed *Pilophorus* in the division Heterotomaria in the subfamily Heterotomina; Carvalho (1952a) placed the genus in the Pilophorini, as have most other modern authors. Slater (1950) noted the marked differences in the female genitalia between *Pilophorus* and *Pseudoxenetus*, the two genera he studied in the Pilophorini, particularly the lack of K-structures in *Pilophorus* and their presence in *Pseudoxenetus*. Kelton (1959b) correctly noted that

the male genitalia of *Pilophorus* appeared much more closely allied to the Phylinae than to the Orthotylinae. *Pilophorus* may be composite as presently constituted, but the basic body plan is the same in all species, and the male genitalia are very similar from species to species for those representatives that have been examined. The female genitalia have the distinct evagination along the posterior margin of the posterior wall.

Pilophorus is well represented in the Palearctic, Nearctic, and Oriental regions. Only one species is known from sub-Saharan Africa and none are as yet recorded from the neotropics or from Australia.

* *Pseudoxenetus* Reuter, 1909, see Orthotylini.

* *Renodaeus* Distant, 1893, see Orthotylini.

* *Sericophanes* Reuter, 1876a, see Orthotylini.

* *Tuxenella* Carvalho, 1952d, see Orthotylini.

* *Zanchisme* Kirkaldy, 1904, see genera *incertae sedis*.

Zaratus Distant, 1909b.

Zaratus is known only from the holotype female of *Z. repandus* Distant, from India. The genus was placed in the Pilophoraria by Distant (1910b), *genera incerta* by Reuter (1910a), and the Pilophorini by Carvalho (1952a). My examination of the holotype indicates that the genus is very closely related to *Pilophorus*, although I have not examined the genitalia. This conclusion is supported by its occurrence in Southeast Asia.

MISPLACED GENERA[1]

Bunsua Carvalho, 1951b.

This African genus was placed in the Orthotylini by Carvalho (1952a). Examination of a paratype of *Bunsua bryocoroides* Carvalho reveals that the genus has the pulvilli attached to the interior surface of the claws and that the posterior wall lacks K-structures. *Bunsua* must therefore be removed from the Orthotylinae and placed in the Bryocorinae, at least tentatively.

Careful examination of the type material of the genus *Petasma* Odhiambo, 1960 (pp. 343–348), reveals that it is synonymous with *Bunsua* Carvalho (**New Synonymy**).

---

[1] The genera listed were placed in the Orthotylinae or Phylinae by Carvalho (1952a; 1958a,b) or subsequent authors but actually belong in other subfamilies.

Closterocoris Uhler, 1890.

The tribal position of *Closterocoris* has been in dispute for some time. Carvalho (1952a) placed the genus in the Hallodapini, although Knight (1922) had shown rather conclusively that it belongs to the Mirinae. Kelton (1959b) confirmed the placement in the Mirinae on the basis of the male genitalia. Wagner (1970b) placed *Closterocoris* in his Cremnocephalini (Phylinae), even though he had access to Kelton's work on the male genitalia and routinely used the vesica in the Phylinae as a diagnostic feature of the subfamily.

Cyphopelta Van Duzee, 1910.

Kelton (1959b) confirmed the placement of *Cyphopelta* in the Mirinae on the basis of the male genitalia, although previous workers showed great disagreement on the proper subfamily position. Carvalho (1952a) placed *Cyphopelta* in the Pilophorini.

Glossopeltis Reuter, 1903.

This African genus was placed in the Hallodapini by Carvalho (1952a). The strongly toothed claws, hair-like parempodia, punctate dorsum, rounded pronotal collar, male genitalia, and claws without pulvilli all confirm a position in the Deraeocorinae, Surinamellini (Carvalho and Fonseca, 1962), however.

Specimens of *G. coutierei* Reuter, the type species of the genus, are present in both the Helsinki and Paris Museums. The single female specimen in Paris bears no locality labels, but has a determination label reading "*Glossopeltis coutierei* Reuter n.g. et n. sp., spec. typ.". Single male and female specimens from Helsinki bear "Obock" labels; the female also bears a determination label of Poppius. Reuter (1903) did not indicate that specimens from the type series which he examined were placed in Helsinki, but Poppius (1914a) cited the same locality data as Reuter (1903) and noted that specimens did exist in Helsinki. The locality data of the two specimens in Helsinki do not agree exactly with that given in Reuter's original description (they read "Museum Paris, OBOCK, Maindron 871–93"), but the specimens are probably those examined by him. I have therefore labeled the female specimen in the Paris Museum as the lectotype—"LECTOTYPE *Glossopeltis coutierei* Reuter, det R. T. Schuh."

Heidemanniella Poppius, 1914c.

The North American genus has long been placed in the Hallodapini (Carvalho, 1952a). My examination of the holotype of *H.*

scutellaris Poppius, reveals that *Heidemanniella* is probably most closely related to *Cyphopelta* and *Closterocoris* in the Mirinae. The only specimen is the holotype female and at the time of my examination it was glued to a card so that the parempodia were not visible. Additional specimens and further study will almost certainly confirm placement of *Heidemanniella* in the Mirinae rather than the Phylinae.

Makakix Odhiambo, 1967, pp. 1673–1676.

This African genus is very closely related to *Opistocyclus* Poppius. Odhiambo (1967) placed *Makakix* in the Hallodapini, with reservation. He gave excellent illustrations of the tarsal claws, which are strongly toothed at the base, but did not mention a possible relationship to the Deraeocorinae. The male genitalia of *Makakix* are not available. Examination of related genera, including *Nicostratus* Distant, reveals that the form of the tarsal claws is a valid subfamily character for recognizing mimetic as well as nonmimetic Deraeocorinae. *Makakix* belongs to the Deraeocorinae, Surinamellini.

Nicostratus Distant, 1904c.

Carvalho (1952a) assigned this peculiar Southeast Asian genus to the Hallodapini. The strongly toothed tarsal claws and the male genitalia, however, unequivocally place it in the Deraeocorinae, Surinamellini.

Opistocyclus Poppius, 1914a.

This African genus is most closely related to *Makakix* and *Glossopeltis*, as confirmed by the strongly toothed tarsal claws, conical scutellum, and punctate dorsum. Therefore it must be placed in the Deraeocorinae, Surinamellini.

Poppius (1914a) stated that the type of *O. myrmecoides* Poppius, the only species in the genus, was deposited in the Berlin-Humboldt Museum; however, it is in the Helsinki Museum (Type No. 7775).

Tylopeltis Reuter, 1904.

My examination of the holotype of *Tylopeltis albosignata* Reuter, the only species in the genus, in the Brussels Museum, indicates that *Tylopeltis* does not belong to the Hallodapini (Carvalho, 1952a), but to the Deraeocorinae, Surinamellini. This position is supported by the structure of the male genitalia, the conical scutellum, the punctate dorsum, and the rounded pronotal collar.

