















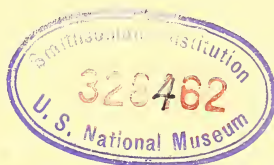
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# ENTOMOLOGICA AMERICANA

A JOURNAL OF ENTOMOLOGY.

Volume XIX (New Series)  
1939



PUBLICATION COMMITTEE

J. R. DE LA TORRE-BUENO Editor

CARL G. SIEPMANN

G. P. ENGELHARDT

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# ENTOMOLOGICA AMERICANA

VOL. XIX

JANUARY, 1939

No. 1

## A REVISION OF THE NORTH AMERICAN SPECIES OF THE PHOBERIA-MELIPOTIS-DRASTERIA GROUP OF MOTHS (LEPIDOPTERA, PHALAENIDAE)

BY A. GLENN RICHARDS, JR.

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NEW YORK, N. Y.

For some years the author has been studying the species of the relatively homogeneous group of quadrifid Phalaenidae (Noctuidae) comprising the genera *Phoberia*, *Litocala*, *Cissusa* (& *Ulosyneda*), *Melipotis* (& *Lyncestis*), *Ianius*, *Asyneda*, *Forsebia*, *Drasteria* (& *Syneda* auct), *Bulia*, *Boryzops* and *Lois* (plus a few genera not occurring in North America). A generic synopsis with tentative rearrangement of the species has already been published (Richards, 1936c) and also revisions of the small genera *Bulia* (Richards, 1936b) and *Forsebia* and *Asyneda* (Richards, 1936a). This specific revision of the remainder of the group is now presented, in necessarily brief style. Monotypical genera are only briefly mentioned as they may be separated by the generic key. The paucity of biological and life history data is regrettable but it has seemed advisable to confine such notes to the author's own observations or to data from specimens which he has determined. Dates are given from the author's notes but are far from complete.

Pending settlement of what is to be done about Hübnerian names of the *Erste Zutraege*, acceptance of which would result in radical changes in the moths which it does not seem desirable to impose on

the literature, these names are used herein in the currently accepted sense. The names concerned in this group are: *Phoberia atomaris* Hbn. (in Erste Zutraege as *Ascalapha atomaris*), *Drasteria graphica* Hbn. (in Erste Zutraege as *Euclidia graphica*), and *Melipotis jucunda* Hbn. (in Erste Zutraege as *Heliothis jucunda*). The first two of these names of the Erste Zutraege (*Euclidia* and *Ascalapha*) contained more than one species, and although the dates of actual validation of the species enters in, it seems that subsequent designation will probably preserve the names *Phoberia* and *Drasteria* in the sense used in this paper. For the third name of the Erste Zutraege (*Heliothis*), *jucunda* was the sole included species and yet due to the Zweite Zutraege is currently cited as the type of *Melipotis* Hübner. Acceptance of the Erste Zutraege, judging from a hasty checking of Hemming's books, would result in replacing *Melipotis* with *Heliothis* and hunting up another name for the species now placed under *Heliothis* and also for the subfamily that bears this name.

In 1870 Behr described eleven species from the west coast in this group: *adumbrata*, *divergens*, *edwardsi*, *hadeniformis*, *maculosa*, *mexicana*, *nubicola*, *ochracea*, *socia*, *stretchii* and *tejonica*. His collection was subsequently destroyed in the San Francisco fire and the descriptions being poor some of the names have proved troublesome. Of three of these, Behr sent cotypes to Strecker and they are now preserved in the Field Museum (*adumbrata*, *divergens* and *stretchii*). An illustration of one of these, presumably a cotype, was published in the Whitney Geological Survey (*divergens*). Henry Edwards saw the Behr collection, and there are now preserved in his collection at the American Museum of Natural History specimens of two of these marked in Edwards' handwriting "Agrees with Behr's type" (a female of *tejonica* and a male of *stretchii*—of the latter a cotype is in the Field Museum). Edwards also included photographs of seven of Behr's species in his Pacific Coast Lepidoptera, at least in the bound copy at the American Museum of Natural History (*adumbrata*, *divergens*, *edwardsi*, *ochracea*, *socia*, *tejonica* and a photo of *stretchii* labeled "howlandi" presumably following the then accepted synonymy proposed by Grote). Unfortunately Edwards does not indicate whether these photos are from Behr's types or other specimens but inasmuch as Behr's types were then available to him they would seem to represent authentic material, especially as the ones that can be checked to cotypes or descriptions are indubitably correct. It must be added concerning this plate

that the figures are not numbered and that the legend does not follow the same sequence but the assignment of names to the various figures seems nevertheless rather definite. Another species was disposed of by making a topotypical specimen a neotype in the revision of the genus *Bulia* (*mexicana*; Richards, 1936b). Three names remain. Of these, *hadeniformis* has been seemingly satisfactorily identified as a yellowish Californian race of *Melipotis jucunda* (Barnes Collection, U. S. National Museum). The other two names (*maculosa* and *nubicola*) are still somewhat uncertain though both names seem to apply to a northern Californian mountain race of *Drasteria hudsonica* (see discussion under these names).

In connection with Henry Edwards' papers, Dr. Alexander B. Klots has called the author's attention to the fact that the last several parts of Henry Edwards' Pacific Coast Lepidoptera never appeared in the Proceedings of the California Academy of Science, despite being so labeled, for the simple reason that this journal suspended publication in 1876. This does not affect the validity of the names concerned but only the correct reference to be used for them.

The author regrets that the high cost of illustrations has forced a considerable crowding of the figures, the use of small figures, the frequent use of partial figures and the omission of many figures he has and would like to include. In so far as possible text and figures that have been given in other recent papers are omitted.

The author has had available for study in addition to his own collection, either by loan or visits, the material in the collections of the U. S. National Museum (including the Neumoegen and Barnes Collections), American Museum of Natural History (including the Henry Edwards Collection), Cornell University, and some material and notes on types in the British Museum, Canadian National Collection, Field Museum (including the Strecker Collection), Museum of Comparative Zoology, Los Angeles Museum, Academy of Natural Sciences of Philadelphia and a number of private collections. The author's thanks are due the curators and owners of these collections for their assistance.

#### ARTIFICIAL KEY TO GENERA AND SUB-GENERA

- |  |                   |
|--|-------------------|
| 1. Fore tibiae with terminal claws or claw-like spines ..... | 2                 |
| 1. Fore tibiae unarmed .....                                 | 5                 |
| 2. Middle tibiae without spines .....                        | 3                 |
| 2. Middle tibiae spined (species all palearctic) .....       | <i>Leucanitis</i> |

3. Frons smooth; fore tibiae produced into claw-like spines at apex; palpi obliquely ascending; hind wing solid brown. *Phoberia*
3. Frons rough or with slight truncated prominence; palpi upturned; fore tibiae with outer and inner claws (macrosetae); hind wing not solid brown ..... 4
4. Frons with truncated prominence with transverse ridges; sacculus of male genitalia reduced; hind wing white with terminal black band and incomplete anal lunule ..... *Forsebia*
4. Frons rough and rounded out, without transverse ridges. Hind wing various ..... *Drasteria* (part)
5. Thoracic vestiture composed entirely of hair; first and sometimes second segment of palpus fringed below; hind wing fuscous, somewhat lighter basally; eyes lashed behind only ..... 6
5. Thoracic vestiture composed of hairs and scales mixed; first and second segments of palpus fringed below; eyes heavily lashed; hind wing black with three yellow or whitish spots. *Litocala*
5. Thoracic vestiture composed largely or entirely of scales; second segment of palpus usually smoothly scaled, rarely fringed below; eyes not lashed; hind wing various but never black with three spots ..... 7
6. Male antennae fasciculate ..... *Cissusa* subg. *Cissusa*
6. Male antennae bipectinate, the apical part serrate. *Cissusa* subg. *Ulosyneda*
7. Frons without pointed conical prominence ..... 8
7. Frons with long pointed conical prominence ..... 17
8. Hind tibiae each with two pairs of spurs; middle tibiae unspined ..... 9
8. Hind tibiae each with only one pair of spurs; middle tibiae with few spines hidden in the vestiture; abdomen with basal crest of scales; third segment of palpus long, dilated at apex ..... *Boryzops*
9. Second segment of palpus long, blade-like, upturned, reaching vertex of head; third segment porrect. *Bulia* (*Cirrhobolina*)
9. Second segment of palpus shorter, when reaching beyond middle of front the third segment erect ..... 10
10. Orbicular a white spot defined by black ..... *Ianius*
10. No orbicular spot present ..... 11



11. Third segment of palpus erect ..... 12
11. Third segment of palpus porrect or almost so ..... 14
12. Third segment of palpus long, two or more times its width; frons smooth and flat; uncus of male genitalia modified (pl. 6, fig. 14); sacculus reduced distally; hind wing black and white, brown or fuscous ..... 13
12. Third segment of palpus shorter, when nearly twice its length the frons distinctly rough and rounded out; uncus long and cygnated (pl. 7, fig. 8, etc.); sacculus well developed distally; hind wing distinctly banded or fuscous.  
*Drasteria* (part)
13. Second segment of palpus smoothly scaled.  
*Melipotis* subg. *Melipotis*
13. Second segment of palpus with large triangular tuft of scales.  
*Melipotis* subg. *Lyncestis*
14. Second segment of palpus tufted above, triangular in outline; hind wing yellowish-orange and black ..... (*Hypocala*)
14. Second segment of palpus not tufted; hind wing not yellow and black ..... 15
15. Fore legs heavily fringed with scales; third segment of palpus scarcely longer than broad ..... *Boryza*
15. Fore legs smoothly scaled; third segment of palpus 2-3 times as long as broad ..... 16
16. Frons with low roughened prominence; third segment of palpus about three times as long as broad; hind wing dirty white in basal half followed by black-brown outer half.....*Asyneda*
16. Frons smooth and flat; third segment of palpus about two times as long as broad; hind wing solid brown ..... *Panula*
17. Prothorax and abdomen without crests of scales; fore tibiae smoothly scaled ..... *Bulia*
17. Prothorax and abdomen with crests of scales; fore legs heavily fringed with scales ..... *Lois*

*Phoberia* Hübner*atomaris* Hübner

*Phoberia atomaris* Hübner. 1818. Zutr. exot. Schm., 1: 16, ff. 75, 76.

Type locality: Georgia. Types: Lost but figured.

*Lyssia orthosioides* Guenée. 1852. Spec. Gen. Lepid., 7: 296-297, pl. 23, fig. 1.

Type locality: North America. Type: U. S. National Museum.

*Poaphila ingenua* Walker. 1858. Cat. Br. Mus., Het., 14: 1472.

Type locality: United States. Type: British Museum.

*Poaphila porrigens* Walker. 1858. Cat. Br. Mus., Het., 14: 1474.

Type locality: East Florida. Type: British Museum.

Figures: Maculation: Pl. 1, fig. 1. Also colored figures by Hübner and Guenée and in Holland's Moth Book (Pl. 36, fig. 14). Genitalia and tympanum: in Richards, 1936c.

Readily identified by the figure given herein or better by the colored figure in Holland's Moth Book. It is the only species in the whole group in which the fore tibiae are apically continued into a projection or spine. It seems to the author not readily confused with anything else but in several collections Colorado specimens have been found placed under the name of one or another of the species of *Cissusa*.

Expanse: 38–45 mm.

Dates: March–April in south; April–May in north.

Distribution: New York, Pennsylvania, Tennessee, Georgia, Florida, Missouri, Nebraska, Colorado, Texas and no doubt intermediate points.

*Litocala* Harvey

*sexsignata* Harvey

*Lita sexsignata* Harvey. 1875. Bull. Buffalo Soc. Nat. Sci., 2: 280.

Type locality: Nevada. Types: British Museum.

*Litocala sexsignata* var. *deserta* Henry Edwards. 1881. Papilio, 1: 25.

Type locality: Arizona. Types: 3 at Amer. Mus. Nat. Hist.

Figures: Maculation: Pl. 1, fig. 2. Also colored figure in Holland's Moth Book (Pl. 30, fig. 39). Genitalia: in Richards, 1936c.

Readily identified by the figures cited as there is no other species with three yellow or white spots on a black hind wing. There is considerable variation in the amount of white mottling on the fore wing, some specimens being almost black with the lines barely traceable; also variation in the size and color of the spots on the hind wings above and below. Edwards' variety is based on this variation and is supposed to be the form with more contrasty fore wings, postreniform area white and spots of the hind wing larger and yellow.

lower. It is no more distinct than the opposite extreme of variation (unnamed) and is here relegated to synonymy.

Expanse: 28-40 mm.

Dates: February-May.

Distribution: Colorado, Utah, Nevada, Arizona, New Mexico and southern California.

*Cissusa* Walker (& subgenus *Ulosyneda* Smith)

The species of this genus are not well known, and no satisfactory revision can be given by this author until more data are at hand bearing on certain of the names that have been proposed. The names that are relegated to synonymy seem certainly synonyms, and there seem surely at least four valid species (*spadix*, *mucronata*, *indiscreta* and *valens*).

A number of the species placed in this genus by various workers up to and including the Barnes and McDunnough Check List (1917) have been removed to *Drasteria* because of their genitalia and the scaly rather than hairy thoracic vestiture. These are *biformata*, *inepta*, *sabulosa* and *scrupulosa*.

Appended is a tentative key to the various names. It is probably only of slight value. All that can be said is that it fits the few notes and specimens at hand.

KEY TO THE SPECIES OF CISSUSA AND ULOSYNEDA

- |   |                   |
|---|-------------------|
| 1. Thoracic vestiture composed of scales .....  | See generic key   |
| 1. Thoracic vestiture composed entirely of hair .....   | 2                 |
| 2. Subterminal line distinct from costa to inner margin .....   | 3                 |
| 2. Subterminal line obsolete or indicated by only a few black preceding spots near costa .....  | 6                 |
| 3. Subterminal line faint and incomplete or indicated by lighter spots, sometimes preceded by a few dark scales; t. a. line excurved from anal vein to inner margin ..... | <i>indiscreta</i> |
| 3. Subterminal line complete, when faint t. a. line incurved from submedian fold to inner margin .....  | 4                 |
| 4. Reniform obsolete; black shading beyond t. p. line at least opposite cell; male antennae bipectinate .....   | <i>valens</i>     |
| 4. Reniform distinct with black basal line; no black shading beyond t. p. line .....  | 5                 |
| 5. T. p. line absent .....  | <i>subtermina</i> |
| 5. T. p. line complete, sometimes faint but distinct throughout.  | <i>mucronata</i>  |

- 6. Moderate black or reddish spot before subterminal line between veins 6 and 7, smaller spots between veins 3 and 4 and between 7 and 8 ..... *spadix*
- 6. No definite spots before the subterminal line ..... 7
- 7. Reniform distinct, with light basal line, filled with brown and defined by light scales outwardly ..... *indiscreta*
- 7. Reniform obsolete or practically so. Male antennae bipectinate ..... 8
- 8. Subterminal line light, never totally lost, some black shading beyond the t. p. line at least opposite cell ..... *valens*
- 8. Subterminal line completely absent, no definite black shading beyond t. p. .... *cervina*

*spadix* Cramer

*Phalaena spadix* Cramer. 1780. Pap. exot., 3: 149, pl. 275, fig. F.

Type locality: "Virginia." Types: Lost but figured.

*Panula remigipila* Guenée. 1852. Spec. Gen. Lepid., 7: 60. Type locality: Florida. Types: 1 ♂, probably in British Museum.

*Taeniocampa vegeta* Morrison. 1875. Proc. Acad. Nat. Sci. Phil., 27: 432-433.

Type locality: Dallas, Texas. Types: Recorded for Tepper Collection.

Figures: Maculation: Pl. 1, fig. 3. Colored figures given by Cramer and in Holland's Moth Book (pl. 30, fig. 9). Female genitalia: in Richards, 1936c.

The type of *spadix* was, according to the figure, grey-brown with three black spots before the subterminal line near the apex, whereas *remigipila*, according to a colored figure of the type, is red-brown and lacks the spots before the subterminal line. Nevertheless they seem to be synonymous. The type of *vegeta* is unknown to the author.

Expanse: 38-42 mm.

Dates: May.

Distribution: Florida, Mississippi, Missouri and Texas. Straying northwards (reported by Forbes from Massachusetts, and in Kearfott collection from Cleveland, Ohio).

*mucronata* Grote

*Synedoida mucronata* Grote. 1883. Can. Ent., 15: 121.

Type locality: Arizona. Type: Neumoegen Coll. (U. S. N. M.).