Genera *incertae sedis*[1]

Amazonocoris Carvalho, 1952c.

Amazonocoris longipilosus Carvalho was placed in the Hallodapini by Carvalho (1952a). On the basis of the male genitalia as illustrated by Carvalho (1952c), this Brazilian genus appears to be much more closely related to the Dicyphinae than to the Phylinae. Carvalho does not mention the structure of the parempodia in the original description, but says only that the pulvilli are minute, which would suggest that *Amazonocoris* does not belong to the Dicyphinae. I have not been able to find the holotype of *A. longipilosus* in the British Museum (Natural History) and therefore cannot determine the correct subfamilial placement.

Anthropophagiotes Kirkaldy, 1908.

The whereabouts of the holotype of the only species included in this Fijian genus is unknown, and the original description is inadequate for placing the genus in the correct subfamily. Carvalho (1952a) placed *Anthropophagiotes* in the Pilophorini.

Dolichostenia Poppius, 1921.

I have not seen specimens of this genus erected by Poppius (1921) for a species from Chile, and therefore its subfamily placement must remain uncertain. Carvalho (1952a) placed *Dolichostenia* in the Pilophorini. This is almost certainly incorrect, and it will probably prove to be a member of the Orthotylini.

Idiomiris China, 1963, pp. 709–711.

China described this peculiar genus from Chile, and on the basis of the pretarsal structures and male genitalia placed it in the Orthotylini. This is certainly incorrect. *Idiomiris* is much more closely related to either the Mirinae or the Deraeocorinae than to the Orthotylinae. I was not able to find the male genitalia in the British Museum (Natural History). All of the characters enumerated by China, however, indicate the closest relationship with the Deraeocorinae, as does the basic facies, even though the claws are not toothed basally, as is usually the case in that subfamily.

Lasiomimus Poppius, 1914a.

I have not examined specimens of this African genus, although they are probably present in the Leningrad Museum. Carvalho (1952a) placed *Lasiomimus* in the Pilophorini.

---

[1] The genera listed were placed in the Orthotylinae and Phylinae by Carvalho (1952a; 1958a,b) or by subsequent authors, but are unknown to me or are otherwise of uncertain systematic position.

Lissocapsus Bergroth, 1903.

Bergroth (1903) commented that the type specimen of *L. wasmanni* Bergroth was received from E. Wasmann of Luxembourg, but he did not say where it was deposited. Until specimens of this species can be located and carefully examined, the subfamily placement must remain in question. Carvalho (1952a) placed this Madagascan genus in the Hallodapini.

Lutheriella Poppius, 1913.

I have not seen specimens of this genus from Ceylon, and therefore cannot confirm its placement in the Pilophorini (Carvalho, 1952a).

Myrmecoridea Poppius, 1921.

The type specimens of this Australian genus are probably deposited in the Hungarian Museum (Poppius, 1921) and will have to be examined before its subfamily placement in the Pilophorini (Carvalho, 1952a) can be confirmed.

Myrmecoroides Gross, 1963, pp. 7–10.

This very peculiar genus from Australia has apically convergent recurved parempodia, but the bizarre structure of the head and the strong ant-mimetic facies require that the male and female genitalia be examined before subfamily placement can be confirmed.

Myrmecozelotes Berg, 1883.

This Argentinian genus was placed in the Pilophorini by Carvalho (1952a). I have not examined specimens and have not found adequate information in the literature to determine its correct subfamily placement.

Zanchisme Kirkaldy, 1904.

This Neotropical genus probably belongs to the Orthotylini. Carvalho (1952a) placed it in the Pilophorini. I have not examined specimens or found adequate information in the literature to confirm the subfamily placement of *Zanchisme*.

ACKNOWLEDGMENTS

I would especially like to thank Dr. James A. Slater of the University of Connecticut, who took a genuine personal interest in this project. Dr. Slater's willingness to discuss problems and to lend new ideas, and the unrestricted use of his fine library of hemipterological literature, helped immensely in bringing this work into its final form.

Dr. W. G. H. Coaton, Director, Systematic Entomology, Plant Protection Research Institute, Pretoria, provided untiring assistance during our stay in South Africa during 1967–1968 and was instrumental in the success of the field work and local arrangements. The staff of the South African National Herbarium, Pretoria, graciously identified all of the host plant specimens. My wife, Janet C. Schuh, constantly stimulated my thinking and typed the original manuscript. Others who have read portions of the manuscript or otherwise helped in ways too diverse to enumerate here are Drs. M. H. Sweet, C. W. Schaefer, and H. W. Pfeifer, and Mrs. D. B. Wilcox.

The following persons have supplied specimens or identifications and many also provided museum space and a pleasant working environment: Dr. P. Arnaud, California Academy of Sciences; Dr. M. Beier, Naturhistorisches Museum, Vienna; Drs. R. C. Froeschner and J. L. Herring, United States National Museum; Mr. Wayne Gagné, Bishop Museum, Honolulu; Dr. U. Göllner-Scheiding, Humboldt University Zoological Museum, Berlin; Dr. A. J. Hesse, South African Museum, Cape Town; Dr. W. J. Knight and Mr. W. R. Dolling, British Museum (Natural History); Dr. Carl Lindroth, Lund University Zoological Institute; Mr. M. Meinander, Helsinki University Zoological Museum; Dr. J. Munting, former curator, South African National Collection of Insects; Dr. P. I. Persson, Naturhistoriska Riksmuseum, Stockholm; Drs. P. Basilewsky and G. Schmitz, Musée Royal de l'Afrique Centrale, Tervuren; Dr. D. R. Smith, Systematic Entomology Laboratory, United States Department of Agriculture; Dr. Henri Synave, Institut Royal des Sciences Naturelles de Belgique, Brussels; Dr. L. Vari, Transvaal Museum, Pretoria; Drs. Andre Villiers and J. Carayon, Museum National d'Histoire Naturelle, Paris; and Dr. P. Wygodzinsky, American Museum of Natural History, New York.

The National Science Foundation, through a grant to the University of Connecticut for graduate studies in evolutionary biology, and the University of Connecticut Research Foundation have provided generous financial support. This has allowed me to travel to South Africa, to visit museums in the United States and Europe, and devote an uninterrupted year to the completion of this work.

REFERENCES

ACOCKS, J. P. H.
1953. Veld types of South Africa. *Bot. Surv. s. Afr., Mem.* 28: 192 pp.

ASHLOCK, P. D. AND J. D. LATTIN.
1963. Stridulatory mechanisms in the Lygaeidae, with a new Amer-

ican genus of Orsillinae (Hemiptera: Heteroptera). *Ann. Entomol. Soc. Amer.* 56: 693–703.

BAILEY, H. P.
1960. A method of determining the warmth and temperateness of a climate. *Geogr. Annaler.* 42: 1–16.

BALLARD, E.
1927. Some new Indian Miridae (Capsidae). *Mem. Dept. Agric. India, Ent.* 10(4): 61–68.

BERG, C.
1883. Addenda et emendanda ad Hemiptera Argentinae (2). *Ann. Soc. Cien. Argen.* 16: 5–32.

BERGROTH, E.
1903. Neue myrmecophile Hemipteren. *Wiener Entomol. Z.* 29: 235–238.
1917. On the types of the exotic Hemiptera Heteroptera described by V. Motschulsky. *Revue Russe d'Entomologie* 17: 96–109.
1925. On the "annectant bugs" of Messrs. McAtee and Malloch. *Bull. Brooklyn Entomol. Soc.* 20: 159–164.
1926. Über einige äthiopische Miridae (Hem. Het.). *Deut. Entomol. Z.* pp. 60–64.

BRINKHURST, R. O.
1959. Alary polymorphism in the Gerroidea. *J. Animal Ecol.* 28: 211–230.
1963. Observations on wing-polymorphism in the Heteroptera. *Proc. Roy. Entomol. Soc. London, Ser. A, Gen. Entomol.* 38: 15–22.

CARAYON, J.
1958. Études sur les Hémiptères Cimicoidea. –1. *Mém. Mus. Natl. Hist. Natur., Paris, Ser. A, Zool.* 16: 141–172.

CARVALHO, J. C. M.
1948. Mirídeos neotropicais, XXX: Gêneros *Ellenia* Reuter, *Eurychilopterella* Reuter, e *Rhinocloa* Reuter, com descrições de espécies novas (Hemíptera). *Bol. Mus. Nac.*, Rio de Janeiro, *Zool.* 85: 13 pp., 24 figs.
1951a. Neotropical Miridae (Heteroptera), XLVI. A new genus and two new species in the collection of the Natural History Museum in Vienna. *Ann. Naturhist. Mus. Wien.* 58: 103–107.
1951b. Five new genera and eleven new species of African Miridae (Hemiptera). *Rev. Zool. Bot. Afr.* 45: 100–115.
1952a. On the major classification of the Miridae (Hemiptera). (With keys to subfamilies and tribes and a catalog of the world genera.) *An. Acad. Bras. Cienc.* 24: 31–110.
1952b. Trois nouveaux genres de Miridae de Madagascar (Hemiptera). *Mem. Inst. Rech. Sci. Madagascar, Sér. E, Entomologie* 1: 93–100.
1952c. Neotropical Miridae. LVI. Description of three new genera

and five new species from Brasil and British Honduras (Hemiptera). *Rev. Brasil. Biol.* 12: 265–272.

1952d. Neotropical Miridae, 47: Notes on the Blanchard, Spinola, and Signoret types in the Paris Museum. *Rev. Fr. Entomol.* 19: 181–188.

1953a. Sur les Miridae Madagascar (Hémiptères). *Mem. Inst. Rech. Sci. Madagascar, Sér. E, Entomologie* 3: 41–51.

1953b. Neotropical "Miridae", LXIII: A new genus and new species from South America (Hemiptera). *Rev. Brasil. Biol.* 13: 33–40.

1954. Neotropical Miridae, LXXIV: Two new genera of Cylapinae from Brazil (Hemiptera). *Proc. Iowa Acad. Sci.* 61: 504–510.

1955a. Keys to the genera of Miridae of the World (Hemiptera). *Bol. Mus. Paraense Emilio Goeldi, Nova Ser. Zool.* 11(2): 151 pp., 263 figs.

1955b. Analecta Miridologica: Miscellaneous observations on some American museums and bibliography. *Rev. Chilena Entomol.* 4: 221–226.

1956a. On a new genus of mirid from the Biliran Island (Hemiptera). *An. Acad. Brasil. Cienc.* 28: 215–216.

1956b. Insects of Micronesia. Heteroptera: Miridae. Honolulu, Bernice P. Bishop Museum, Vol. 7(1): 100 pp.

1956c. Neotropical Miridae, LXXVIII: A peculiar new genus of "Orthotylinae" (Hemiptera). *Rev. Brasil. Biol.* 16: 235–237.

1958a. Catalogue of the Miridae of the World. Part II. Subfamily Phyline. *Arq. Mus. Nac.*, Rio de Janeiro 45: 216 pp.

1958b. Catalogue of the Miridae of the World. Part III. Subfamily Orthotylinae. *Arq. Mus. Nac.*, Rio de Janeiro 47: 161 pp.

1960. Catalogue of the Miridae of the World. Part V. Bibliography and general index. *Arq. Mus. Nac.*, Rio de Janeiro 51: 194 pp.

1965. A new species of "Melanotrichus" Reuter from Australia (Hemiptera, Miridae). *Rev. Brasil. Biol.* 25: 265–267.

CARVALHO, J. C. M. AND J. BECKER.

1959. Neotropical Miridae, LXXXV: New species of Orthotylinae in the collection of the United States National Museum (Hemiptera, Heteroptera). *An. Acad. Brasil. Cienc.* 31: 113–117.

CARVALHO, J. C. M. AND J. A. P. DUTRA.

1959. Mirídeos Neotropicais, LXXXVI: Revisão do gênero *Tuxenella* Carvalho (Hemiptera). *Arq. Mus. Nac.*, Rio de Janeiro 49: 139–153.

CARVALHO, J. C. M., J. A. P. DUTRA, AND J. BECKER.

1960. Hemiptera Heteroptera: Miridae. South African Animal Life. Stockholm, Swedish National Research Council, Vol. 7: 446–477.

CARVALHO, J. C. M. AND A. FONSECA.
1962. Mirídeos Neotropicais, XCI: Uma tribo e dois generos novos (Hemiptera). *Rev. Brasil. Biol.* 22: 427–432.
1965. Mirídeos Neotropicais, XCI: Sôbre um gênero e duas espécies novas de Orthotylinae (Hemiptera). *Rev. Brasil. Biol.* 25: 53–57.

CARVALHO, J. C. M. AND D. LESTON.
1952. The classification of the British Miridae (Hem.), with keys to the genera. *Entomol. Mon. Mag.* 88: 231–251.

CARVALHO, J. C. M. AND T. R. E. SOUTHWOOD.
1955. Revisão do complexo *Cyrtorhinus* Fieber-*Mecomma* Fieber (Hemiptera-Heteroptera, Miridae). *Bol. Mus. Paraense Emilio Goeldi, Nova Ser. Zool.* II(1): 72 pp., 25 figs.