Figures: Maculation: Pl. 1, fig. 4. Male genitalia: in Richards, 1936c.

The type of *mucronata* is grey-brown and without spots before the subterminal line. In the U. S. National Museum there is a specimen labeled "*punctella* Grote, type" (*non descr.*); this specimen is greenish-brown and has two small spots before the subterminal line. These notes give an indication of the variation.

Expanse: 40 mm.

Dates: March.

Distribution: Arizona. The author has one female from McMinnville, Oregon, that was received in a small lot of specimens that had been recently collected and seemingly correctly labeled.

*indiscreta* Henry Edwards

*Phoberia indiscreta* Henry Edwards. 1886. Ent. Amer., 2: 170-171.

Type locality: Havelah, Kern Co., Calif. (Stretch). Type: 1 ♀, Amer. Mus. Nat. Hist.

Figure: Maculation: Pl. 1, fig. 5.

A rare but distinct species. The type is a female and so this species has always been placed in the subgenus *Ulosyneda* (species with pectinated antennae) but the author has recently seen some males and finds the antennae clearly not pectinated.

Dates: March.

Distribution: California.

*subtermina* Smith

*Synedoida subtermina* Smith. 1900. Proc. U. S. Natl. Mus., 22: 492.

Type locality: San Diego Co., Calif. Type: 2 ♀♀, U. S. Natl. Mus.

This name seems to the author probably a synonym of *indiscreta* Hy. Edw., judging from a superficial examination of the types.

*valens* Henry Edwards

*Synedoida valens* Henry Edwards. 1881. Papilio, 1: 119-120.

Type locality: Kanab, Utah. Type: 1 ♂, U. S. Natl. Mus.

*Synedoida insperata* Grote. 1882. Can. Ent., 14: 176.

Type locality: Arizona. Type: U. S. Natl. Mus.

Figures: Maculation: Pl. 1, fig. 6. Also colored figure of male in Holland's Moth Book (pl. 30, fig. 12). Genitalia: in Richards, 1936c.

This seems to be the commonest species in collections. It is char-

acterized by the complete subterminal line, the absence of the reniform and the black shading beyond the t. p. line. The females are less maculate and have less black suffusion and also the suffusion may be reddish-brown rather than black. This and presumably the following are the only species with pectinated antennae in the male sex (subgenus *Ulosyneda*).

Expanse: 38-45 mm.

Dates: May.

Distribution: Arizona, Utah and Colorado (also recorded as from Wyoming).

Larva: Described by Dyar (Proc. U. S. Natl. Mus., 25: 381-382. 1902).

Food plant: Young oak leaves.

#### *cervina* Henry Edwards

*Synedoida cervina* Henry Edwards. 1882. *Papilio*, 2: 129.

Type locality: Arizona (coll. by H. K. Morrison). Type: 1 ♀, U. S. Natl. Mus.

This name seems to the author probably a synonym of *valens* Hy. Edw., judging from a superficial examination of the type.

#### *Melipotis* Hübner

This is fundamentally a neotropical genus, with only one species limited to North America (*jucunda* Hbn.). Twelve other species are known to extend or stray into the United States, sometimes straying into the northern states or even reaching southern Canada. One species (*indomita* Wlk.) is sometimes a pest on mesquite in the southwest.

Following Hampson's unpublished revision the author listed 40 species in the generic revision (Richards, 1936c). Many more synonymous names are involved. The types are largely in the British Museum and so unavailable to the author. The identifications used herein are from the U. S. National Museum, and hence determined from material named by Dr. Wm. Schaus. The following is not intended as a partial revision of the genus but rather as a presentation of data possibly of use to North American collectors and collections (and so many synonyms unfamiliar to North American literature are omitted).

The names *pallescens*, *fumosa* and *brunneifasciata*, included in *Melipotis* in the 1917 Check List of Barnes and McDunnough, have been transferred to *Drasteria*.

## KEY TO THE SPECIES OF MELIPOTIS RECORDED FROM THE UNITED STATES

1. Third segment of palpus scarcely or not longer than broad. (See generic key)
1. Third segment of palpus two or more times as long as broad..... 2
2. Second segment of palpus with tuft of scales below making this segment triangular in outline; fore wing grey, markings mostly obsolete; hind wing white with black border that extends only a little beyond vein 2 ( $Cu_2$ ) ..... *acantioides*
2. Second segment of palpus smoothly scaled; color not as above..... 3
3. T. p. line produced into long inwardly directed point on vein 2 ( $Cu_2$ ) ..... 4
3. T. p. line various but never strongly angled in on vein 2, when obsolete ground color brown (not grey) ..... 5
4. Small white orbicular defined by black; all lines complete. (*Ianius mosca*)
4. No orbicular; lines more or less incomplete ..... *jucunda*
5. Basal half of hind wing white (margins may be dark) ..... 6
5. Hind wing fuscous, darker apically ..... 16
6. T. a. line obsolete or nearly so, t. p. line obsolete except near costa, basal half of fore wing olivaceous (first line across wing is median line) ..... *fasciolaris* ♀
6. T. a. line straight and outwardly oblique or somewhat concave from costa to inner margin ..... 7
6. T. a. line strongly waved, distinctly excurved in both discal and submedian folds ..... 13
7. T. p. line obsolete around postreniform area; subterminal line obsolete except near costa ..... *fasciolaris* ♂
7. T. p. line and subterminal line distinct throughout, occasionally faint but always traceable ..... 8
8. Small white orbicular defined by black; all lines complete. (*Ianius mosca*)
8. No orbicular ..... 9
9. Fore wing rather uniformly dark grey-brown, the lines slightly darker, without white dash at base of the crescentic reniform; t. p. line rounded around postreniform area and widely separated from the subterminal line ..... *prolata*
9. Fore wing contrastingly colored; more or less distinct light line at base of reniform; t. p. line angled out on vein 6 ( $M_1$ ) or close to subterminal line ..... 10
10. T. p. line angled back to base of reniform along vein 3 ( $Cu_1$ ). *contorta* ♂

10. T. p. line extending well beyond vein 3 and then abruptly curved back to it or to near it .....11
11. T. p. a contrasting black line interrupted on veins 3, 4 and 6 ( $M_1$ ,  $M_3$  &  $Cu_1$ ); also t. p. line distinctly angled out on vein 6 ( $M_1$ ) ..... *indomita*
11. T. p. line not so black, not interrupted, with only faint outward angulation on vein 6 .....12
12. Subterminal line defined only by preceding black dashes in costal half of the fore wing .....*nigrobasis*
12. Subterminal line a light line defined by preceding dark ground color; no black dashes .....*perpendicularis*
13. Inner margin of hind wing pure white ..... *agrotoides*
13. Inner margin of hind wing fuscous (cilia may be white) .....14
14. T. p. line angled out on vein 3 ( $Cu_1$ ) in male; female with markings faint, t. p. line more or less obsolete; no greenish scales in reniform ..... *novanda*
14. T. p. line incurved from vein 4 ( $M_3$ ) across vein 3; when t. p. line faint in female there are greenish scales in reniform...15
15. T. p. line curved back to base of reniform along vein 3; no greenish scales in reniform ..... *contorta* ♀
15. T. p. line extending clearly beyond vein 3 and then curving back to it at base of reniform; greenish scales in reniform. *famelica*
16. T. a. line inwardly oblique from costa to inner margin; hind wing almost uniformly fuscous ..... *cellaris*
16. T. a. line not inwardly oblique, sometimes faint or obsolete .....17
17. T. p. line angled back to base of reniform along vein 3 ( $Cu_1$ ); females more or less immaculate ..... *januaris*
17. T. p. extending well beyond vein 3 and then abruptly curved back to it or to near it; females maculate or at least with this recurvation of the t. p. line discernible .....18
18. T. p. black, interrupted on veins 3, 4 and 6 ( $M_1$ ,  $M_3$  &  $Cu_1$ ). *indomita*
18. T. p. black, brown or obsolete opposite cell but never appearing as a series of black dashes between the veins; females sometimes nearly immaculate ..... *perpendicularis*

*acantioides* Guenée

*Bolina acantioides* Guenée. 1852. Spec. Gen. Lepid., 7: 61-62.  
Type locality: Unknown to Guenée. Type: Probably in British Museum.

*Melipotis sinualis* Harvey. 1877. Can. Ent., 9: 94-95.  
Type locality: Bosque Co., Texas. Type: British Museum.



Figures: Maculation: Pl. 1, fig. 7. Also a colored figure in Holland's Moth Book (pl. 30, fig. 23). Male genitalia: in Richards, 1936c; one harpé herein, Pl. 6, fig. 1.

This is the only species of *Melipotis* in the new world that has a tuft on the second segment of the palpus making this segment triangular in outline, and also making this species the only New World representative of *Lyncestis* which Hampson classed as a separate genus but which the author placed as a subgenus in his generic revision. The species is equally distinct in general appearance. It varies considerably in size but should be readily recognized from the figures cited. Some specimens show a black suffusion along the inner margin or throughout the fore wing and the author has seen two specimens from Peru with the black margin of the hind wing reduced to about one-third of that figured herein. Sexes alike.

Genitalia: The male genitalia (Pl. 6, fig. 1) are characterized among the species treated in this paper by having well-developed scale pouches at the base of the harpes and a heavy, forked clavus. In the female genitalia the ductus bursae is shorter than the length of segment VIII; the two supporting sclerites of the ductus are both short, the one near the vulva quite short; the bursa is wrinkled and bears many minute micro-trichia which become somewhat larger near the ductus bursae but are not localized into any signum-like patch.

Expanse: 40–50 mm. One dwarf only 32 mm.

Dates: May–November.

Distribution: From Florida and Texas southwards; sometimes straying north as shown by specimens from “Nevada, Iowa” and “Didsbury, Alberta.”

*agrotoides* Walker

*Bolina agrotoides* Walker. 1857. Cat. Br. Mus. Het., 13: 1166–1167.

Type locality: Venezuela. Type: British Museum.

*Bolina agrotipennis* Harvey. 1875. Bull. Buffalo Soc. Nat. Sci., 2: 280.

Type locality: Texas. Type: British Museum.

Figures: Maculation: Pl. 1, figs. 8–9. Male genitalia: Pl. 6, fig. 3.

Another large species characterized by the pure white basal two-thirds of the hind wing including the inner margin. The male has the broad median area contrastingly light and continuous below the reniform with the similarly and evenly colored postreniform area; the whole fore wing is in greys and browns with the terminal area brown. The female has the whole wing lightly colored.

Genitalia: The male genitalia (Pl. 6, fig. 3) are of the same type as those of *acntioides* but have very long scale pouches at the base of the harpes, a slim, unforked clavus, and a heavy spine at the end of the aedaeagus with two more internally. The female genitalia are similar to those of *acntioides* but have a somewhat longer ventral sclerite on the ductus, and the area of the bursa near the ductus is clearly sclerotinized.

Expanse: 48–50 mm.

Dates: May.

Distribution: From Texas southward.

*novanda* Guenée

*Bolina novanda* Guenée. 1852. Spec. Gen. Lepid., 7: 64.

Type locality: Colombia. Types: Probably in British Museum.

Figures: Maculation: Pl. 1, figs. 10–11. Male genitalia: Pl. 6, fig. 2.

Very similar to *agrotoides* Wlk. from which it is most readily separated by the slight fuscous strip along the inner margin of the hind wing. Also in the male the median area is less or not continuous with the postreniform area; veins 3 and 4 ( $M_3$  &  $Cu_1$ ) are streaked with white; the fore wing is more bluish-grey with black and the terminal area distinctly bluish-grey. The female resembles that of *agrotoides* but is darker, more nearly immaculate and more bluish.

Genitalia: The male genitalia (Pl. 6, fig. 2) are quite similar to those of *agrotoides* but the scale pouches at the base of the harpes are much shorter and there are no heavy teeth on the vesica. The female genitalia are also similar to those of *agrotoides* but the sclerites of the ductus bursae are longer and the bursa is membranous throughout.

Expanse: 40–50 mm.

Distribution: Previously recorded only from the neotropics. The Barnes Collection (U. S. Natl. Mus.) has eleven specimens from southern Arizona and one from Boulder, Colorado. Also Mr. S. E. Crumb has recently bred the species.

Food plant: Cat Claw (*Acacia* sp.) (teste S. E. Crumb).

*contorta* Guenée

*Bolina contorta* Guenée. 1852. Spec. Gen. Lepid., 7: 64–65.

Type locality: Il St. Thomas. Type: Probably in British Museum.

Figures: Maculation: Pl. 1, figs. 12-13. Male genitalia: Pl. 6, fig. 4.

A large species, predominantly brown with more or less black suffusion, especially in the male. In the male the t.a. line is straight and oblique, in the female waved. This species is nearest *famelica* from which it may be separated by the brown color of thorax and wings, the absence of greenish scales in the reniform, the course of the t. p. line which is much more produced on vein 4 ( $M_3$ ) than 6 ( $M_1$ ) and which curves back to the base of the reniform along vein 3 ( $Cu_1$ ), and by the complete subterminal line.

Genitalia: The male genitalia (Pl. 6, fig. 4) are of the same general type as those of *acontioides* but (like the following three species) lack the definite scale pouch and have only flat or slightly swollen areas for these scale tufts; clavus heavy and with small distal prong, and the clasper arises very near the clavus. The female genitalia are similar to those of *acontioides* but the two supporting sclerites of the ductus bursae are of approximately equal size, the one near the vulva very slightly larger.

Expanse: 45-55 mm.

Distribution: Southern Florida (Richards, 1937) and southwards.

*famelica* Guenée

*Bolina famelica* Guenée. 1852. Spec. Gen. Lepid., 7: 62.

Type locality: Campeche, Mexico. Type: Probably in British Museum.

Figures: Maculation: Pl. 1, figs. 17-18. Male genitalia: Pl. 6, fig. 5.

A moderately large species usually distinguished by the mottling of grey and brown and by the greenish scales in the reniform. In addition it is distinguished from *contorta* by the t. a. line being waved in both sexes, the grey ground color of thorax and wings, the course of the t. p. line which is scarcely more produced at vein 4 than at vein 6 and which extends well beyond vein 3 and then curves back to it at the base of the reniform, and by the subterminal line becoming weak or obsolete towards the inner margin.

Genitalia: The male genitalia (Pl. 6, fig. 5) are very close to those of *contorta* but the clavus is single (without distal prong). The female genitalia are too close to those of *contorta* to make brief notes possible.

Expanse: 40-45 mm.

Dates: March.

Distribution: From southern Florida and Mexico southwards.

*prolata* Walker

*Gerespa prolata* Walker. 1857. Cat. Br. Mus., Het., 13: 1169.  
Type locality: Jamaica. Type: British Museum.

Figures: Maculation: Pl. 1, fig. 14. Male genitalia: Pl. 6, fig. 6.

A distinct species which in general appearance reminds one of certain unrelated European species (*Aedia sericea*, *alchymista*, etc.), an appearance that is aided by the relatively broad rounded wings of this species. The body, fore wings and outer half and margins of the hind wings are a dark grey-brown. The black t. p. line bends in around the end of the cell but is widely separated from the jagged subterminal line which is defined on its inner side by some black scales. The base of the hind wing, except the margins, is pure white as are also the cilia at the apex and inner angle.

Genitalia: The male genitalia (Pl. 6, fig. 6) are of the same type as the preceding but the clavus is longer and definitely forked near the tip. The female genitalia are also similar to the previous species but the ductus bursae is somewhat longer and the selicite nearer the vulva is definitely the longer one.

Expanse: 32-35 mm.

Distribution: Southern Florida (Richards, 1937) and southwards.

*jucunda* Hübner

*Melipotis jucunda* Hübner. 1818. Zutr. exot. Schm., f. 81.

Type locality: Georgia. Type: Lost but figured.

*Bolina cinis* Guenée. 1852. Spec. Gen. Lepid., 7: 62.

Type locality: North America. Type: Probably in British Museum.

*Melipotis jucunda* var. *versabilis* Harvey. 1877. Can. Ent., 9: 94.

Type locality: Alabama. Type: British Museum.

*jucunda* race *hadeniformis* Behr

*Bolina hadeniformis* Behr. 1870. Trans. Amer. Ent. Soc., 3: 25.

Type locality: California. Type: Destroyed.

*Cirrhobolina tetrica* Henry Edwards. 1878. Pac. Coast Lepid., no. 29, p. 10.

Type locality: California. Type: 1 ♀ at Amer. Mus. Nat. Hist.