CHINA, W. E.
1932. A new species of *Trichophthalmocapsus* Poppius (Hemiptera, Heteroptera, Capsidae) from Kenya. *Ann. Mag. Natur. Hist.* (10)10: 594–597.
1938. Die Arthropodenfauna von Madeira nach den ergebnissen der Reise von Prof. O. Lundblad Juli–August 1935. III—Terrestrial Hemiptera. *Ark. Zool.* 30A(2): 1–68.
1945. New and little known West African Miridae (Capsidae) (Hemiptera-Heteroptera), *Bull. Entomol. Res.* 35: 171–191.
1963. Hemiptera-Heteroptera collected by the Royal Society Expedition to South Chile 1958–1959. *Ann. Mag. Natur. Hist.* (13)5: 705–723.

CHINA, W. E. AND J. C. M. CARVALHO.
1951. A new genus of Hallodapini and two new species of the genus *Nicostratus* Distant (Miridae, Phylinae). *Ann. Mag. Natur. Hist.* (12)4: 1120–1125.

COBBEN, R. H.
1968. Evolutionary trends in Heteroptera. Part I. Eggs, architecture of the shell, gross embryology and eclosion. Wageningen, Centre for Agricultural Publishing and Documentation, 475 pp.

DAVIS, N. T.
1955. Morphology of the female organs of reproduction in the Miridae (Hemiptera). *Ann. Entomol. Soc. Amer.* 48: 132–150.

DELATTRE, R.
1950. Description de nouveaux Miridae africains (Hem.). *Bull. Soc. Entomol. Fr.* 55: 151–153.

DIETZ, R. S. AND J. C. HOLDEN.
1970. The breakup of Pangea. *Sci. Amer.* 223(4): 30–41.

DISTANT, W. L.
1893. Biologia Centrali Americana. Insecta. Rhynchota. Hemiptera-Heteroptera. London, 1 (Supplement): 304–462, 1884–1893, 39 pls.

1904a. XI.—Rhynchotal Notes.—XX. *Ann. Mag. Natur. Hist.* (7) 13: 103–114.

1904b. XXI.—Rhynchotal Notes.—XXI. *Ann. Mag. Natur. Hist.* (7) 13: 194–206.

1904c. The fauna of British India including Ceylon and Burma. Rhynchota. (Heteroptera). London, Taylor and Francis, Vol. II, 503 pp.

1909a. Descriptions of Oriental Capsidae. *Ann. Mag. Natur. Hist.* (8)4: 440–454.

1909b. Oriental Capsidae. *Entomologist.* 42(550): 58–60.

1910a. Descriptions of Oriental Capsidae. *Ann. Mag. Natur. Hist.* (8)5: 10–22.

1910b. The fauna of British India including Ceylon and Burma. Rhynchota. Vol. V. Heteroptera: Appendix. London, Taylor and Francis, 362 pp.

EMSLEY, M.

1969. The Schizopteridae (Hemiptera: Heteroptera) with description of new species from Trinidad. *Mem. Amer. Entomol. Soc.* 25: 154 pp.

FIEBER, F. X.

1858. Criterien zur generischen Teilung der Phytocoriden (Capsini auct.). *Wiener Entomol. Monatschrift* 2: 289–327; 329–347, 1 pl.

1860–61. Die europäischen Hemipteren. Halbflügler. (Rhynchota Heteroptera). Wien, Carl Gerold's Sohn, 2 pts. I: 1–112; II: 113–444.

1864. Neuere Entdeckungen in europäischen Hemipteren. *Wiener Entomol. Monatschrift* 8(3): 65–86.

1870. Dodecas neuer Gattungen und neuer Arten europäischer Hemipteren. *Verhandl. K. K. Zool. Bot. Ges. Wien.* 20: 243–264, pls. 5 & 6.

GOEL, S. C. AND C. W. SCHAEFER.

1970. The structure of the pulvillus and its taxonomic value in the land Heteroptera (Hemiptera). *Ann. Entomol. Soc. Amer.* 63: 307–313.

GROSS, G. F.

1963. A new ant-mimicking mirid bug (Hemiptera-Heteroptera) from Victoria. *Mem. Nat. Mus. Victoria* 26: 7–10.

HAHN, C. W.

1826. Icones ad Monigraphium Cimicum. Lechner, Nürnberg.

HAHN, C. W. AND G. A. W. HERRICH-SCHAEFFER.

1831–1853. Die wanzenartigen Insecten. Nürnberg, Vol. I–IX.

HENNIG, W.

1966. Phylogenetic systematics. Urbana, University of Illinois Press, 263 pp.

HOBERLANDT, L.
1953a. Hemipteren-Heteropteren von Shaqlawa in Südkurdistan. *Beitr. Entomol.* 3: 377–384.
1953b. Results of the Armstrong College Expedition to Siwa Oasis (Libyan Desert), 1935, under the leadership of Prof. Omer-Cooper. *Bull. Soc. Fouad. Entomol.* 37: 359–370.

HUTCHINSON, J.
1946. A botanist in southern Africa. London, P. R. Gawthorn, 686 pp.

INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE.
International Trust for Zoological Nomenclature, London, 1964, 176 pp.

KELTON, L. A.
1959a. Synopsis of the genus *Semium*, and description of a new species from Mexico (Hemiptera: Miridae). *Can. Entomol.* 91: 242–246.
1959b. Male genitalia as taxonomic characters in the Miridae (Hemiptera). *Can. Entomol. Supplement* 11: 72 pp.
1964. Revision of the genus *Reuteroscopus* Kirkaldy 1905 with descriptions of eleven new species (Hemiptera: Miridae). *Can. Entomol.* 96: 1421–1433.

KERZHNER, I. M. AND T. L. YACZEWSKI.
1964. Order Hemiptera (Heteroptera) (*In*: Keys to the insects of the European USSR, Vol. 1, Apterygota, Palaeoptera, Hemimetabola). 851–1118. (Translated from Russian.)

KIRKALDY, G. W.
1902a. Fauna Hawaiiensis. Vol. III, Part II. Hemiptera. Cambridge Univ. Press.
1902b. Miscellanea Rhynchotalia No. 5. *Entomologist.* 35(475): 315–316.
1902c. Memoir upon the rhynchotal family Capsidae auctt. *Trans. Roy. Entomol. Soc. London.* 2: 243–272, pls. V and VI.
1904. Bibliographical and nomenclatorial notes on the Hemiptera—No. 3. *Entomologist.* 37: 279–283.
1905. Neue und wenig bekannte Hemiptera, *Wiener Entomol. Z.* 24: 266–268.
1908. A catalog of the Hemiptera of Fiji. *Proc. Linnaean Soc. N. S.W.* 33: 345–391, pl. IV.

KNIGHT, H. H.
1918. Synoptic key to the subfamilies of Miridae (Hemiptera-Heteroptera). *J. N. Y. Entomol. Soc.* 26: 40–44.
1922. The genus *Cyrtopeltis* in North America (Heteroptera-Miridae). *Bull. Brooklyn Entomol. Soc.* 17: 65–67.
1923. The Hemiptera or sucking insects of Connecticut. Hartford, State Geological and Natural History Survey, Bull. 34, pp. 422–658.