Figures: Maculation: Pl. 1, figs. 19-20. Also colored figures by Hübner and in Holland's Moth Book (pl. 30, fig. 24). Genitalia:

Male: Pl. 6, figs. 7 & 14; both male and female figured in generic revision (Richards, 1936c).

This, the only species limited to North America, has no relatives that are likely to cause confusion. The sexes are different, the females being largely immaculate though the inward angulation of the t. p. line on vein 2 ( $Cu_1$ ) seems always discernible. The males vary greatly in the degree of maculation of the fore wings, development of a contrasting median area and amount of brown.

The synonymy as given here was discussed in the generic revision (Richards, 1936c, footnote on p. 354). The author is somewhat dubious of the value of a separate racial name for the Pacific coast specimens though in series they do appear somewhat different.

Genitalia: The male genitalia (Pl. 6, figs. 7 & 14; and in Richards, 1936c) are characterized by having the clasper divided into two wholly separate pieces. The female genitalia (figured in Richards, 1936c) are characterized by the short ductus bursae with a characteristically shaped dorsal sclerite near the vulva.

Expanse: 35-47 mm.

Dates: April-October in the south; May-June in the north.

Distribution: New York to southern Florida and west to Texas, California, Idaho and British Columbia, and extending southwards as far as central Mexico.

Food plant: *Salix bonplandia*, *S. wrightii* and *Acacia* sp. (teste S. E. Crumb).

*indomita* Walker

*Bolina indomita* Walker. 1857. Cat. Br. Mus., Het., 13: 1161.

Type locality: Brazil. Type: British Museum.

*Aedia nigrescens* Grote & Robinson. 1866. Proc. Ent. Soc. Phil., 6: 20-21, pl. 3, fig. 4.

Type locality: Texas. Type: 1 ♀ at Phil. Acad. Nat. Sci.

*Bolina ochreipennis* Harvey. 1875. Bull. Buffalo Soc. Nat., Sci., 3: 12, fig. 10.

Type locality: Texas. Type: 1 ♂ at British Museum.

*Melipotis ochreifascia* Grote, non descr. (lapsus typogr. for *ochreipennis* Harvey) 1875. Trans. Amer. Ent. Soc., 5: 117.

*Melipotis flavipennis* Grote, non descr. (lapsus typogr. for *ochreipennis* Harvey) 1883. Can. Ent., 15: 5.

Figures: Maculation: Pl. 1, figs. 21-22. Also the female figured by Grote & Robinson, and the male by Harvey in their descriptions. Male genitalia: Pl. 6, fig. 8.

This well-known sexually dimorphic species is a pest on mesquite in parts of the southwest. The straight oblique t. a. line, the black t. p. line interrupted on veins 3, 4 and 6, and the cream, dusky or fuscous base of the hind wing are ample for separation from other North American species.

Genitalia: The male genitalia (Pl. 6, fig. 8) are readily recognized by the bifurcate clavus, the long clasper located far out on the harpé, and the vesica with only small spines. The harpé is membranous with an irregular, somewhat folded margin. This and all the following species lack the membranous area bearing long scales at the base of the harpés. The female genitalia have the ductus bursae longer than segment VIII; both of the supporting sclerites long, the dorsal one longer and dilated near the vulva; the bursa is minutely spined but without signum-like patches.

Expanse: 40–55 mm.

Dates: May–July.

Distribution: Texas and Arizona and southwards, straying east to Georgia and north to Colorado, Delaware and New York.

Larva: Described by Dyar (Bull. Brook. Inst. Arts & Sci., 1: 201. 1906) and again by Brisley (Pan-Pacific Ent., 1: 94. 1924.).

Food plant: Mesquite (*Prosopis glandulosa*).

*fasciolaris* Hübner

*Aedia fasciolaris* Hübner. 1825. Zutr. exot. Schm., 3: 15, f. 443.

Type locality: Bahia, Brazil. Type: Lost but figured.

*Bolina cunearis* Guenée. 1852. Spec. Gen. Lepid., 7: 70.

Type locality: Cuba. Type: Probably in British Museum.

Figures: Maculation: Pl. 1, figs. 23–24. Also colored figure in Hübner's original description, and colored figure of female in Holland's Moth Book (pl. 30, fig. 22). Male genitalia: Pl. 6, fig. 9.

The sexes of this species are greatly different and likely to be taken for two species. In the male the thorax, the base of the fore wing to the t. a. line, the triangular space between the median line and the reniform and the costa to the subterminal line are dark red-brown with some black; the t. a. line is straight and oblique; the median light area narrow, and the t. p. and subterminal lines obsolete from a little below the costa. In the female the t. a. line is absent or almost so, and the thorax and base of the wing to the oblique median line is olivaceous; the apical part of the fore wing is reddish-brown with the pattern vague. In both sexes there is a heavy fuscous border to the hind wing, preceded by pure white, the base being fuscous.

Genitalia: The male genitalia (Pl. 6, fig. 9) are similar to those of *indomita* but the clavus is not forked though it does have a small distal lobe, and the vesica has heavier spines plus one long curved spine over half as long as the aedaeagus (Pl. 6, fig. 9a). In the female genitalia the ductus bursae is much longer than segment VIII; the supporting sclerites both long, the ventral one much longer (longer than segment VIII) and somewhat dilated near the vulva; bursa minutely spined.

Expanse: 35–48 mm.

Distribution: Florida, Texas and Arizona and southwards; sometimes straying north (recorded by Latham from Orient, Long Island. Bull. Brook. Ent. Soc., 28: 198. 1933).

*perpendicularis* Guenée

*Bolina perpendicularis* Guenée. 1852. Spec. Gen. Lepid., 7: 65–66.

Type locality: Colombia. Type: Probably in British Museum.

*Melipotis stygialis* Grote. 1878. Bull. Geol. Survey, 4: 184.

Type locality: "Illinois." Type: Unknown to author.

Figures: Maculation: Pl. 1, figs. 26–28. Male genitalia: Pl. 6, fig. 10.

The males are readily separated by the broad, oblique, more or less ruddy median area and the solid black t. p. line which extends well beyond vein 3 (Cu<sub>1</sub>) and then curves back to it at the base of the reniform. The females are very variable and immaculate ones difficult to separate from immaculate females of *januaris* except by the larger size; when the t. p. line can be traced they may be separated readily.

The name *stygialis* Grote, still an unplaced name in American check lists, stands as a synonym under *perpendicularis* in the neotropical collection at the U. S. National Museum. A colored figure of the type of *stygialis* in the Barnes Collection (U. S. N. M.) confirms this placement, and shows the type of *stygialis* to have been a large, rather poorly marked female of this species.

Genitalia: The male genitalia (Pl. 6, fig. 10) are of the same type as the preceding two species, and are separated from *indomita* most easily by the heavier spines on the vesica, and from *fasciolaris* by the bifurcated clavus and lack of a long spine in the aedaeagus. The female genitalia (figured in Richards, 1936c) have a long ductus bursae, and the bursa definitely wrinkled and with a large, band-like signum-like patch of microtrichia almost surrounding the opening of the ductus into the bursa.

Expanse: 40–50 mm.

Distribution: Throughout the neotropics with scattered records from Texas, Arizona and southern Florida (Richards, 1937). Grote's type of *stygialis* was supposed to have been caught in Illinois.

*cellaris* Guenée

*Bolina cellaris* Guenée. 1852. Spec. Gen. Lepid., 7: 66.

Type locality: Colombia. Type: Probably in British Museum.

= *Panula inconstans* of Grote and subsequent North American lists but not of Guenée.

Figures: Maculation: Pl. 1, fig. 25. Also colored figure in Holland's Moth Book (pl. 30, fig. 21) under name of "*Panula inconstans*." Male genitalia: Pl. 6, fig. 11; entire male genitalia figured in Richards, 1936c.

A lightly built species readily separated by the fuscous hind wing, the straight t. a. line which is slightly oblique inwardly from the costa to the inner margin, and the t. p. line which is incurved in the submedian fold. Sexes alike.

Genitalia: The male genitalia (Pl. 6, fig. 11; and in Richards, 1936c) are characterized by the narrow, curved tegumen, the very slim and long clavus, and the divided clasper that extends far out on the harpé, the exact distance varying somewhat. There is also a moderate sized spine inside the aedaeagus, about one-third the length of that in the aedaeagus of *fasciolaris* relatively. The female genitalia are similar to those of *perpendicularis* but the signum-like patch in the bursa is a short, straight band on one side; the bursa wrinkled and with microtrichia.

Expanse: 35–40 mm.

Dates: February, June and September.

Distribution: Arkansas to Texas and southwards (Richards, 1937).

*nigrobasis* Guenée

*Bolina nigrobasis* Guenée. 1852. Spec. Gen. Lepid., 7: 65, pl. 13, fig. 8.

Type locality: Mexico. Type: Probably in British Museum.

Figures: Maculation: Pl. 1, figs. 29–30. Also colored figure in original description. Male genitalia: Pl. 6, fig. 12.

A distinctive species that cannot be confused with anything else recorded from the United States. The fore wing is brown overlain with black scales; the black dashes in the costal half of the fore wing beyond the t. p. line are distinctive.



Genitalia: The male genitalia (Pl. 6, fig. 12) are similar to those of *cellaris* but the clavus is much heavier and swollen just before the tip (rudimentary prong ?). The female genitalia are also similar to those of *cellaris* but the bursa is smooth and without microtrichia.

Expanse: 35–38 mm.

Distribution: Previously recorded only from the neotropics. The U. S. National Museum has a short series from Brownsville, Texas (February, May, July and August, collected by Geo. Dorner) and from San Benito, Texas (March, July and August).

*januaris* Guenée

*Bolina januaris* Guenée. 1852. Spec. Gen. Lepid., 7: 67.

Type locality: Haiti. Type: Probably in British Museum.

Figures: Maculation: Pl. 1, figs. 15–16. Male genitalia: Pl. 6, fig. 13.

This is a very variable species. Normally the males are well marked and the females poorly marked, but some males are very lightly marked and some females rather well marked. Also, some females show a dark patch on the costa between the t. p. and sub-terminal lines, the rest of the wings being lighter (compare females of *perpendicularis*). The fuscous hind wing leaves no room for confusion except with *perpendicularis* from which it is readily separated by the t. p. line when that line is discernible, when in females that line can not be traced size is about the best character.

Genitalia: The male genitalia (Pl. 6, fig. 13) have a narrow curved tegumen and may be readily recognized from the drawings but are best characterized by being the only species of *Melipotis* treated herein which has the juxta covered with small teeth laterally. Also there are three lobes at the base of the harpé, two seemingly the clavus with a basal lobe, the third a prong from the basal end of the line of chitinization that leads out to the elasper (but this line to the clasper usually begins at the base of what is called here the clavus). The female genitalia have the ductus bursae about as long as segment VIII, the two supporting sclerites of about equal length; the bursa minutely spined but without signum-like patches.

Expanse: 32–42 mm.

Dates: May–July.

Distribution: From southern Florida southwards (Richards, 1937).

*Panula* Guenée

The author has already pointed out above and in a previous paper (Richards, 1937) that the *Panula inconstans* of Grote, Hol-

land, Barnes and McDunnough Check List, etc., is *Melipotis cellaris* Guenée (as was pointed out by Butler in 1892). So far as is known true *P. inconstans* does not occur or stray north to the United States. It resembles a small species of *Melipotis* in appearance from which it differs in palpi and genitalia. It may also be separated by the *uniform* brown color of the hind wing and lower surfaces (see Pl. 1, fig. 31).

*Panula scindens* Walker has been recorded from the United States by Barnes & Benjamin (Proc. Ent. Soc. Wash., 28: 19-20, 1926) but, as they suggested, does not belong in this genus. Recently the author has examined this species and the male and female genitalia at the U. S. National Museum and agrees with Barnes & Benjamin in removing it to the *Isogona* group where for the present at least it may be placed in the genus *Isogona* itself.

#### Ianius, gen. nov.

Proboscis fully developed; palpi obliquely ascending, first segment fringed below, second segment reaching middle of frons, third segment erect or almost so and almost three times as long as broad; frons protruding and slightly roughened, not tufted; antennae simple and ciliated in both sexes; femora fringed with long scales; tibiae heavily scaled, not spined, middle tibiae of male swollen and enclosing a tuft of long scales; fore wing with orbicular spot present; thoracic vestiture scaly, slight metathoracic tuft; abdomen smoothly scaled; venation as in *Melipotis*.

Genitalia: Male (Pl. 6, fig. 16): uncus long and cygnated; base of sacculus with heavy row of macrosetae; sacculus rudimentary distally. Female (Pl. 6, fig. 15): sternite VIII a single band-like sclerite.

Genotype and sole species: *Melipotis mosca* Dyar.

This species was described in the genus *Melipotis* but looks rather out of place wherever put. With *Forsebia perlaeta* and *Asyneda mendozina* it occupies an anomalous position between *Phoberia-Litocala-Cissusa-Melipotis* and *Drasteria-Leucanitis*. These three species have much in common and yet are quite different from one another as comparison of the above generic diagnosis with the original descriptions of *Forsebia* and *Asyneda* will show (Richards, 1936a). They all agree with *Drasteria* and differ from *Melipotis* in the very characteristic shape of the uncus and the presence of heavy macrosetae at the base of the sacculus, and agree with *Melipotis* and differ from *Drasteria* in habitus and in having the sacculus rudimentary

distally. The author would not be inclined to place much reliance in the above characters were it not for two facts: (1) These characters hold universally in this group of genera named above, and, excepting these three species above mentioned, divide the group into two clear-cut subgroups (plus the anomalous *Panula* and *Bulia* and the doubtfully included *Boryza*, *Boryzops* and *Lois*). (2) These three species are all of somewhat anomalous appearance and no one of them so far as the author knows has any close relatives in either *Melipotis* or *Drasteria*.

The author's first impression on examining the genitalia of *mosca* was to include it in the subgenus *Asyneda* of *Forsebia*, but there are so many differences between these three species that despite the similarities it seems necessary to use separate generic names.

Named after the author's son who is too young either to approve or object.

*mosca* Dyar

*Melipotis mosca* Dyar. 1911. Proc. U. S. Natl. Mus., 38: 253.

Type locality: Mexico City, Mexico (Sept.-Nov., R. Müller). Types: 1 ♂, 4 ♀, U. S. National Museum.

Figures: Maculation: Pl. 1, fig. 35. Genitalia: Male: Pl. 6, fig. 16; female: pl. 6, fig. 15.

This species is readily recognized from the figure. It looks like a peculiar species of *Melipotis* but may be distinguished from all other species of the *Melipotis-Drasteria* group by the presence of a definite orbicular spot (white outlined by black). Sexes similar but median area lighter and brighter in the male.

Genitalia: The male genitalia (Pl. 6, fig. 16) are more or less intermediate between those of *perlaeta* and *mendozina*; sacculus with heavy row of setae at base, rudimentary beyond clasper; clavus bifurcated with long basal lobe; vinculum long; aedaeagus with ridges poorly developed, one ending in a recurved point, the other almost straight (not serrated). The female genitalia (Pl. 6, fig. 15) are similar to those of *mendozina* but differ in that sternite VIII is a single narrow sclerite and that the bursa is smooth (unspined) near the entrance of the ductus bursae and has only minute microtrichiae over the remainder of the surface.

Expanse: 35-40 mm.

Distribution: Previously recorded only from the neotropics. The U. S. National Museum has a series of 18 perfect specimens (ex Barnes Collection) collected at Alpine, Texas in April, May, June and July, 1926, by O. C. Poling (called to the author's attention by

Mr. J. F. Gates Clarke to whom thanks are due for permission to incorporate the records here).

*Asyneda* Richards

*mendoza* Hampson

*Syneda mendoza* Hampson. 1926. Lepid. Phal. N. G. & Spec. Noct., p. 44.

Type locality: Mendoza, Argentina. Types: ♂ & ♀, British Museum.

Figures: Maculation: Pl. 1, fig. 34. Genitalia: Male and female genitalia figured in Richards, 1936a.

Distribution: Mendoza and La Rioja, Argentina. Included here for comparison of photograph with other species. Sexually dimorphic; females with reduced maculation.

*Forsebia* Richards

*perlaeta* Henry Edwards

*Melipotis perlaeta* Henry Edwards. 1882. Papilio, 2: 14.

Type locality: Prescott, Arizona. Types: ♂, U. S. National Museum.

*Synedoida aegrotata* Henry Edwards. 1884. Papilio, 4: 47.