1935. Insects of Samoa. Part II, Hemiptera. Miridae and Anthocoridae. British Museum (Natural History), Fasc. 5, pp. 193–228.
1941. The plant bugs, or Miridae of Illinois. *Bull. Ill. Nat. Hist. Surv.* 22(1): 234 pp.
1966. *Schaffneria*, a new genus of ground dwelling plant bugs (Hemiptera, Miridae). *Iowa State J. Sci.* 41: 1–6.
1968. Taxonomic review: Miridae of the Nevada Test Site and the Western United States. *Brigham Young Univ. Sci. Bull., Biol. Ser.* 9(3): 282 pp.

KULLENBERG, B.
1944. Studien über die Biologie der Capsiden. *Zool. Bidr. Uppsala.* 23: 522 pp., 25 pls.
1947a. Über Morphologie und Funktion des Kopulations-Apparats der Capsiden und Nabiden. *Zool. Bidr. Uppsala.* 24: 218–418, 23 pls.
1947b. Der Kopulations-Apparat der Insekten aus phylogenetischen Gesichtspunkt. *Zool. Bidr. Uppsala.* 25: 74–90.

LESTON, D.
1957. The stridulatory mechanisms in terrestrial Hemiptera Heteroptera. *Proc. Zool. Soc. London* 128: 369–386.
1961. Testis follicle number and the higher systematics of Miridae (Hemiptera-Heteroptera). *Proc. Zool. Soc. London.* 137: 89–106.

LETHIERRY, L.
1881. Liste des Hémiptères recueillis par M. Delauney à la Guadeloupe, La Martinique, et Saint-Barthélemy. *Ann. Soc. Entomol. Belg.* 25: 1–12.

LINDBERG, H.
1940. Inventa entomologica itineris Hispanici et Maroccani, quod a. 1926 fecerunt Harald et Hakan Lindberg. XXVI. Die Capsidenfauna von Marokko. *Commentat. Biol., Soc. Sci. Fenn.* 7(14): 1–55.
1951. *Canariocoris*, eine neue kanarische Miridengattung. *Commentat. Biol., Soc. Sci. Fenn.* 12(9): 1–12.
1953. Hemiptera Insularum Canariensium. *Commentat. Biol., Soc. Sci. Fenn.* 14(1): 114–153.
1956. Über einige Miriden in E. de Bergevins Sammlung. *Notulae Entomol.* 36: 53–64.
1958. Hemiptera Insularum Caboverdensium. *Commentat. Biol., Soc. Sci. Fenn.* 19: 246 pp.

LINNAVUORI, R.
1961. Hemiptera of Israel, II. *Acta Zool. Soc. 'Vanamo'.* 22(7): 51 pp.
1964. Hemiptera of Egypt, with remarks on some species of the adjacent Eremian region. *Ann. Zool. Fenn.* 1: 306–356.

1965. Some new and interesting Hemiptera from the Middle East. *Ann. Ent. Fenn.* 31(4): 264–269.

MALDONADO, J.

1969. The Miridae of Puerto Rico (Insecta, Hemiptera). *Univ. of Puerto Rico Agri. Expt. Sta., Tech. Pap.* 45: 133 pp.

1970. New species in the genus *Sericophanes* Reuter, (Hemiptera: Miridae). *Proc. Entomol. Soc. Wash.* 72: 98–106, 20 figs.

MILLER, N. C. E.

1937. A new genus of Malayan Capsidae (Rhynchota) from palm. *Bull. Entomol. Res.* 28: 535.

1956. The biology of the Heteroptera. London, Leonard Hill Books, Limited, 162 pp.

MOREAU, R. E.

1966. The bird faunas of Africa and its islands. New York-London, Academic Press, 424 pp.

MOTSCHULSKY, V.

1863. Essai d'un catalogue des insectes de l'ile Ceylon. *Bull. Soc. Nat. Moscou.* 36: 82–88.

NOUALHIER, M. J. M.

1895. Supplement à la liste des Hémiptères d'Akbés. *Rev. Entomol.* 14: 176.

ODHIAMBO, T. R.

1958a. Notes on East African Miridae (Hemiptera). IV. A new species of *Pseudosthenarus* Poppius from Uganda. *Ann. Mag. Natur. Hist.* (13)1: 241–246.

1958b. Notes on the East African Miridae (Hemiptera). VI: A new species of *Pilophorus* Hahn from Uganda. *Ann. Mag. Natur. Hist.* (13)1: 326–330.

1958c. Notes on the East African Miridae (Hemiptera). IX: Descriptions of a new species of *Lasiolabops* Poppius and of *Psallus* Fieber. *Ann. Mag. Natur. Hist.* (13)1: 758–764.

1959a. Notes on East African Miridae (Hemiptera). XII: New species of the genera *Campylomma* Reuter and *Sthenarus* Fieber. *Ann. Mag. Natur. Hist.* (13)1: 421–438.

1959b. Notes on the East African Miridae (Hemiptera). XIII: Twelve new species of *Psallus* Fieber. *Ann. Mag. Natur. Hist.* (13)2: 513–544.

1959c. Notes on the East African Miridae (Hemiptera). XIV: New genera and species of the tribe Hallodapini. *Ann. Mag. Natur. Hist.* (13)2: 641–687.

1960a. Notes on the East African Miridae (Hemiptera). XVII: A new genus of Dicyphini. *Ann. Mag. Natur. Hist.* (13)3: 343–348.

1960b. Notes on the East African Miridae (Hemiptera). XVIII: A new genus of Pilophorini. *Ann. Mag. Natur. Hist.* (13)3: 393–400.

1960c. Notes on the East African Miridae (Hemiptera). XX: One new genus and two new species of Phylinae. *Ann. Mag. Natur. Hist.* (13)2: 513–520.

1963. Two new species of myrmecophilous Miridae (Hemiptera) from Tanganyika. *Proc. Roy. Entomol. Soc. London, Ser. B, Taxon.* 32: 111–113.

1967. A taxonomic study of some genera of the Ethiopian Miridae (Hemiptera) (Part 1). *Bull. Inst. Fondam. Afr. Noire, Ser. A.* 29: 1655–1687.

PHILLIPS, E. P.

1951. The genera of South African flowering plants. *Bot. Sur. S. Afr., Mem.* 25.

POPPIUS, B.

1912. Die Miriden der Äthiopischen Region. I. Mirina, Cylapina, Bryocorina. *Acta Soc. Sci. Fenn.* 41(3): 203 pp.

1913. Zur Kenntnis der Miriden, Isometopiden, Anthocoriden, Nabiden und Schizopteriden Ceylon's. *Entomol. Tidskr.* 34: 239–260.

1914a. Miriden der Äthiopischen Region. II. Macrolophinae, Heterotominae, Phylinae. *Acta Soc. Sci. Fenn.* 44(3): 136 pp.

1914b. Übersicht der *Pilophorus*—arten nebst Beschreibung verwandter Gattungen (Hem. Het.). *Ann. Entomol. Soc. Belg.* 58(8): 237–254.

1914c. Einige neue Miriden—Gattungen und Arten aus Nord-America und Cuba. *Ann. Soc. Entomol. Belg.* 58: 255–261.

1921. Beiträge zur Kenntnis der myrmecoiden Heteropteren. Miridae. *Ann. Mus. Nat. Hungarici.* 18: 31–69, 2 pls.

POYNTON, J. C.

1965. The Amphibia of Southern Africa. *Ann. Natal Mus.* 17: 1–334.

REUTER, O. M.

1876a. Capsinae ex America boreali in Museo Holmiensi asservatae, descripta. *Öfv. K. Vet. Akad. Förh.* 32: 59–92.

1876b. Sur le *Capsus 4-guttatus* Kirschbaum. *Petrop, Nouv. Entomol.* 2(145): 26.

1879. Till kännedomen om mimiska Hemiptera och deras lefnadshistoria. *Öfv. Finska Vet.-Soc. Förh.* 21: 141–198.

1881. Analecta Hemipterologica, zur Artkenntnis, Synonymie und geographischen Verbreitung der Palearktischen Heteropteren. *Berliner Entomol. Z.* 25: 155–196.

1882. Ad cognitionem Heteropterorum Africae occidentalis. *Öfv. Finska Vet.-Soc. Förh.* 25: 1–43.

1883. Hemiptera Gymnocerata Europae. Hémiptères Gymnocérates d'Europe, du bassin de la Méditerranée et de l'Asie Russe. III. *Acta Soc. Sci. Fenn.* 13: 313–496, 5 pls.

1884. [Diagnosen neuer arten] *in* P. M. Ferrari: Materiali per lo

studio della fauna Tunisia raccolti de G. e L. Doria V. Rincoti. *Ann. Mus. Civ. Stor. Nat. Genov.* 2: 482.

1890. Capsidae novae ex Africa boreali, descripsit. *Rev. Entomol.* 9: 255–260.

1891. Ein falscher und einer echter *Sthenarus* (Capsidae). *Wiener Entomol. Z.* 10: 49–51.

1900. Capsidae novae mediterraneae descripsit. II. *Öfv. Finska Vet.-Soc. Förh.* 42: 259–267.

1901. Capsidae rossicae descriptae. *Öfv. Finska Vet.-Soc. Förh.* 43: 161–194.

1903. Capsidae ex Abessinia et regionibus confinibus enumeratae novaeque species descriptae. *Öfv. Finska Vet.-Soc. Förh.* 45 (6): 1–18.

1904. Ad cognitum Capsidarum aethiopicarum. I. *Öfv. Finska Vet.-Soc. Förh.* 46(10): 1–8.

1905a. Hemipterologische Spekulationen. I. Die Classification der Capsiden. *Festschr. Palmen* 1: 58 pp.

1905b. Ad cognitum Capsidarum aethiopicarum. II. *Öfv. Finska Vet.-Soc. Förh.* 47(10): 1–22.

1905c. Capsidae stalianae secundum specimena typica redescriptae, I. II. *Öfv. Finska Vet.-Soc. Förh.* 47(12): 1–20.

1905d. Ad cognitum Capsidarum aethiopicarum. III. *Öfv. Finska Vet.-Soc. Förh.* 47(22): 1–9.

1907a. Capsidae novae in insula Jamaica mense Aprilis 1906 a D. E. P. van Duzee collectae. *Öfv. Finska Vet.-Soc. Förh.* 49(5): 1–27.

1907b. Ad cognitum Capsidarum aethiopicarum. IV. *Öfv. Finska Vet.-Soc. Förh.* 49(7): 1–27.

1909. Bermerkungen über nearktische Capsiden nebst Beschreibung neuer Arten. *Acta Soc. Sci. Fenn.* 36(2): 86 pp., 3 pls.

1910a. Neue Beiträge zur Phylogenie und Systematik der Miriden nebst einleitenden Bermerkungen über die Phylogenie der Heteropteren-familien. Mit einer Stammbaums-tafel. *Acta Soc. Sci. Fenn.* 37(3): 169 pp.

1910b. Mitteilgungen uber einige Hemipteren des Russischen Reiches. *Horae Soc. Entomol. Rossicae.* 39: 73–88.

SCHMITZ, G.

1968. Monographie des espèces Africaines du genre *Helopeltis* Signoret (Heteroptera, Miridae) avec un exposé des problèmes relatives aux structures génitales. *Ann. Mus. Roy. Afr. Cent., Ser. Quarto Zool.* 168: 247 pp., 80 figs.

1969. Description d'un nouveau genre et d'une nouvelle espèce d'Hallodapini (Miridae, Phylinae) du Sudan. *Ann. Entomol. Fenn.* 35: 72–81.

1970. Contribution à la fauna du Congo (Brazzaville). Mission A. Villiers et A. Descarpentries. XCVIII. Hémiptères. Miridae

et Isometopidae (1re partie). *Bull. Inst. Fondam. Afr. Noire, Ser. A.* 32: 501–530.

SCOTT, J.

1872. Notes on some Corsican Insects. *Entomol. Mon. Mag.* 8: 193–195.

SIGNORET, V.

1862. *Coriodromus* n.n.f. *Ocypus* Montruzier. *Bull. Soc. Entomol.* Fr. 4: 5.

SINGH-PRUTHI, H.

1925. The morphology of the male genitalia in Rhynchota. *Trans. Roy. Entomol. Soc. London.* 5: 127–267, 32 pls.

SLATER, J. A.

1950. An investigation of the female genitalia as taxonomic characters in the Miridae (Hemiptera). *Iowa State J. Sci.* 25: 1–81, 7 pls.

1964. Hemiptera (Heteroptera): Lygaeidae. South African Animal Life. Stockholm, Swedish National Research Council, 10: 15–228.

SLATER, J. A. AND T. SCHUH.

1969. New species of Isometopinae from South Africa (Hemiptera: Miridae). *J. Entomol. Soc. S. Afr.* 32: 351–366.

SOUTHWOOD, T. R. E.

1953. The morphology and taxonomy of the genus *Orthotylus* Fieber (Hem., Miridae) with special reference to the British species. *Trans. Roy. Entomol. Soc. London.* 104(11): 415–449, 152 figs.

1962. Migration of terrestrial arthropods in relation to habitat. *Biol. Rev.* (Cambridge) 37: 171–214.

SOUTHWOOD, T. R. E. AND D. LESTON.

1959. Land and water bugs of the British Isles. London and New York, Frederick Warne and Co. 436 pp.

STÅL, C.

1858. Orthoptera och Hemiptera fran Sodra Afrika. *Öfv. Svenska K. Vet-Akad. Förh.* 15: 307–320.

STUCKENBERG, B.