Type locality: Arizona. Types: 1 ♂, 1 ♀, U. S. National Museum.

*Syneda flavofasciata* Streecker. 1898. Lepid. Rhop. Heter., Suppl. 1, p. 12.

Type locality: Arizona. Types: 1 ♂, Field Museum (Chicago).

Figures: Maculation: Pl. 1, figs. 32-33. Also colored figure of female in Holland's Moth Book as a species of *Melipotis* (Pl. 30, fig. 26). Genitalia: Male and female genitalia figured in Richards, 1936a.

The figures are ample for determination of this sexually dimorphic species, especially in combination with the spined fore tibiae.

Distribution: Texas, Arizona and California.

*Drasteria* Hübner

In the generic revision (Richards, 1936c) the lengthy reasons why the author groups all these species together instead of splitting into two or more genera on a basis of the presence or absence of spines at the tip of the fore tibiae are given in detail.

In his new Check List McDunnough largely follows the rearrangement of the North American species suggested in the generic

revision by the present author, but the present author cannot agree to his use of the generic name *Synedoida*. To understand the situation one must remember that the name *Syneda* must be dropped (same genotype as *Drasteria*), and also hold in mind two tendencies of Dr. McDunnough: (1) that he likes small genera, many genera and no subgenera, and (2) that whenever possible he will hold that the nearctic species of any group are not congeneric with the palearctic species of the same group. This leads to a dilemma in this group; for with the name *Syneda* unavailable and with none of the palearctic names acceptable to Dr. McDunnough, there are only two names available for the North American species and the genotypes of both have spined fore tibiae (unless more generic names are to be proposed, which McDunnough has not seen fit to do). The genotypes of these two names, despite the spined fore tibiae are not closely related but are in fact each closely related to a different group of unspined species. McDunnough tries to circumvent these facts by using *Drasteria* in the old restricted sense, and *Synedoida*<sup>1</sup> for its spined genotype (*scrupulosa*) and all the unspined species. It is true that *Synedoida scrupulosa* is very close to some of the unspined species (*inepta*, *sabulosa*), but the catch comes in the fact that *Drasteria mirifica* is even more closely related to what McDunnough calls "*Synedoida*" *howlandi* and *tejonica* (*perfecta*). Such inconsistency cannot be accepted by the present author.

There seems to the present author to be three ways that would be more satisfactory. Either make all possible genera: this would mean restricting *Drasteria* to *graphica*, *occulta*, *ingeniculata*, *mirifica* and *eubapta*, restricting *Synedoida* to the single species *scrupulosa*, and erecting several new generic terms (one for *inepta*, one for *grandirena*, and at least one for the remaining unspined species). Or, the second alternative and the one followed by the author in his generic revision, group all these species into one genus and recognize three subgenera and a number of unnamed species groups: *Drasteria* and *Synedoida* for the spined species and *Aleucanitis* (accepting the palearctic name<sup>2</sup>) for the unspined species. The type of *Aleucanitis* (*caolino* Lef., pl. 5, fig. 15) is structurally similar to our peculiar species *grandirena* (*limbolaris*) and except for its smooth flat front

<sup>1</sup> Incidentally McDunnough cites *Bolina* Dup. as a homonomous name under *Synedoida*, seemingly overlooking the fact that it has the same genotype as *Aleucanitis* Warren which he refuses to accept because palearctic.

<sup>2</sup> For convenience of comparison a few photographs of palearctic species have been included. See pl. 5, figs. 15-18.

also seems congeneric with other nearctic species (*pallescens*, *hudsonica*, etc.). Or, a third alternative conforming to the grouping of species given herein, use the name *Synedoida* (as of either generic or subgeneric rank) for the first species group including the spined genotype *scrupulosa* and the unspined but otherwise closely related *inepta*, *sabulosa*, *ochracea* and *biformata* and include with these or make a separate group for *pallescens*, *fumosa*, *divergens* and *edwardsi*; use *Aleucanitis* for the single North American species *grandirena*, and use *Drasteria* for the unspined *hudsonica*, *petricola*, *perplexa*, *adumbrata*, *stretchii*, *pulchra*, *howlandi* and *tejonica* and for the spined but closely related *mirifica*, *eubapta*, *graphica*, *occulta* and *ingeniculata*. Any of these alternatives allows an arrangement of the species which in so far as linear tabulation permits will show both relationships and differences without doing injustice to either. (See below under "Species groups in *Drasteria*.")

There are two groups of species as yet not satisfactorily "speciated." In the first of these (*sabulosa-abrupta-nichollae*) very little material is available except for Colorado specimens of *sabulosa sabulosa*, and wide gaps exist between the points of collection outside of Colorado. In the second case (*howlandi* versus *tejonica*) long series are available for study but still no convincing arrangement has been made (see under *howlandi*). To this list one might add in a lesser sense: *mirifica* versus *eubapta* and *graphica atlantica* versus *occulta*.

The other species seem understandable. Races, when such occur, are usually not clear-cut and variation is considerable. There is a strong temptation to describe distinct looking forms known only from one section, locality or collection lot. In the past this has accounted for a considerable portion of our present synonymy. In this category are included the dark grey specimens of *inepta* collected around Logan, Utah (no other form occurring there when the author collected in 1933); the somewhat larger and darker specimens of *ochracea* found in the northern part of its range (note that most of the variation in this respect is sexual); the darker, almost melanic form of *edwardsi* that is commoner in the northern part of the range of this species although rarely occurring in the southern part; the yellow hind-winged form of *howlandi* known to the author only from two specimens from Montana, etc. None of these are described herein (nor other forms that seem surely individual variants) partly because of what seems to me inadequate material but largely because the variation in this genus is so complex that such names would seem to have little value unless based on a large amount of carefully analyzed ecological data or on genetic analyses corre-

lated with field data. Needless to add neither of the above is available.

In at least two species there seem to be good races occupying the same regions but different habitats. The surer of these is the case of the plains versus mountain race of *hudsonica*. The less sure one is *divergens* versus *socia*, the suggestion being based on the two being seldom taken together. There is unsatisfactory evidence that similar races may occur in certain other species. Then, of course, there is the case of northern versus southern races of *graphica* (female maculate versus immaculate).

It should be noted that there is a great range of intraspecific variability in the genital armature of the various species. The brief notes under each species are necessarily somewhat indefinite because of this considerable range of variation. For instance, in the males of some species the clasper of the left harpé is bifurcated. In some (*adumbrata*, *pallescens* and *edwardsi*) this is a constant character though the size of the clasper and its two parts varies; in another species (*perplexa*) the left clasper is usually single but occasionally has a rudimentary costal piece; in still others (*stretchii* and *mirifica*) this clasper is usually bifurcated but some specimens show the costal piece rudimentary or even absent (similar variation occurs in *pulchra* and possibly in *eubapta* but too few slides are available to say which is usual). The other genitalic characters of the male also show wide intraspecific variation but with the exception of *occulta*, *eubapta*, *tejonica* and *nichollae* the genitalia of each species seem always separable from those of related species. Some of these variations may be seen by comparing the figures herein.

In this connection it might be well to note that the most difficult character to determine is whether or not a patch of spines is present on the aedaeagus near the tip. There is really a graded series from spines on a chitinized hump or swelling (*perplexa*, *adumbrata* and *stretchii*) to spines on a normally chitinized aedaeagus (*inepta*, *biformata*, *sabulosa*, *scrupulosa* and *ochracea*), to species in which there are some small spines on a membranous area in this region which becomes continuous with the spined vesica (*hudsonica* and especially *howlandi* and *tejonica*).

The author would like to call attention to the necessity of a uniform method of mounting male genitalia in this genus. Slight differences in the degree of spreading of the harpes make considerable differences in the appearance of the characters. This is well shown by plate 8, figures 1 and 2 (*adumbrata* race *alleni*) which are almost identical genitalia but which at first glance appear widely different

due to the manner of arranging the harpes. On the whole it seems to the author best to remove the aedaeagus and spread the valves wide and flat, obtaining a considerable distortion of the vinculum and juxta and a seeming reduction of the basal shelf-like projection of the sacculus but showing clearly the clavus. Whatever may be the best method of mounting these genitalia, one must take the position of the harpes into consideration in using the figures given in this paper and in comparing different slides.

The female genitalia present few characters for specific differentiation. The principal ones mentioned under each species are the two sclerites supporting the ductus bursae. These two are (1) a sclerite near the bursa copulatrix which is located on the dorsal side of the ductus bursae and extends down the lateral sides of the ductus and usually more or less across the ventral surface, particularly from the left side. This sclerite near the bursa is herein referred to as the "dorsal sclerite." (2) A sclerite located on the ventral side of the ductus near the opening of the same to the outside and separated from the preceding sclerite by an area of membrane. This second sclerite is herein referred to as the "ventral sclerite."

The female genitalia, like the male genitalia, vary greatly in these differential characters (see figures, Pl. 11, figs. 1-5). Frequently satisfactory characters for identifying slides of the female genitalia are lacking in this genus.

#### SPECIES-GROUPS IN *DRASTERIA*

The North American species seem to fit most naturally into three groups though some may not approve such listing because two of the groups contain species both with and without spines (macrosetae) at the tip of the fore tibiae. No key to these groups can be given readily but considering all characters including genitalia and habitus the species seem best arranged in the following manner (within the limits of linear arrangement). Group I. (Subgenus *Synedoida*, type *scrupulosa*) Includes: (1) *scrupulosa*, *inepta*, *sabulosa* (and *abrupta*), *nichollae* (& *garthi*), *biformata*, *ochracea*, (2) *edwardsi*, (3) *pallascens*, *fumosa* (& *brunneifasciata*) and *divergens* (& *socia*).

*Scrupulosa* has the unbanded hind-wing and genitalia of the type shown by *inepta-sabulosa*: claspers of the male genitalia reduced, obsolete on the right harpé, sacculus reduced basally, greatly developed apically, aedaeagus spined on the dorsal side near the tip, but the male antennae are shortly ciliated and the fore tibiae, unlike all others of this group, are armed with spines (macrosetae) at the tip. *Inepta* has the markings of the fore wing obsolescent, male genitalia



with small claspers and not so greatly developed apical parts of the sacculus, but the aedaeagus is spined dorsally at the tip and the male antennae are somewhat fasciculate and slightly serrated and the middle tibiae of the male (unlike all other species of this genus) are normal and without an enclosed tuft of sex-scales. *Sabulosa* (& *abrupta*) has a well-marked fore wing, male genitalia with claspers and sacculus reduced and aedaeagus spined on the dorsal side near the tip; male antennae not serrate and with somewhat shorter cilia than *inepta*; the middle tibiae of the male are swollen and enclose a moderate tuft of sex-scales. *Biformata* has the hind wing unbanded, male genitalia of more normal looking type with claspers and sacculus moderately developed and aedaeagus with patch of spines on the dorsal side near the tip; male antennae ciliated about as in *sabulosa*. *Ochracea* is a distinctive species with reduced maculation of the fore wing but unlike the preceding species has clearly banded hind wings; male genitalia with reduced claspers (obsolete on left harpé), moderate sacculus, peculiar heavy uncus and spined aedaeagus. The above species agree in having distinct spines on a strongly sclerotinized aedaeagus, usually a reduction of the claspers of the male genitalia, and all except *ochracea* having unbanded hind wings.

*Edwardsi* is a distinctive species not closely similar to any other in either the new or old world. It has distinct maculation and banded hind wings; claspers well developed, bifurcated on left harpé, sacculus moderate, left harpé of unique shape and aedaeagus without external spines. *Edwardsi* is placed here because of the similarity of the male genitalia to those of *pallescens* but whatever placement is given this species at present would have to be admittedly arbitrary.

*Pallescens* has a white hind wing which is dark fuscous or black in the outer half or less (though the males show a reduced banding); claspers well-developed, bifurcated on left harpé, sacculus moderate, clavus long, especially on right harpé, and aedaeagus without external spines; female genitalia with the ventral sclerite moderate. This species is clearly related to both the *sabulosa* group and to *fumosa* though having its own peculiarities. *Fumosa* agrees with the preceding in maculation, especially of the hind wing, and also is similar to *sabulosa abrupta*; male genitalia with long single claspers, clavus and sacculus moderate, and aedaeagus without external spines; the female genitalia are intermediate in type between those of *pallescens* and *divergens* and serve to link the latter here. *Divergens* (& *socia*) are structurally more related to the above than to

the other species with yellow and black banded hind wings (Group III).

Group II. (Subgenus *Aleucanitis*, type *cailino* Lef. of Europe). From the North American species the author places in this group only the single peculiar species *grandirena* (*limbolaris*) which differs from other nearctic species in maculation and in having a smooth flat front; male antennae minutely ciliated and male genitalia with a swollen uncus. On the whole this species seems to resemble the European representatives of the *cailino-obscurata* group rather than anything in the New World (see Pl. 5, figs. 15-18), but the markings of the lower surfaces of *grandirena* might be used as an argument for closer affinity to *graphica*, etc.

Group III. (Subgenus *Drasteria*, type *graphica*). Includes: *petricola* (and *athabasca*), *hudsonica* (and its races), *perplexa*, *adumbrata* (and *alleni*), *stretchii*, *pulchra*, *howlandi*, *tejonica*, *mirifica* (and its races), *eubapta*, *graphica* (and *atlantica*), *occulta*, and *ingeniculata*.

*Petricola* (and race *athabasca* and form *crockeri*) is the only species in which the veins on the underside of the fore wing in the terminal area are streaked with black. The male genitalia are somewhat reduced and heavily chitinized, claspers small and single, sacculus rudimentary basally on right harpé and basal lobes of the clavus very small (in last two characters agreeing with *sabulosa*, etc.).

*Hudsonica* and its races (presumably including the names *nubicola* and *maculosa*) are northern and fairly high altitude forms with one race occurring in the northern plains. The male genitalia are normal with single claspers, moderate sacculus the basal half of which is recurved in outline, and aedaeagus with minute, scarcely discernible points on the dorsal side near the tip.

The next eight species form a beautiful series beginning with *perplexa* and *adumbrata* in which the aedaeagus has a large dorsal hump covered with heavy spines, through *stretchii* which has the pattern of *adumbrata* and the color of *howlandi* and a spined swelling rather than hump on the aedaeagus, through *pulchra* which has the facies of *howlandi* and *tejonica* and an unswollen but spined aedaeagus to *howlandi* and *tejonica* which have a smooth aedaeagus with scarcely discernible points on the dorsal side near the tip, to *mirifica* and *eubapta* which seem to lack these spines or points on the aedaeagus but otherwise to be very similar. Other differences may of course be seen by studying the genitalic figures, some of them such as the bifurcation of the claspers not following the above se-

quence. Also note that in passing from *tejonica* to *mirifica* one passes from species with unspined fore tibiae to ones with spines (macrosetae) at the tip. The genitalic and habitus similarity seem to this author to force including the above all in one sequence despite the cropping up of spined tibiae.

Somewhat distinct from the above are the other three species with spined fore tibiae: *graphica* (and race *atlantica*), *occulta* and *ingeniculata*. These agree in the female possessing a short ovipositor and a large ventral sclerite on the ductus bursae. The male genitalia of *graphica* and *occulta* have short blunt harpés, while those of *ingeniculata* are long and rounded.

KEY TO THE SPECIES OF DRASTERIA OF NORTH AMERICA

- 1. Fore tibiae unspined ..... 2.
- 1. Fore tibiae with spines (macrosetae) on the outer and inner sides of apex ..... 32.
- 2. Hind wing white in basal half, dark fuscous or black in outer half (sometimes much less than half) except for cilia and median white lunule; subterminal line not sharply angled in opposite cell ..... 3.
- 2. Hind wing fuscous, creamy, pinkish or dirty white, darker outwardly; when whitish at base subterminal line sharply angled in opposite cell ..... 5.
- 2. Hind wing of various colors but always with distinct postmedian and terminal bands or spots and usually with distinct discal spot ..... 11.
- 3. Thorax and base of fore wing pinkish-grey, contrasting with abdomen and rest of wing ..... *pallescens*.
- 3. Thorax and fore wing mottled gray ..... 4.
- 4. Cilia distinctly checkered on fore wing ..... *fumosa fumosa*.
- 4. Cilia of fore wing uniform smoky ..... *fumosa brunneifasciata*.
- 5. T. a. and t. p. lines obsolete or almost so throughout most of their course ..... *inepta*.
- 5. T. a. and t. p. line black, distinct throughout ..... 6.
- 6. T. a. line outwardly oblique from costa to beyond cell, then incurved across anal vein; terminal line absent; underside without dark bands ..... *biformata*.
- 6. T. a. line excurved in discal and submedian folds or evenly excurved from costa to inner margin; terminal line faint but present; undersides particularly of fore wings with dark bands (sometimes rather faint) ..... 7.