1962. The distribution of the montane paleogenic element in the South African invertebrate fauna. *Ann. Cape Prov. Mus. Natur. Hist.* 2: 190–205.

1969. Effective temperature as an ecological factor in Southern Africa. *Zool. Afr.* 4: 145–197.

SWEET, M. H.

1964. The biology and ecology of the Rhyparochrominae of New England (Heteroptera: Lygaeidae). Part I. *Entomol. Amer.* 43: 124 pp.

UHLER, P. R.

1876. List of the Hemiptera of the region west of the Mississippi

River, including those collected during the Hayden explorations of 1873. *U. S. Geol. and Geog. Surv.* 1: 269–361, pls. 19–21.

1887. Observations on some Capsidae with descriptions of a few new species. *Entomol. Amer.* 3: 29–35.

1890. Observations on North American Capsidae, with descriptions of new species (No. 5). *Trans. Maryland Acad. Sci.* 1: 73–88.

USINGER, R. L.

1946. Hemiptera Heteroptera of Guam. *In*: Insects of Guam.—II. *Bull. Bernice P. Bishop Mus.* 189: 58–91.

VAN DUZEE, E. P.

1910. Descriptions of some new and unfamiliar North American Hemiptera. *Trans. Amer. Entomol. Soc.* 36: 73–88.

1916. Check list of the Hemiptera (excluding Aphididae, Aleurodidae, and Coccidae) of America North of Mexico. New York, New York Entomological Society, 111 pp.

1917. Catalog of the Hemiptera of America North of Mexico (excepting Aphididae, Coccidae, and Aleurodidae). *Univ. Calif. Pubs. Entomol.* 2: 902 pp.

1921. Characters of some new species of North American hemipterous insects, with one new genus. *Proc. Calif. Acad. Sci.* 11: 111–134.

WAGNER, E.

1952. Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise. 41-teil-Blindwanzen oder Miriden. Jena, Gustav Fischer, 218 pp.

1953. Nachtrag zu "Einige neue Miriden-Arten aus Ägypten". *Bull. Soc. Fouad. Entomol.* 37: 477.

1955. Bermerkungen zum System der Miridae (Hem. Het.). *Deut. Entomol. Z.* 2(5): 230–242.

1956. On the genus *Strongylocoris* Blanchard, 1840 (Hemiptera, Heteroptera, Miridae). *Proc. Entomol. Soc. Wash.* 58: 277–281.

1957a. Die systematische Stellung der Gattung *Amixia* Reuter, 1883. (Hem. Het. Miridae). *Deut. Entomol. Z.* 4: 22–25.

1957b. *Laurinia* Reuter, 1884, und *Formicocoris* Lindberg, 1940 (Hem. Het. Miridae). *Deut. Entomol. Z.* 4: 263–267.

1959. Bermerkungen zum System der Miridae. II (Hem. Het.). *Deut. Entomol. Z.* 6: 1–7.

1961. Hemiptera Insularum Madeirensium. 2. Der *Cephalocapsus*-komplex auf den Makaronesischen Inseln (Hem. Het. Miridae). *Commentat. Biol., Soc. Sci. Fenn.* 24: 85–110.

1962. Berichtigung zu einigen neueren Arbeiten über Miridae (Hem. Het.). *Notulae Entomol.* 42: 83–84.

1965. Die Gattung *Atomoscelis* Reuter, 1875, und ihre Verwandten in der Paläarktis (Hem. Het. Miridae). *Notulae Entomol.* 45: 74–92.

1970a. Über *Paramixia* Reuter, 1900 (Hem. Het. Miridae). *Nachr. Bayer. Entomol.* 19: 1–5.

1970b. Zur Systematik der Hallodapinae van Duz. (Heteroptera, Miridae). *Reichenbachia.* 13: 149–155.

WAGNER, E. AND H. H. WEBER.

1964. Faune de France. 67. Hétéroptères, Miridae. Paris, Fédération Française des Sociétés de Sciences Naturelles, Office Central de Faunistique, 589 pp.

WOODROFFE, G. E.

1957. A preliminary revision of the British *Psallus* Fieber (Hem., Miridae), with a description of a new species. *Entomol. Mon. Mag.* 93: 258–271.

WYGODZINSKY, P.

1966. A monograph of the Emesinae (Reduviidae, Hemiptera). *Bull. Amer. Mus. Natur. Hist.* 133: 614 pp.

ZIMMERMAN, E. C.

1948. Insects of Hawaii. Vol. 3. Heteroptera. Honolulu, University of Hawaii Press, 255 pp.

ZINDEREN BAKKER, E. M. VAN.

1967. Upper Pleistocene and Holocene stratigraphy and ecology on the basis of vegetation changes in the sub-Saharan Africa. pp. 125–147. *In*: Background to evolution in Africa, Walter W. Bishop and J. Desmond Clark, Editors, Chicago, University of Chicago Press.

ZINDEREN BAKKER, E. M. VAN, EDITOR.

1969. Palaeoecology of Africa and of the surrounding islands and Antarctica. Vol. 4, Cape Town, A. A. Balkema, 274 pp.

INSTRUCTIONS TO AUTHORS

1. *Manuscripts* must be typed, double-spaced throughout, on standard bond paper, with margins of 1½ inches on all sides and pages numbered consecutively.

2. A *title page* should be supplied with the title of the paper centered at the top of the page and the author's name (or authors' names) centered below it.

3. *Page one* of the manuscript should include the title, centered at the top of the page, the author's name centered below the title and followed by a superscript footnote number, a brief *table of contents*, a brief *abstract*, and a footnote at the bottom of the page giving the author's present professional titles and affiliations. The text of the paper may begin immediately after the abstract if there is space.

4. A paragraph of *acknowledgments* should appear at the end of the text of the paper.

5. The list of *references* should be in alphabetical order by authors' names. Two or more entries under one author should be in chronological order. The entry should appear, indented, beginning on the line below the auhor's name with the information in the following order: date, title of article (with only the first word and proper nouns capitalized), name of journal (underlined, for italics, with conventional title capitalization, and abbreviated according to the list published by the current *Biological Abstracts* or *Chemical Abstracts* or spelled out in full if not listed), volume number (in arabic numerals, followed by a colon), and page numbers; *OR* date, title of book (with only the first word and proper nouns capitalized), city of publication, publisher, volume number if any (preceded by "vol."), and the number of pages in the book (followed by the abbreviation "pp."). Authors are wholly responsible for accuracy and completeness of references. Examples follow:

   Beal, R. S., Jr.
   1954. A revision of the species included in the genus *Novelsis* (Coleoptera: Dermestidae). *Trans. Amer. Entomol. Soc.*, 80: 73–90.
   Allee, W. D., A. E. Emerson, O. Park, T. Park, and K. P. Schmidt
   1949. Principles of animal ecology. Philadelphia and London, W. B. Saunders Co., 837 pp.
   Kistner, D. H.
   1969. The biology of termitophiles. *In* Biology of termites, vol. 1 (ed. K. Krishna and F. M. Weesner). New York and London, Academic Press, Inc., chap. 17, pp. 525–557.