7. Thorax and base of fore wing pinkish-grey, contrasting with abdomen and rest of wing ..... *pallescens* (part).
7. Thorax and base of fore wing not contrasting pinkish-grey ..... 8.
8. Subterminal line obsolete below vein 7 ( $R_5$ ) or very faint..... 9.
8. Subterminal line irregular but distinct and clear to inner margin ..... 10.
9. Fore wing with uniform bluish-grey ground color, markings black ..... *nichollae nichollae*.
9. Fore wing more bluish, median and terminal areas more contrasting ..... *nichollae garthi*.
10. T. p. line erect or concave below cell (southwestern).  
*sabulosa abrupta*.
10. T. p. line excurved below cell (southern Rocky Mtns.).  
*sabulosa sabulosa*.
11. Hing wing largely black, terminal band not narrowed opposite cell, remainder of hind wing white or light cream above and below ..... *grandirena*.
11. Hind wing not as above ..... 12.
12. Underside of fore wing with veins 7-3 ( $R_5-Cu_1$ ) streaked with black in terminal area ..... 13.
12. Veins of underside of fore wing not streaked with black ..... 14.
13. Hind wing and undersides bright orange-yellow (S. Rocky Mtn.) ..... *petricola petricola*.
13. Hind wing and undersides light yellow or white (N. Rocky Mtn.) ..... *petricola athabasca*.
14. Area between reniform and t. p. line concolorous with area between the t. p. and subterminal lines ..... 15.
14. Area between reniform and t. p. line light, contrasting with the area between the t. p. and subterminal lines, usually white scales beyond reniform and extending along some veins in the postreniform area ..... 18.
15. Fore wing grey, all markings including reniform obscure; hind wing and lower surfaces light cream or whitish.  
*hudsonica heathi* ♀.
15. Fore wing with at least the reniform distinct; hind wing yellow or orange ..... 16.
16. T. a. line single, sharply defined, excurved across cell then erect or slightly excurved to inner margin.....*edwardsi* (part).
16. T. a. double, sometimes weak, excurved in discal and submedian folds ..... 17.
17. T. p. line faint, when traceable not bent back to lower end of reniform ..... *ochracea*.

17. T. p. line black except sometimes near margins, clearly bending back to lower end of reniform ..... *adumbrata* (part).
18. Discal spot of hind wing connected to postmedial band by black suffusion at least along cubital veins (see Pl. 3, figs. 2 & 16); hind wing usually yellowish-orange, yellow, cream or white ..... 19.
18. Discal spot of hind wing not connected to postmedial band, sometimes absent; hind wing usually (not always) red, reddish-orange or pink and white ..... 25.
19. T. a. line conspicuous, single, almost erect from cell to inner margin; subterminal line completely obsolete below vein 5 ( $M_2$ ) ..... *edwardsi*.
19. T. a. line more or less distinctly double, excurved below cell. 20.
20. Hind wing light cream or white ..... 21.
20. Hind wing distinctly yellow or orange ..... 22.
21. Fore wing highly mottled, sexes alike (mountains).  
*hudsonica* (part).
21. Fore wing not so mottled, female with fore wing almost immaculate (plains of northwest) ..... *hudsonica heathi*.
22. Fore wing grey or blue-grey, highly mottled, brown largely confined to median area or absent ..... *hudsonica* (part).
22. Fore wing not mottled, usually predominantly brown ..... 23.
23. Veins 3 and 4 ( $M_3$  &  $Cu_1$ ) clearly outlined by white in postreniform area; collar with distinct dark brown or black streak on both sides. Usually 36–44 mm. in wing expanse ..... 24.
23. Veins 3 and 4 usually not outlined by white in postreniform area or only faintly so; collar usually concolorous, occasionally with faint brown streaks; subterminal line usually excurved across vein 7 ( $R_5$ ). 30–38 mm. in wing expanse.<sup>3</sup>  
*adumbrata* and *alleni*.
24. Hind wing yellow, the black markings heavy.  
*divergens divergens*.
24. Hind wing pinkish-orange, the black markings lighter.  
*divergens* form *socia*.
25. Hind wing vermilion, the black markings very light and the discal spot faint or absent; the contrasting median band of the fore wings narrow in submedian fold (2 mm.); t. p. line curving back to base of reniform just below vein 3 ( $Cu_1$ ).  
*pulchra*.

<sup>3</sup> No one of these characters holds rigidly for all specimens but the combination works fairly well. Compare to figures or examine genitalia.

25. Hind wing not vermilion throughout or median space broader (3 mm.) and other characters different ..... 26.
26. Collar concolorous or at most with very faint streaks; t. p. line curving back to base of reniform along vein 3 ( $Cu_1$ ) ..... 27.
26. Collar with contrasting dark streaks through it on both sides; t. p. line usually extending clearly beyond vein 3 and then curving back to it at or before reniform ..... 30.
27. T. p. line definitely touching subterminal line at veins 3 and 4 ( $M_3$  &  $Cu_1$ ); veins 3 and 4 not streaked with white in post-reniform area; no distinct black dashes before subterminal line near costa ..... *perplexa*.
27. T. p. line separated from subterminal throughout though sometimes very close to it at veins 3 and 4; or veins 3 and 4 streaked with white in postreniform area; usually with black dashes before subterminal line near costa ..... 28.
28. T. p. line strongly excurved below cell then incurved across anal vein (see Pl. 4, figs. 4-13) ..... *cf.* 31.
28. T. p. line straight or only moderately excurved below cell (see Pl. 3, figs. 15-19) ..... 29.
29. Hind wing reddish or salmon, the black markings light (Pl. 3, fig. 19); reniform defined by clear white outwardly; aedaeagus with spined swelling (Pl. 9, fig. 1) ..... *stretchii*.
29. Hind wing yellow or orange, the black markings heavier (Pl. 3, figs. 15-18); reniform not clearly defined by white outwardly; aedaeagus with distinct "hump" covered with spines (Pl. 8, fig. 1) ..... *adumbrata* (part).
30. T. p. line outwardly oblique below cell or only slightly excurved; subterminal line not strongly incurved between veins 4 and 7 ( $R_5$  &  $M_3$ ). (See Pl. 3, fig. 2.)  
*socia* (part).
30. T. p. line excurved below cell; subterminal line usually strongly incurved between veins 4 and 7 (see Pl. 4, figs. 4-13) ..... 31.
31. Sexes alike; hind wing yellow, orange or reddish (Rocky Mtns.).  
*howlandi*.
31. Male with hind wing white above and below at least in basal half; female reddish-orange or even vermilion (Texas to Calif.) ..... *tejonica*.
32. Basal half or more of hind wing white, outer part dark with white lunule near center of termen; no discal spot (Pl. 1, figs. 32-33) ..... (*Forsebia perlaeta*).
32. Hind wing dusky, darker in outer part ..... *scrupulosa*.
32. Hind wing clearly banded in outer part; discal spot present though sometimes small ..... 33.

33. Fore wing with white line defining outer edge of reniform and usually more or less streaked along veins 3 and 4 ( $M_3$  &  $Cu_1$ ) ..... 34.
33. Fore wing with postreniform area concolorous, the reniform not defined by a white line which contrasts with the rest of the postreniform area ..... 37.
34. Hind wing white or nearly so, discal spot faint, postmedial band rufous and fused with terminal band at apex, a contrasting black spot at middle of termen ..... *eubapta*.
34. Hind wing usually not white above, discal spot more distinct, bands and spots of hind wing of same color, and postmedian and terminal bands separate throughout ..... 35.
35. Postmedial band of hind wing thick throughout (N. Pacific states) ..... *mirifica hastingsi*.
35. Postmedial band of hind wing distinctly thinner or broken between veins 2-4 ( $M_3$  to  $Cu_2$ ) ..... 36.
36. Underside of hind wing white or with only very faint pink flush (southwestern: Calif., Nev. & Ariz.).  
*mirifica mirifica*.
36. Underside of hind wing suffused with salmon-pink except along costa (Rocky Mtn. : Colo., Nebr., Utah & northern N. Mex.).  
*mirifica klotsi*.
37. Ground color of hind wing salmon-pink or red ..... *ingeniculata*.
37. Ground color of hind wing white above and below (see *eubapta*).
37. Ground color of hind wing yellow or yellowish-orange ..... 38.
38. Subterminal line defined only by preceding dark ground color  
*occulta*.
38. Subterminal line light, defined by preceding dark ground color and succeeding dark irregular line, or subterminal represented by series of light points ..... 39.
39. Fore wing of female almost immaculate (southern)  
*graphica graphica*.
39. Fore wing of female maculate like male (northern)  
*graphica atlantica*.

*scrupulosa* Henry Edwards

*Syncooida scrupulosa* Henry Edwards. 1878. Pac. Coast Lepid., no. 29, p. 9.

Type locality: Havilah, Kern Co., California (collected by R. H. Stretch).

Cotypes: 1 ♂, 2 ♀♀, Amer. Mus. Nat. Hist.; 2 ♂♂, U. S. Natl. Mus. (cotypes).

Figures: Maculation: Pl. 2, fig. 1 (cotype); photo presumably of cotype in Edwards' bound volume of Pac. Coast Lepid. Genitalia: Male genitalia figured in generic revision (Richards, 1936c); female genitalia, pl. 10, fig. 1.

A rare and distinctive species. Readily distinguished as the only species of the genus with spined fore tibiae and a fuscous hind wing which is darker apically. Thorax and fore wing grey; t. a. line black, excurved in discal and submedian folds and below anal vein; brown median line; t. p. line black, distinct, widely separated from the subterminal line; reniform distinct, outlined by black; postreniform area concolorous with rest of wing; subterminal line faint or complete; terminal line reduced to a series of black points between the veins.

Genitalia: In the male genitalia (Richards, 1936c) the uncus normal for genus; harpes narrow, relatively short; elasper greatly reduced on left harpé, absent on right harpé; clavus with small basal lobe; sacculus greatly reduced basally but with large broad terminal prongs widely fused to harpé near apex; aedaeagus with patch of spines on dorsal side near tip; vesica spined. In the female genitalia (pl. 10, fig. 1) the dorsal sclerite of the ductus bursae of moderate length; ventral sclerite small, narrow, somewhat produced medially.

Expanse: 40–45 mm.

Dates: July.

Distribution: California, Nevada, Utah and Colorado.

*inepta* Henry Edwards

*Synedoida inepta* Henry Edwards. 1881. Papilio, 1: 27.

Type locality: Southern Colorado. Cotypes: (according to original descr. 5 specimens) Amer. Mus. Nat. Hist. and U. S. Natl. Mus.

*Synedoida morbosa* Henry Edwards. 1881. Papilio, 1: 27–28.

Type locality: Colorado, Arizona, Utah and Florida (the last seems surely an error). Cotypes: Amer. Mus. Natl. Hist. and U. S. Natl. Mus.

*Syneda violescens* Hampson. 1926. Lepid. Phal. N. G. & Spec. Noct., p. 45–46.

Type locality: Palmerlee, Huachuca Mtns., Arizona. Type: 1 ♀, British Museum.

Figures: Maculation: Pl. 2, figs. 2–4. Also colored figure in Holland's Moth Book where the species is given under the genus *Cissusa* (pl. 30, fig. 10). Genitalia: Male pl. 7, fig. 5; female pl. 10, fig. 2.



The general color of the fore wing varies from reddish-grey (*inepta*) to grey, to brown-grey and ochreous (*morbosa*), to dull violaceous (*violescens*) to dark grey. The hind wing is fuscous or smoky, darker apically, and so the only species with which it might be confused is *sabulosa*. From this it differs in the almost or quite concolorous collar, the indistinctness of the t. a. and t. p. lines which are never clear black lines, the terminal line being usually reduced to a series of points between the veins, and the cilia concolorous.

Racial differentiation in this species is questionable. From some localities only one color form has been collected (for instance the author found only very dark grey specimens in northern Utah near Logan in June, 1933) but from other localities a variety of color forms may be obtained. Sometimes one obtains a hodge-podge of colors from one place, but sometimes the colors are more nearly the same and tend to resemble the color of the rocks on which the adults rest during the day.

Genitalia: The male genitalia (pl. 7, fig. 5) have short harpes which are rather strongly sclerotized; claspers small; clavus moderate, the one on the right harpé longer, basal lobes of clavus moderate; sacculus reduced in various degrees, sometimes with moderate shelf-like projections basally, sometimes with very small projections which seem separated from the more distal parts of the sacculus; aedaeagus with patch of few or numerous spines on dorsal side near tip; vesica spined. Female genitalia (pl. 10, fig. 2) with dorsal sclerite of ductus bursae of moderate length; ventral sclerite rather narrow, slightly thicker at middle.

Expanse: 40–48 mm. Rarely to 35 and 52 mm.

Dates: April, June, July, August and September.

Distribution: Colorado, Utah, New Mexico and Arizona. (One cotype of *morbosa* recorded from Florida but this seems certainly an error.)

This species is a denizen of open rocky hillsides where it rests on the ground and rocks during the daytime, the specimens frequently tending to match more or less the color of the rocks of the vicinity. It is found at rather low elevations (4000–6000 ft. usually) in country that becomes quite dry in middle and late summer. The adults fly mostly from early June to mid-July.

*sabulosa* Henry Edwards

*Synedoida sabulosa* Henry Edwards. 1881. Papilio, 1: 26–27.  
Type locality: Southern Colorado. Types: Amer. Mus. Nat. Hist. and U. S. National Museum (4 specimens according to original description).

*sabulosa* race *abrupta* Barnes & McDunnough

*Syneda abrupta* Barnes & McDunnough. 1918. Contrib. Nat. Hist. N. A. Lepid., 4: 119-120, pl. 19, figs. 12 & 14.

Type locality: Palmerlee, Huachuca Mtns., Arizona (some of paratypes from Jemez Springs, New Mexico). Types: 2 ♂♂, 3 ♀♀, U. S. National Museum.

Figures: Maculation: Pl. 2, figs. 5-7. Also colored figures of *sabulosa sabulosa* in Holland's Moth Book (Pl. 30, fig. 11) and in Grote's Illustrated Essay (Pl. 4, fig. 39. 1882), and photographs of both sexes of *sabulosa abrupta* in original description. Genitalia: Male: Pl. 7, fig. 6; female: pl. 10, fig. 4.

This and the following species are separated from all others by having the hind wing fuscous or dirty white suffused with fuscous basally, darker apically, the banding discernible below but scarcely visible above; collar with prominent dark streaks on both sides; the t. a. and t. p. lines black; the subterminal line sharply angled in opposite cell, and the cilia of the fore wing more or less distinctly checkered. The chief possibilities for confusion are between females of the race *abrupta* and *fumosa* (see under *fumosa*), and with the following species (see under *nichollae*).

Division of *sabulosa*, *abrupta*, *nichollae* and their variants into species or races is one of the hardest tasks in revising this genus, no doubt partly due to insufficiency of material (except of the Colorado form) and to the wide gaps between points of collection. The genitalia are inseparable, or at least the differences extremely slight. And I have found no characters for constant key separation of the forms although I must admit they present a somewhat different habitus which I find difficult to describe without colored figures. The maculation characters, as frequently the case in this genus, vary greatly and intergrade. For instance, much use has been made in descriptions of the course of the t. p. line from the reniform to the inner margin (excurved in submedian fold or not) but in the series the author has had for study all intergrades are shown from evenly incurved to evenly excurved. And, while on the subject of habitus, it might not be amiss to mention that there are two different color forms in Colorado. The types (both at U. S. N. M. and A. M. N. H.) are distinctly grey, whereas virtually all the other specimens seen have been distinctly brown.

The two races may be compared as follows: *sabulosa*: color of body and fore wings grey or brown; median area broad, not sharply contrasting with rest of wing; postreniform area with some white scales or with reniform defined by white outwardly which also out-

lines veins 3 and 4; t. p. line usually clearly excurved below cell; subterminal line principally defined by preceding dark ground color, strongly incurved opposite cell; cilia faintly checkered; hind wing fuscous at base, darker outwardly, cilia brownish or smoky. *Abrupta*: fore wing grey suffused with black; median area contrastingly lighter than basal and terminal areas; reniform defined outwardly by white which also outlines veins 3 and 4; t. p. line erect or (usually) slightly excurved below cell; subterminal line as in *sabulosa*; cilia clearly checkered; hind wing dirty white basally, dark outwardly, cilia mostly white or whitish (see also under *nichollae*).