6. *Keys* should be typed on a separate sheet of paper, not run into the text, and provided with a formal title. Each couplet should be numbered, the numbers aligned flush left. The first words of all couplet enries should be aligned, and run-over lines indented and aligned. The number or name which ends each couplet entry should be aligned flush right and the space leading up to it filled in with leaders (periods separated by spaces). Examples:

   4. Transverse fascia on corium always present and straight 5
      Transverse fascia on corium irregular, not straight; or fascia absent 8
   5. Dorsum piceous; all marginal areas of pronotum continuously and widely yellowish orange . . . . . *ashmeadi* Heidemann
      Dorsum reddish brown; at most only the posterior marginal area of the pronotum yellowish 6

7. *Synonymy citations* should begin with a flush left alignment, with run-over lines indented uniformly. Authors' surnames only should be used, separated from the previous citation by a dash (two hyphens) and followed by date and page numbers. In cases where the first name mentioned is not that of the author of a species, it should be preceded by a colon. Example:

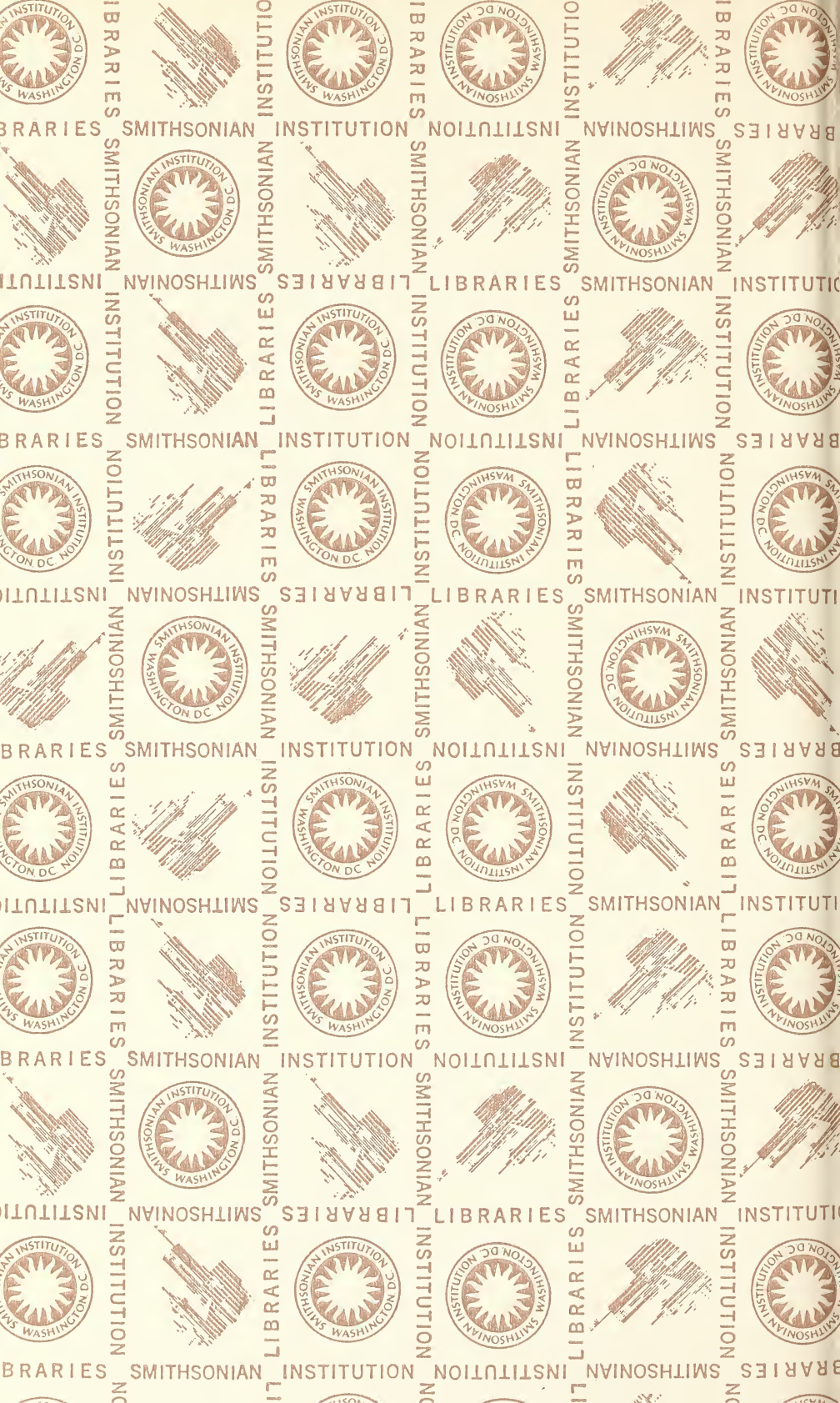
   Dermestes megatoma Fabricius, 1798, p. 313.
   Attagenus megatoma: Dahl, 1823, p. 30.—Laporte, 1840, p. 35.—Erichson, 1846, p. 441.—Wollaston, 1854, p. 204.—LeConte, 1854, p. 109.—Chevrolat, 1863, p. 616.—Howe, 1952, p. 40.—Mroczkowski, 1954, p. 7; 1958, p. 4; 1962, p. 6; 1965, p. 668.—Zhantiev, 1963b, p. 421.

8. The dimensions of the printed page (4″ × 6¼″) should be kept in mind in the preparation of *illustrations*, which should be large enough to that details will be clear after reduction. All figures should be numbered consecutively, in the order of their mention in the text, with no distinction between text figures, plates, maps and photographs. All figures should be identified on the reverse side with the author's name and the figure number. The approximate places where figures are to be inserted in the text should be indicated by the author in the margin of the manuscript. *Legends* for figures should be typed, double spaced, on a separate sheet of paper.

9. *Tables* should be typed on separate sheets of paper, double spaced, and the places where they are to be inserted in the text indicated by the author in the margin of the manuscript. A brief title should be typed above each table, and tables should be numbered consecutively (with arabic numerals) in the order of their mention in the text.

10. The metric system should be used for all *measurements*. The *names* of authors of species and geographical names (except in journal titles) should not be abbreviated.

11. A page charge of $15.00 per printed page is assessed but may be reduced in the case of a member of the society who cannot obtain institutional or grant funds for publication. *Reprints* are not given gratis. They must be ordered from the printer at the time that proofs are returned. Extensive changes in *proofs*, other than correction of printer's errors, will be charged to authors.


SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION
WASHINGTON DC


SMITHSONIAN INSTITUTION LIBRARIES