Genitalia: The male genitalia (Pl. 7, fig. 6) have the clasper on the left harpé small, on right harpé absent, its position indicated by slightly heavier sclerotization and setae; clavus moderate, longer on right side, basal lobe small and arising well above base of clavus; sacculus on left harpé with small or moderate shelf-like projection basally which is more or less separated from the rudimentary terminal part of the sacculus; sacculus on right harpé with shelf-like projection greatly reduced or absent (position indicated by patch of setae), the terminal half strongly sclerotized; aedaeagus with spines on dorsal side near tip; vesica spined. The female genitalia (Pl. 10, fig. 4) have the dorsal sclerite of the ductus bursae of moderate length; ventral sclerite rather narrow, somewhat irregular and somewhat produced medianly.

Expanse: 32–40 mm., some specimens of *abrupta* reaching 44 mm.

Distribution: *sabulosa sabulosa*: Colorado, New Mexico and Utah.

*sabulosa abrupta*: Arizona, New Mexico and southern California.

Dates: June, July and September.

*nichollae* Hampson

*Syneda nichollae* Hampson. 1926. Lepid. Phal. N. G. & Spec. Noct., p. 45.

Type locality: Ashnold, British Columbia (Mrs. Nicholl).

Types: 3 ♀♀, British Museum.

Figures: Maculation: Pl. 2, figs. 8–10. Male genitalia: Pl. 7, fig. 7.

This species is differentiated from the preceding by the subterminal line which becomes barely traceable or obsolete below vein 7 ( $R_5$ ). The body and fore wings are grey or bluish-grey suffused with brown and black especially in basal area and beyond t. p. line; median area contrasting with basal and subterminal areas; reniform with some

white scales beyond it but veins 3 and 4 not clearly defined by white; t. p. line erect below cell or slightly incurved; cilia faintly checkered; hind wing smoky-grey at base, darker outwardly; cilia cream or light brown.

After having placed *nichollae* as a race of *sabulosa* in the generic revision, the author is forced to re-establish it as a species, despite genitalic similarity, partly because of the subterminal line but largely because of the distribution. The author has seen *nichollae* from scattered localities from northern California to southern British Columbia and east and south to Montana with thence a gap across Wyoming and Colorado and then a series of three specimens collected at Alpine, Texas, by O. C. Poling (at U. S. N. M.). The gap from southern California to Colorado is occupied by *sabulosa* and its race *abrupta*. Inasmuch as there seems no reason for questioning the data on the short series collected by Poling, it seems that *nichollae* must for the present at least be classed as a distinct species since one race can scarcely exist on both sides of another race of the same species when there are no apparent habitat differences. Judging from some of the other species in this genus, genitalic similarity is not necessarily indicative of specific identity (note *eubapta*, *occulta* and *tejonica*).

Genitalia: (Pl. 7, fig. 7) Not separable from *sabulosa*, *q. v.*

Expanse: 33–40 mm.

Dates: June and July.

Distribution: Washington, southern British Columbia, Idaho, Montana (Hamilton) and Texas (Alpine). Race *garthi*: Yosemite, California.

*nichollae* race *garthi*, race nov.

Figures: Maculation: Pl. 2, figs. 9–10.

Male holotype: Fore wing with the ground color distinctly blue-grey; basal area suffused with brown; basal line black; t. a. line double, outer line black, excurved in discal and submedian folds; median space narrow, contrastingly ochreous except at costa and inner margin where it is bluish-grey; median line single, brown; reniform brown, basally defined by a few black scales and preceding white line, outwardly defined by white which is faintly extended along veins 3 and 4; t. p. line black, angled out on vein 7 and bluntly across veins 3 and 4, extending back to base of reniform along vein 3, thence almost erect to near inner margin where it is excurved; subterminal line defined by preceding dark ground and by two black dashes near

costa, barely traceable as wavy line of lighter spots below vein 7; terminal area blue-grey; terminal line complete; cilia faintly checkered. Hind wing fuscous; light crescent across cubitals beyond faint postmedian band; cilia light. Beneath fore wing light powdered with dark scales, oblique dark shade from reniform to inner angle and dark dash from near apex towards inner margin; cilia distinctly checkered; hind wing light with darker irroration; dark discal spot, faint postmedian and incomplete terminal lines.

Female allotype: Like the male but t. a. line not so distinctly excurved across cell; median area grey; median line faintly double; t. p. line recurved from vein 4 without angle on vein 3; subterminal line lost below vein 7. Beneath markings same but more distinct and complete.

Male Holotype: Yosemite, California, June 28, 1933 (collected by John S. Garth).

Female Allotype: Same data (both Holo- and Allotype deposited in U. S. National Museum).

Mr. Garth collected six specimens of this race, all at the same time and place, but only the above two are before the author for inclusion in the type series.

This race is distinguished from nymotypical *nichollae* by the bluer color, the much more colorful and contrasty fore wing, and perhaps by the narrower median area.

*biformata* Henry Edwards

*Synedoida biformata* Henry Edwards. 1878. Pac. Coast Lepid., no. 29, p. 9.

Type locality: Havilah, Kern Co., California. Types: 2 ♂♂, 1 ♀, Amer. Mus. Nat. Hist. and U. S. National Museum.

Figures: Maculation: Pl. 2, fig. 14. Genitalia: Male: Pl. 7, fig. 8; Female: Pl. 10, fig. 5.

A rare and distinctive species. Basal line black; t. a. line black, oblique to middle of submedian fold, sometimes not straight but never excurved in cell, incurved or angled in across anal vein; median area rather concolorous, no definite median line; reniform indistinct with faint basal line; postreniform area concolorous without distinct white lines; t. p. line black, following usual course around reniform, angled back to base of reniform just below vein 3 (Cu<sub>1</sub>), then erect to middle of submedian fold and then abruptly angled outwards to inner margin; subterminal line faint, sinuous, defined only by the

slightly darker preceding ground color; terminal line faint or absent; cilia concolorous with the terminal area. Hind wing light at base, cream or faded pink in outer part; discal spot very faint or absent; postmedian band not traceable; some diffuse fuscous scales at apex and middle of termen. Beneath the hind wing uniform light pinkish cream without black markings.

Genitalia: The male genitalia (Pl. 7, fig. 8) have the claspers single, short and broad; clavus normal, somewhat longer on right harpé, the basal lobes about three times as long as broad; sacculus well-developed and with a large terminal prong on both harpes; aedaeagus with patch of spines on dorsal side near tip. The female genitalia (Pl. 10, fig. 5) have the dorsal sclerite of the ductus bursae rather long; the ventral sclerite narrow except medianly where it is produced in both directions.

Expanse: 37–40 mm.

Distribution: California.

*ochracea* Behr

*Syneda ochracea* Behr. 1870. Trans. Amer. Ent. Soc., 3: 25.

Type locality: San Francisco & Marion Co., California.

Types: all lost.

Figures: Maculation: Pl. 2, figs. 15–16. Also a photo, perhaps type or compared with type, in Edwards' bound copy of Pacific Coast Lepidoptera. Male genitalia: Pl. 9, fig. 3.

A distinctive species. Females larger and darker than males. Thorax and fore wing greyish or ochreous ranging to medium dark brown; t. a. line weak, double, excurved in discal and submedian folds; reniform defined by black and connected by two lines to the costa; t. p. line very faint or obsolete, when traceable not angled back to reniform but strongly angled in on vein 2 ( $Cu_2$ ); subterminal line faint or obscure; some black streaks or suffusion between veins at apex. Hind wing orange with usual black discal spot and postmedian and terminal black bands; base sometimes suffused with black. Underside of forewings orange with solid black reniform which is not connected to the subapical fuscous band.

It is possible that slightly differentiated desert and mountain races exist in this species.

Genitalia: The male genitalia (Pl. 9, fig. 3) have a very heavy uncus with unusually long black bifurcated setae; clasper small on right harpé, absent on left harpé; clavus much longer on right side and with a longer basal lobe, basal lobe on left clavus small; sacculus well-developed as shown; aedaeagus with patch of spines on

dorsal side near tip; vesica spined. The female genitalia are similar to those of *inepta*.

Expanse: 40–48 mm.

Dates: May, June and July.

Distribution: California, Arizona, Nevada, Utah, Colorado, Montana, Idaho and southern British Columbia.

*edwardsi* Behr

*Syneda edwardsi* Behr. 1870. Trans. Amer. Ent. Soc., 3: 28.

Type locality: Alameda and other parts of Contra Costa, California. Types: all lost.

Figures: Maculation: Pl. 3, fig. 12. Also colored figure in Holland's Moth Book (Pl. 30, fig. 37) and a photo in Edwards' bound copy of his Pacific Coast Lepidoptera. Genitalia: Male: Pl. 7, fig. 4; Female: Pl. 10, fig. 3.

Another distinctive species readily recognized from the figures and the key to species. As usual in this genus there is considerable variation. The hind wing varies from yellow through orange to almost vermilion, and the black margins on this wing vary considerably in breadth. The fore wing is usually as in Holland's figure and the photo given herein but the author has seen a number of specimens in which the fore wing was rather uniformly dark (powdered and suffused with black), the usual markings visible but with no contrasts.

Genitalia: The male genitalia (Pl. 7, fig. 4) have harpes of different size and shape; the right harpé short and blunt, the left harpé longer and oblique to end of long sacculus; clasper bifurcated on left harpé, single on right; clavus of moderate length but basal lobes usually vestigial (sometimes present as small lobes on left clavus); sacculus well-developed, elongated distally and with small terminal prongs; aedaeagus without external spines; vesica spined. The female genitalia (Pl. 10, fig. 3) have the dorsal sclerite of the ductus bursae long; the ventral sclerite rather narrow with a blunt median projection extending to the opening of the ductus bursae.

Expanse: 30–38 mm.

Dates: May, June, July and August.

Distribution: Arizona, California (northern and southern), Oregon and Washington.

*pallescens* Grote & Robinson

*Melipotis pallescens* Grote & Robinson. 1866. Proc. Ent. Soc. Phila., 6: 21–22, pl. 3, fig. 5.

Type locality: Texas (E. T. Cresson). Types: 1 ♀, Phila. Acad. Sci.

*Melipotis tenella* Henry Edwards. 1881. Papilio, 1: 26.

Type locality: N. W. Texas (J. Boll). Types: ♂ and ♀, U. S. National Museum.

Figures: Maculation: Pl. 2, figs. 11-12. Also figure in original description of *pallescens*, and a colored figure in Holland's Moth Book (Pl. 30, fig. 25). Genitalia: Male: Pl. 7, fig. 3; Female: Pl. 10, fig. 6.

This is one of the two species of this genus which have the basal part of the hind wing white, the apical part dark fuscous or black, but with the banding incomplete or obscured and the discal spot lacking. Superficially it resembles a species of *Melipotis* from which it may be separated by the structure of the palpi and genitalia. From *fumosa*, the other species with a similar hind wing, it may be separated by the usually pinkish-grey thorax and base of the fore wing, the usually evenly excurved t. a. line (sometimes very slightly excurved in discal and submedian folds), the uniform cilia, and the incomplete white lunule at the middle of the termen of the hind wing. Some specimens have some dark suffusion in the basal half of the hind wing, especially along the veins of the lower part of the cell.

The name *tenella* is based on specimens in which the black band on the hind wing is greatly reduced. It occurs rarely in diverse localities.

Genitalia: The male genitalia (Pl. 7, fig. 3) has the left clasper broadly bifurcated, right clasper long; clavus very long, with long basal lobe arising near extreme base of clavus; sacculus varying in size of the shelf-like projection, terminal prong small; aedaeagus normal, without external spines; vesica moderately spined. The female genitalia (Pl. 10, fig. 6) have the dorsal sclerite of the ductus bursae moderately long; ventral sclerite narrow and medianly produced into a point.

Expanse: 35-48 mm.

Dates: May, June, July, August and September.

Distribution: Texas, Arizona, Lower California (Mexico), California, Nevada, Utah, Idaho and Montana.

*fumosa* Strecker

*Syneda fumosa* Strecker. 1898. Lepid. Rhopal. & Heter., Suppl. 1: 12.

Type locality: Texas (Bern. Gerhard). Type: 1 ♀, Field Museum (Chicago).



*fumosa* race *brunneifasciata* Barnes & McDunnough

*Syneda brunneifasciata* Barnes & McDunnough. 1916. Contrib. Nat. Hist. N. A. Lepid., 3: 17, pl. 1, fig. 4.

Type locality: Camp Baldy, San Bernardino Co., California (July 16). Types: 1 ♂, 1 ♀, U. S. National Museum.

Figures: Maculation: Pl. 2, fig. 13. Also photograph of *brunneifasciata* in the original description. Genitalia: Male: Pl. 7, fig. 1; Female: Pl. 10, fig. 7.

A rare species that differs from *pallescens* in having the thorax and base of the fore wing mottled grey-brown, the t. a. line excurved in both discal and submedian folds, and the hind wing without a distinct white lunule at the middle of the termen. Reniform also defined outwardly by white which is more or less streaked onto veins 3 and 4, and in nymtotypical *fumosa* the cilia of the fore wing are checkered. Females may be confused with *sabulosa abrupta*, but in *abrupta* the dark outer part of the hind wings on the undersides is curved and not sharply set-off from the lighter base whereas in *fumosa* the line of separation is sharper and straight.

This species varies widely, and in view of the few dozens of specimens known it is questionable whether or not to hold the name *brunneifasciata* as a distinct race. The series at the U. S. National Museum shows a considerable degree of intergradation and led the author to place *brunneifasciata* in synonymy in the preliminary listing given in the generic revision. Conservatism and an attempt to define races leads the author now to place it, still tentatively, as a Californian race. The type of *fumosa* has the median band of the fore wing grey and the cilia checkered black and white; the types of *brunneifasciata* have the broad median band ruddy-brown and the cilia uniformly smoky.

The maculation of the fore wings of this species reminds one of *divergens*, with which the genitalia also relate it.

Genitalia: The male genitalia (Pl. 7, fig. 1) have the claspers about twice as long as broad, single, the one on the left harpé pointed, the one on the right harpé blunt; basal lobe of clavus only about as long as broad; sacculus with well-developed shelf-like projection, narrow beyond this and with a small distal prong, similar on the two harpes; aedaeagus without external spines; vesica spined. The female genitalia (Pl. 10, fig. 7) have the dorsal sclerite of the ductus bursae very short; the ventral sclerite long and broad (compare *divergens*).

Dates: July and August.

Distribution: *fumosa fumosa*: Texas.

*fumosa brunneifasciata*: Arizona and California.

*divergens* Behr

*Syneda divergens* Behr. 1870. Trans. Amer. Ent. Soc., 3: 27-28.

Type locality: Foothills of the Sierra Nevada, California.  
Types: those in Behr collection destroyed; 1 ♀ cotype (paratype) in Field Museum (Chicago).

*divergens* form *socia* Behr

*Syneda socia* Behr. 1870. Trans. Amer. Ent. Soc., 3: 27.

Type locality: Ft. Tejon, California. Types: all lost.

Figures: Maculation: Pl. 3, figs. 1-2. Also colored figures of both in Holland's Moth Book (Pl. 30, figs. 32 & 38), figure presumably of a type of *divergens* in the Whitney Geological Survey Report, and photos of both, perhaps from types, in Edwards' bound copy of his Pacific Coast Lepidoptera. Genitalia: Male: Pl. 7, fig. 2; Female: Pl. 10, fig. 8.

A large species that can be most readily spotted from the figures. Despite the obvious placement of most specimens by comparison it has been difficult to try to find an unvarying character to separate this species from *adumbrata* in the maculation key. The difficulty is due primarily to the enormous range of variation of *adumbrata*.

The forms *divergens* and *socia* intergrade but both names seem worthy of retention. They are perhaps best separated by the ground color of the hind wing; less serviceable characters include the amount of black on the hind wing, and the contrastiness of the fore wing, especially the median and terminal areas. Some specimens of *socia* have the discal spot of the hind wings separate from the postmedial band. Both forms are wide-spread in California, especially *socia*, which is seldom matched by specimens from elsewhere, but the author has no positive records of these two having been captured flying together and very few records of their having been taken at the same place. Superficially *socia* looks like a valid race, but the distributional records are such that it seems better to place it as a color form.

Genitalia: The male genitalia (Pl. 7, fig. 2) have the claspers single, the one on the left harpé very small; clavus long and slender, longer on the right side, basal lobe small or very small; sacculus reduced, variable but always present, terminal prong of sacculus small or absent; aedaeagus without external spines; vesica spined. The female genitalia (Pl. 10, fig. 8) have the dorsal sclerite of the ductus bursae of moderate length; the ventral sclerite very long and broad (compare *fumosa*).

Expanse: Normally 36–44 mm., but dwarfs as small as 30 mm.

Dates: February to September in Arizona and California; April to August farther north.

Distribution: *divergens divergens*: Arizona, California, Oregon, Washington, Idaho, Montana, Nevada, Utah and Colorado. *divergens socia*: common throughout California and a few similar specimens seen from Washington, Utah and Colorado.

Early stages: Dodge. Lepidopterist, 3: 117. 1920.

Food plant: Elder (*Sambucus glauca*)—teste Mr. S. E. Crumb.

Judging from the locality labels this species occurs in a wide range of elevations. The records seem largely from mountainous country, and the one time the author collected this species in Utah it was in open woods in upper Canadian zone. It is usually found, at least in the eastern half of its range, together with *adumbrata*.

*grandirena* Haworth

*Phytometra grandirena* Haworth. 1809. Lepid. Britt., p. 264.

*Aedia limbolaris* Geyer. 1827. Zutr. exot. Schm., 4: 23, figs. 689 & 690.

Type locality: Georgia. Types: lost but figured.

Figures: Maculation: Pl. 4, fig. 3. Also figured in colors in Holland's Moth Book (Pl. 30, fig. 27) and in the original description of *limbolaris*. Genitalia: Male: Figured in generic revision (Richards, 1936c); Female: Pl. 11, fig. 11.

Readily recognized from the figures. Resembles a species of *Melipotis* in general appearance. This species is equally distinctive by the maculation, smooth front and genitalia; it has no close relatives (but the maculation of the undersides of the hind wings remind one of *graphica* and *occulta* which have quite different genitalia).

Genitalia: The male genitalia (see generic revision for figure) have a greatly swollen uncus covered with unusually long black bifurcated setae; claspers single; clavus with small basal lobe; sacculus with a broad shelf-like projection, distally with a free prong; aedaeagus without external spines; vesica spined. The female genitalia (Pl. 11, fig. 11) have the dorsal sclerite of the ductus bursae very long, broader near the bursa; the ventral sclerite narrow, somewhat wider medianly; bursa with more sclerotized patch with spines near the ductus bursae.

Expanse: 35–40 mm.

Dates: April, May, August and October in the south; May to August in the north.

Distribution: New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Wisconsin, Maryland, Virginia, North Carolina, South Carolina, Tennessee, Georgia, Alabama and Florida (including southern part).

Although this species is frequently captured and all collections have it in series, still specimens are almost always taken singly and the author has no record of a series having been taken anywhere at any time. The author has taken the species only at light but Mr. Otto Buchholz says he has taken about a dozen specimens, representing both sexes, always singly, in open spots close to woods on top or near the top of the Orange and Ramapo Mountains, New Jersey.

*petricola* Walker

*Euclidia petricola* Walker. 1858. Cat. British Mus., 14: 1462.

Type locality: "Rocky Mountains." Type: British Museum.

*petricola* race *athabasca* Neumoegen

*Syneda athabasca* Neumoegen. 1883. Papilio, 3: 143-144.

Type locality: Belly River, N. W. British Columbia (Capt. Gedder). Types: ♂ & ♀, U. S. National Museum.

*petricola* race *athabasca* form *crockeri* Barnes & Benjamin

*Syneda athabasca* form *crockeri* Barnes & Benjamin. 1924. Ent. News, 35: 15.

Type locality: Saskatchewan, Canada. Types: ♂ & ♀, U. S. National Museum.

Figures: Maculation: Pl. 3, figs. 3-4. Also colored figures in Holland's Moth Book where the form *crockeri* is given under the name of *athabasca* (Pl. 30, fig. 29), and where what looks like the true *athabasca* is given under the name of *alleni* (Pl. 30, fig. 35). Male genitalia: Pl. 8, fig. 4.

This little mountain species, the smallest in the genus, is readily separated as the only species in the genus with veins 7-3 ( $R_5$  to  $Cu_1$ ) streaked with black in the terminal area on the underside of the fore wings. On veins 7-5 the vein is defined as a black line, on veins 4-3 the black is more suffused especially towards the termen.

*Petricola* is the southern Rocky Mountain race. It is somewhat larger and has the hind wing and undersides bright orangish-yellow. *Athabasca* is the scarcely distinct northern Rocky Mountain race. As Barnes & Benjamin pointed out in the original description of

*crockeri*, it is difficult to judge the original color of the type of *athabasca* but presumably it was light yellow or cream. The form *crockeri* is the extreme in which the hind wing and lower surfaces are pure white and the fore wings with more white and bluish and no brown. As color forms go it certainly is a distinct one, and the author, not having seen *athabasca* and *crockeri* from the same locality, would be inclined to class it as a race were it not for the contrary opinion of Dr. McDunnough who has had the opportunity to examine much more Canadian material.

Genitalia: The male genitalia (Pl. 8, fig. 4) are nearly symmetrical and heavily and rather uniformly sclerotized; claspers small and single; clavus long and curved, the basal lobe small or almost lost; sacculus with a small shelf-like projection, the terminal prong blunt, its length variable; aedaeagus seemingly without external spines; vesica spined. The female genitalia are similar to those of *hudsonica* but the ventral sclerite of the ductus bursae is narrower.

Expanse: 25–32 mm. (*petricola petricola* largest, *crockeri* smallest).

Dates: May, June and July.

Distribution: *petricola petricola*: Colorado, Utah and Montana;  
*petricola athabasca*: British Columbia, Alberta,  
 Saskatchewan, Manitoba and perhaps Montana.

*petricola athabasca* form *crockeri*: Saskatchewan  
 and Manitoba.

In the La Sal Mountains of Utah, *petricola* was collected commonly visiting mint flowers on a chaparral covered mesa (Transition zone) in mid-July by Dr. Alexander B. Klots (locality known to this author). This was much lower than where the author had collected *adumbrata* and *divergens* in the upper edge of the aspen belt (upper Canadian zone) in the same mountains three years earlier.

*hudsonica* Grote & Robinson

*Syneda hudsonica* Grote & Robinson. 1865. Proc. Ent. Soc. Phil., 4: 494–496, pl. 3, fig. 7–8.

Type locality: Hudson's Bay Territory (Kennicott).

Types: 1 ♂, 1 ♀, Philadelphia Acad. Nat. Sci.

*hudsonica* race *heathi* Barnes & McDunnough

*Syneda hudsonica heathi* Barnes & McDunnough. 1918. Contrib. Nat. Hist. N. A. Lepid., 4: 122, pl. 19, figs. 9–10.

Type locality: Cartwright, Manitoba (June). Types: 2 ♂♂, 3 ♀♀, U. S. National Museum.

*Syneda pedionis* Hampson. 1926. Lepid. Phal. N. G. & Spec. Noct., p. 42-43.

Type locality: Winnipeg, Manitoba (Wallis). Types: 1 ♂, 1 ♀, British Museum.

*hudsonica* race (?) *seposita* Henry Edwards

*Syneda seposita* Henry Edwards. 1881. Papilio, 1: 25.

Type locality: southern Colorado. Types: ♂ & ♀, U. S. National Museum and Amer. Mus. Nat. Hist.

*hudsonica* race (?)

See under *nubicola* and *maculosa*.

Figures: Maculation: Pl. 3, figs. 5-11. Also *hudsonica* and *heathi* both figured in original descriptions; photograph of *hudsonica* given by Barnes & McDunnough in Contributions Nat. Hist. N. A. Lepid., vol. 4, pl. 19, figs. 7-8, and a colored figure of *hudsonica* in Holland's Moth Book (Pl. 30, fig. 31). Genitalia: Male: Pl. 8, figs. 7-8; Female: Pl. 11, figs. 7-8.

This is another variable species clearly separated into two races, one in the mountains, the other in the northern plains and prairies. The mountain form (*hudsonica hudsonica*) is characterized by the fore wing being of very mottled appearance and the sexes alike. Also the fore wing is grey, blue-grey, violaceous or brown (always mottled with black scales), the usual lines not sharply defined; postreniform area light with the reniform when distinct extended as long points on veins 3 and 4, these veins not being defined with white which contrasts with the rest of the postreniform area; t. a. and t. p. lines usually both excurved below cell; subterminal line complete, sinuous or irregular; terminal line complete; hind wing white, cream or light yellow, the black markings heavy, and the discal spot broadly connected with the postmedian band.

The prairie race (*heathi*) is sexually dimorphic. Both sexes lack the mottled appearance of the mountain race. In the male the usual markings of the fore wing are complete and similar to the specimens from the mountains, from which they differ in the absence of the mottling (there is a powdering of black scales), the shade of the greyish or blue-grey fore wing, and the hind wing and lower surfaces being always a very light cream. The female has all the markings of the fore wing obscure or obsolete, otherwise it is like the greyish males.

The form at the southern end of the Rocky Mountains (Colorado) is a rather poor race not clearly separated from northern specimens. As a rule the specimens are more brownish than grey, or even largely suffused with brown. The name *seposita* is available for use here if desired. The form at the southern end of the range of the species in California (vicinity of Tuolumne Meadows and Inyo County) seems to represent a distinct race though adequate material is not at hand to evaluate such. The single Californian specimen at hand appears more marbled and violaceous. The name *nubicola* and probably also *maculosa* seem applicable (see under *nubicola* and *maculosa*).

There is a discrepancy in the type series of *hudsonica*. The male type, which will fix the application of the name, is a representative of the mountain race as shown by the photograph reproduced here and by compared with type material in the author's collection. The female type, however, seems to be a somewhat more maculate than usual female of the plains race (*heathi*).

Genitalia: The male genitalia (Pl. 8, figs. 7-8) are more nearly symmetrical than those of most species in this genus; elaspers single, well-developed; clavus long and slender, longer on right side, basal lobes arising at base and three to four times as long as broad; sacculus with a distinctive shelf-like projection somewhat recurved towards base and bearing a cluster of unusually heavy macrosetae; aedaeagus with very minute, scarcely discernible microtrichiae on the membranous dorsal side near the tip; vesica spined. The female genitalia (Pl. 11, figs. 7-8) have the dorsal sclerite of the ductus bursae of moderate length; the ventral sclerite a moderately heavy band bluntly produced distally at the center.

Expanse: 30-40 mm.

Dates: Mostly June and July but records from May through August.

Distribution: *hudsonica hudsonica*: "Hudson Bay to Alaska and down the Rockies at higher altitudes" to southern Colorado in the east and Inyo Co., California in the west. Specimens studied from Alaska, Alberta, Montana, Wyoming, Colorado, Utah and California. *hudsonica heathi*: British Columbia, Saskatchewan, Alberta, Manitoba, Montana, North Dakota and Nebraska. (There is one specimen of the mountain race in the Amer. Mus. Nat. Hist. labeled "N. Y." but this seems likely an error.)

*nubicola* Behr

*Syneda nubicola* Behr. 1870. Trans. Amer. Ent. Soc., 3: 25-26.

Type locality: Alpine prairies around headwaters of Tuolumne River, California. Types: all lost.

*maculosa* Behr

*Syneda maculosa* Behr. 1870. Trans. Amer. Ent. Soc., 3: 26.

Type locality: Headwaters Tuolumne River, California.  
Types: all lost.

There seems to the author little doubt but that the above two names represent synonyms or at most a northern Californian race of the mountain race of *hudsonica*. However, the author hesitates to place these names definitely in synonymy in the absence of topotypical material. The description of *nubicola* sounds more certainly that of a form of *hudsonica* than the description of *maculosa* does.

Although lacking topotypical material the author does have in his collection a single female from Round Valley, Inyo County, California, Elev. 6,500 ft., August 5, 1928 (collected by John S. Garth). This specimen (Pl. 3, figs. 7-8) shows the essential features of Behr's descriptions of both *nubicola* and *maculosa* but does not match perfectly his short and unsatisfactory description of either name. This specimen is unquestionably a variant of the mountain race of *hudsonica* but looks distinct from all the other specimens the author has seen. The fore wing is distinctly violaceous (as called for in Behr's descriptions) with little or no brown, and with the markings of *hudsonica* but with the color values all changed; the hind wings are creamy at the base, yellowish apically, with the usual black markings; beneath both wings white with some black powdering and the black markings of the mountain race of *hudsonica*.

This specimen is sufficiently near the descriptions of Behr's names but unfortunately the locality while near Tuolumne Meadows in terms of miles is quite different in biotic terms. Mr. Garth writes, "Round Valley is on the abrupt East slope of the Sierra Nevada. The flora and fauna are influenced to a marked degree by ascending currents of heated air from the Owens Valley, which is removed but one valley from 'Death Valley' and is continuous on the north with the Mono Basin which is emphatically of the Great Basin fauna . . . 6,500 ft. is Transition zone. . . About 50 miles north of Round Valley and opposite Mono Lake the Tioga Pass, elevation almost 10,000 ft., communicates with the Tuolumne Meadows, the drainage of which is Pacific and the flora of which is cismontane. The pass forms an entering wedge for a number of Great Basin butterflies and may also let your *Syneda* through. However, unless it is a Hudsonian flyer, the chances are against this." This species



does fly in a wide range of elevations including Hudsonian. The author is inclined to believe that this specimen belongs to the same population that furnished Behr's specimens of *nubicola* and *maculosa* but he prefers to await topotypical material before definitely synonymizing the names.

*perplexa* Henry Edwards.

*Syneda perplexa* Henry Edwards. 1884. Papilio, 4: 47.

Type locality: Arizona. Type: 1 ♂, U. S. National Museum.

Figures: Maculation: Pl. 3, figs. 13-14. Male genitalia: Pl. 8, fig. 3.

A distinctive and not very common species. There is considerable variation in the amount of red-brown suffusion on the fore wings. The t. a. line is double, the inner line faint (fig. 14), sometimes filled in with black (fig. 13), usually evenly excurved; t. p. line clearly touching the subterminal line at veins 3 and 4, excurved below cell; postreniform area usually concolorous except for white line on outer edge of reniform; veins 3 and 4 never sharply defined with white; no black dashes before subterminal line near costa; terminal area blue-grey, contrasting with rest of wing; terminal line reduced to a series of points between the veins. Hind wing yellowish-orange, the black markings light, the discal spot not connected with the postmedian band. Beneath ruddy-orange, the black markings incomplete.

Genitalia: The male genitalia (Pl. 8, fig. 3) have the claspers single, or the one on the left harpé with a barely detectable costal lobe widely separated from the other part; clavus normal on both sides, with moderate basal lobes; sacculus moderate; aedaeagus with a large dorsal hump covered with heavy spines (similar to that of *adumbrata*, *q. v.*); vesica spined. The female genitalia have the dorsal sclerite of the ductus bursae long; the ventral sclerite weak and moderately narrow.

Expanse: 34-38 mm.

Dates: April, May, June and July.

Distribution: Arizona, Nevada, Utah, Colorado and Montana.

*adumbrata* Behr

*Syneda adumbrata* Behr. 1870. Trans. Amer. Ent. Soc., 3: 27.

Type locality: Downieville, California. Types: destroyed except 1 ♀ cotype (paratype) in the Field Museum.

*adumbrata* race *saxea* Henry Edwards

*Syneda adumbrata* var. *saxea* Henry Edwards. 1881. Papilio, 1: 26.

Type locality: Colorado and higher Sierra Nevadas, California. Types: 3 ♂, 4 ♀ according to original description; one of the Colorado females is at the Amer. Mus. Nat. Hist.; some of the others will no doubt be at the U. S. National Museum.

*adumbrata* race *alleni* Grote

*Syneda alleni* Grote. 1877. Canadian Ent., 9: 215.

Type locality: Orono, Maine. Types: Recorded by Smith for British Museum. Mr. Gerhard writes that there is 1 ♂ type in the Field Museum received from Fernald.

Figures: Maculation: Pl. 3, figs. 15-18. Also good colored figure of *adumbrata* and very poor figure labeled *alleni* (but looking more like *athabasca*) in Holland's Moth Book (Pl. 30, figs. 34 and 35); photograph of *adumbrata*, perhaps type or compared with type, in Edwards' bound copy of Pacific Coast Lepidoptera. Genitalia: Male: Pl. 8, figs. 1-2; Female: Pl. 11, fig. 13.

This protean species is more readily recognized from Holland's colored figure or from the photographs herein than from any description, except for separation from *stretchii*. The habitus is characteristic but every character except genitalia that might be listed for separation from *divergens* falls down on one variant or another. *Stretchii* is easily confused here: the color of the hind wing, the white in the postreniform and the discal spot of the hind wing being wholly separated from the postmedian band will usually work but occasionally will give trouble. The male genitalia are the only satisfactory means of identifying questionable specimens.

The recognition of the above three names as separate races is open to considerable question, especially the segregation of *saxea* from nymotypical *adumbrata*. Nymotypical *adumbrata* (fig. 15) has the discal spot of the hind wing broadly connected to the postmedian band, whereas *saxea* (figs. 17-18) has the discal spot connected to the postmedian band only by a line of black scales along the cubital veins. Both of these vary greatly in the shade and contrast of the fore wings, and both throw dull and contrasty forms. *Alleni* (fig. 16) has the discal spot of the hind wing as in *saxea* but has a rosy flush to both wings that is lacking in more western examples.

Genitalia: The male genitalia (Pl. 8, figs. 1-2) have the left clasper broadly bifurcated, the right clasper long and single; clavus on left side very heavy, on right of normal proportions, both rather short, the basal lobes of moderate length; saccus with moderate, rather variable shelf-like projections bearing heavy setae, distally about reaching end of blunt harpé on left side; aedaeagus with a large dorsal hump bearing heavy spines; vesica spined. The female genitalia (Pl. 11, fig. 13) has the dorsal sclerite of the ductus bursae moderately long, and unlike all other species except *stretchii* with lateral projections towards the vulva, these projections in turn expanding around the sides to give the appearance in ventral view of a ventral sclerite which is incomplete at the mid-ventral line (compare fig. 12). This appearance is enhanced by the presence of a constriction at the point where the dorsal sclerite gives off the two lateral arms. There is no ventral sclerite in the sense that there is in other species of this genus except *stretchii*.

Expanse: 28-38 mm.

Dates: Mostly June and July but records from April to November.

Distribution: *adumbrata adumbrata*: California, Oregon, Washington and southern British Columbia; *saxea*: Arizona, Nevada, Utah, Colorado, Wyoming, Idaho, Montana, Manitoba and eastern California; *alleni*: Colorado, Manitoba, Ontario, New York (Adirondacks), Quebec and Maine.

Early stages: Unknown although Phipps originally described the larva of *occulta* under this name (see under *occulta*).

The author collected this species commonly on the more open slopes of the upper aspen belt (upper Canadian zone) in the La Sal Mountains, Utah (elevation 9,300-9,800 ft.) in July 1933. They were collected resting among the rocks on the ground during the daytime. Normally occurring with *divergens* in the west. Dr. Phipps collected one adult of *alleni* (determined by author) visiting Blueberry blossoms in Maine.

*stretchii* Behr

*Syneda stretchii* Behr. 1870. Trans. Amer. Ent. Soc., 3: 27.  
Type locality: Virginia City, Nevada (R. H. Stretch).  
Types: destroyed except 1 ♂ cotype (paratype) in Field Museum. There is also a male in the Amer. Mus. Nat. Hist. that was compared with the types in Behr's collection by Henry Edwards.

Figures: Maculation: Pl. 3, fig. 19. Also photographs of both sexes given by Barnes & McDunnough in Contrib. Nat. Hist. N. A. Lepid., vol. 2, part 1, pl. 8, figs. 19-20 (compared with type in Field Museum), and a photograph in Edwards' bound copy of Pacific Coast Lepidoptera (labeled "*howlandi*" presumably following the then currently accepted synonymy proposed by Grote). Genitalia: Male: Pl. 9, figs. 1-2; Female: Pl. 11, fig. 12.

Collar concolorous or almost so; fore wing with faint black basal line, t. a. line double, excurved to submedian fold (sometimes almost straight across cell), then strongly incurved to inner margin; median space of moderate width, usually with double brown median lines; reniform brown with some black scales, shaped as in *adumbrata* (not as in *howlandi*), defined basally by a light line and distally by white which is also streaked onto veins 3 and 4; t. p. line black, excurved and angled around cell as usual, sometimes virtually touching subterminal line at veins 3 and 4, curved back to base of reniform along or just below vein 3, then outwardly oblique to inner margin (sometimes slight excurvation in submedian fold) where it is close to the subterminal line; subterminal line angled in just below costa or straight, preceded near costa by some black dashes, incurved below cell and approximate to t. p. line at inner margin; terminal line a series of crescents. Hind wing salmon-orange, black markings moderate, the discal spot not connected to the postmedian band. Beneath a salmon-pink with the usual black markings rather faint and incomplete.

This rarity is a difficult species to separate until one gets to know it. From *howlandi* (of which Grote listed it as a synonym) it is best separated by the shape of the reniform and the course of the t. p. line from vein 3 to the base of the reniform and thence to inner margin. From *adumbrata*, to which it is most nearly related, it may usually be separated by the discal spot of the hind wing; rarely specimens of *adumbrata* show a fully separate spot also and they have to be separated either by the color of the hind wing and lower side or by the white in the postreniform area or best by the male genitalia.

Genitalia: The male genitalia (Pl. 9, figs. 1-2) have the left clasper bifurcated but the parts widely separated and the costal piece sometimes rudimentary (fig. 2), clasper on right harpé single, long and pointed; clavus of left side somewhat heavier than that on right and with longer basal lobes; sacculus somewhat reduced apically on left harpé; aedaeagus with a dorsal spined swelling that is not so distinctly a "hump" as in *adumbrata*. The female geni-

talia (Pl. 11, fig. 12) are inseparable from those of *adumbrata*; compare figures 12 and 13.

Expanse: 30–38 mm.

Distribution: Scattered records from California, Nevada and Utah.

*pulchra* Barnes & McDunnough

*Syneda pulchra* Barnes & McDunnough. 1918. Contrib. Nat. Hist. N. A. Lepid., 4: 121, pl. 19, fig. 4.

Type locality: Palm Springs, Riverside Co., California, in March. Type: 1 ♂, U. S. National Museum.

Figures: Maculation: Pl. 4, figs. 1–2. Also photograph of unique type in original description. Male genitalia: Pl. 8, figs. 9–10.

A seemingly very rare species genitally forming a connecting link between the *perplexa-adumbrata-stretchii* complex and the *howlandi-tejonica-mirifica* complex. The reduced discal spot and the color of the hind wing (vermilion), the contrasting median area of the fore wing and the white in the postreniform area make confusion possible only with *howlandi* and certain females of *tejonica* (and of course *mirifica* which has however spined fore tibiae). From these *pulchra* may be distinguished by the greatly reduced discal spot and usually by the color of the hind wing; by the narrow median area, and then sometimes by the subterminal line which is usually almost straight below the costa (this subterminal line character stressed in the original description is not good, partly because some specimens of *pulchra* show it angled in below costa, and partly because occasional specimens of *stretchii* and even *howlandi* have straight subterminal lines). The postmedian band of the hind wing of *pulchra* is broad at the costa, narrow throughout the rest of its course, in some interrupted at the middle. Doubtful cases should be checked by the male genitalia.

Genitalia: The male genitalia (Pl. 8, figs. 9–10) have the claspers of the left harpé bifurcated, the parts distinct and widely separated (2 specimens) or single due to lacking the costal piece (1 specimen); clasper on right harpé long and single; clavus as usual with long basal lobe which is three to four times as long as broad; sacculus with normal shelf-like projections basally, the distal half more or less reduced on the left harpé; aedaeagus with small patch of heavy spines on dorsal side near tip but no swollen area; vesica spined. As the single female available is badly rubbed and so possibly wrongly identified the genitalia are not figured. If the determination is correct this specimen would indicate that *pulchra* has a longer

dorsal sclerite and a narrower more band-like ventral sclerite than *howlandi* and *tejonica* have.

Expanse: 35–38 mm.

Dates: March and April.

Distribution: The author has seen only five specimens including the type: 2 males from Palm Springs, Riverside Co., California; 2 males from Jacumba, San Diego Co., California, and one female, determined with slight doubt, from San Andreas Canyon, Riverside Co., California.

*howlandi* Grote

*Syneda howlandi* Grote. 1864. Proc. Ent. Soc. Phila., 3: 533–534, pl. 6, fig. 7.

Type locality: "Colorado Territory" (J. Ridings). Type: ♀ Phila. Acad. Nat. Sci.

*Syneda exquisita* Hampson. 1926. Lepid. Phal. N. G. & Spec. Noct., p. 41–42.

Type locality: Denver, Colorado (Oslar). Type: 1 ♀, British Museum.

Figures: Maculation: Pl. 4, figs. 4–8. Also figure of *howlandi* in original description. The figure in Holland's Moth Book (Pl. 30, fig. 33) under this name seems wrongly labeled and certainly is not to be trusted for making identifications (see under *mirifica klotsi*). Genitalia: Male: Pl. 8, fig. 5; Female: Pl. 11, figs. 9–10.

Collar with two dark streaks through it; fore wing with t. a. line double, the outer line black, varying from evenly excurved to excurved in both discal and submedian folds; reniform outwardly more or less distinctly defined by white which also defines veins 3 and 4 in the postreniform area; t. p. line double, the inner line black, extending well beyond vein 3 (Cu<sub>1</sub>) and then curved or angled back to base of reniform, oblique and excurved below cell, well separated from subterminal line at inner margin; subterminal line usually distinctly angled in above vein 7, less often incurved, rarely straight; terminal area usually without a prominent darker patch at costa by apex; cilia faintly checkered. Hind wing usually red-orange, less often (most frequently in females) reddish or even vermilion, and in two specimens from Montana yellow; discal spot light but always present, not connected with postmedian band which is moderately broad and usually complete but sometimes interrupted at the middle of the wing. Beneath the hind wing a lighter orange, the black markings lighter than above.

There are four species that might be confused with *howlandi*, namely *mirifica*, *pulchra*, *stretchii* and *tejonica* (*perfecta*). From *mirifica* this species is easily separated by the absence of spines on the fore tibiae. From *pulchra* it is best separated by the markings of the hind wing and the narrow median space of the fore wing (see under *pulchra*). From *stretchii*, which is quite likely to be confused unless examined carefully, it is separated by the course of the t. p. line and the shape of the reniform (see under *stretchii*). And from *tejonica* this species is separated chiefly by the sexes being nearly alike. In *howlandi* the hind wing is usually a reddish-orange whereas *tejonica* is more red or pink (and white in the male), but some specimens of *howlandi*, particularly females, have the hind wing just as reddish as many *tejonica* females.

The unique female type of *exquisita* is simply a brightly marked female with a red hind wing whereas the type of *howlandi* is less contrasty and with less red on the hind wing. The two forms are inseparable when long series are at hand. However, the author believes that there is a valid and distinct race of *howlandi* in the northwest (Washington) but refrains from describing it as he has only one specimen and has seen only one other (see pl. 4, fig. 8).

The *howlandi-tejonica* (*perfecta*) complex has puzzled everyone for a long time and still continues to do so. The outstanding difference between typical *howlandi* and typical *tejonica* is that in the former the sexes are alike, in the latter the sexes different. In the two other cases in which such a sexual difference occurs in different regions (*graphica* and *hudsonica*) the forms are classed as races but this case is somewhat different aside from being much more complex. For one thing there are some slight differences between the male genitalia of typical *howlandi* from Colorado and of *tejonica* from Arizona and California, and a series of intermediates tend to occur in western Texas. One might therefore postulate two species with overlapping distribution which hybridize in the zone of mingling. But this too has some objections, one of which is that males quite similar to those from Colorado are sometimes taken in southern California. All types of intermediates are to be found, principally but not exclusively in western Texas. After studying hundreds of specimens from many localities the author's only conclusion is that this is a puzzle neither to be answered in the museums nor one to be settled by ordinary collecting. It would seem answerable only by the use of genetical methods correlated with accurate field data.

Genitalia: The male genitalia (Pl. 8, fig. 5) have the claspers single; clavus long, with moderate or long basal lobes; sacculus usually more or less reduced in distal half on left harpé; aedaeagus with very minute microtrichiae on membranous dorsal side near tip; vesica spined. The female genitalia (Pl. 11, figs. 9–10) have the dorsal sclerite on the ductus bursae moderate; the ventral sclerite a narrow band definitely produced medianly.

The author has studied and compared the male genitalia of over forty specimens of the *howlandi-tejonica* complex, including a picked set of twelve males from the large series in the Barnes Collection (U. S. National Museum). In comparison with *tejonica*, typical *howlandi* from Colorado and Montana tend to have the clasper of the right harpé longer, more tapering and less often bent or bulbous at the tip; the distal part of the sacculus of the left harpé less reduced and with more of a terminal prong; and the basal lobes of the clavus longer (3–4 times as long as broad in *howlandi*, 2–3 times as long as broad in *tejonica*). Intergradés, all types and degrees of which seem to occur, are found chiefly in specimens from western Texas.

Expense: 33–40 mm.

Dates: May, June, July and August.

Distribution: Colorado, Utah, Nevada, Nebraska, Montana, Washington (Yakima and Pateros), and some from Texas, northern New Mexico, northern Arizona and possibly California.

Early stages: Egg and larva: Dyar. Proc. U. S. Natl. Mus., 25: 382–384. 1902.

Foodplant: *Eriogonum*.

#### *tejonica* Behr

*Syneda tejonica* Behr. 1870. Trans. Amer. Ent. Soc., 3: 26.

Type locality: Ft. Tejon, California. Types: all destroyed, but there is one compared with type female in the Henry Edwards Collection at the Amer. Mus. Nat. Hist.

*Syneda perfecta* Henry Edwards. 1884. Papilio, 4: 46–47.

Type locality: Arizona. Type: 1 ♂, U. S. National Museum.

*Syneda decepta* Strecker. 1898. Lepid. Rhop. Heter., Suppl. 1, p. 11.

Type locality: Colorado (D. Bruce). Type: 1 ♂, Field Museum (Chicago).

*Syneda nigromarginata* Strecker. 1898. Lepid. Rhop. Heter., Suppl. 1, p. 11.

Type locality: Arizona (J. Doll). Type: 1 ♂, Field Museum (Chicago).



Figure: Maculation: Pl. 4, figs. 9-13. Also photographs given by Barnes & McDunnough in Contrib. Nat. Hist. N. A. Lepid., vol. 4, pl. 19, figs. 5-6, 1918, and a worthless photograph in Edwards' bound copy of Pacific Coast Lepidoptera. Male genitalia: Pl. 8, fig. 6.

Differs from other species except *howlandi* in the same way that that species does (except for the color of the hind wing of the males). From *howlandi* this species is separated by the sexual differences and in part by the locality. Also the fore wing is more contrasty, the white more distinct especially in the postreniform area, and the median and particularly the terminal areas more contrastingly bluish or bluish-grey (see under *howlandi*).

The males differ from the females in that the hind wing is more pink with white basally or the hind wing white with only a little pinkish flush in the distal half; beneath lighter, varying from white with a pink flush in the distal half to pure white. The female has the hind wing red-orange or crimson only somewhat lighter basally, same on under sides.

The name *tejonica* is based on Californian specimens in which the black markings of the undersides are light; *perfecta* is the scarcely distinct Texas form, to this author not seeming a valid race; the author has not personally seen Strecker's types but from the original descriptions and notes on the types, *nigromarginata* is the somewhat less common color form, not localized, which is distinguished by the broad black marginal bands on the undersides of both wings (see Pl. 4, fig. 11); and *decepta* is another color form with broad black bands below and distinguished from *nigromarginata* by the white hind wing with a yellow lunule at the middle of the termen of the hind wing. The type locality of *decepta* (Colorado, received from Bruce) seems peculiar and may be wrong or at least not what is today called Colorado.

The types of *tejonica* were all destroyed and the name unplaced for many years. Barnes & McDunnough (Contrib. Nat. Hist. N. A. Lepid., 4: 120-121. 1918) assigned it to its present place. This position is corroborated by a female of this species from Havilah, California, in the Henry Edwards Collection (Amer. Mus. Nat. Hist.) bearing a label in Edwards' handwriting "agrees with Behr's type. H. E." and a species label also in Edwards' handwriting "*Syneda tejonica* Behr." This specimen is the species to which Barnes & McDunnough decided the name must belong. Like all females the hind wings and undersides of this specimen are not white though they are lighter basally and could be called white more or less suffused with orange. (See Pl. 4, fig. 12.)

Genitalia: Pl. 8, fig. 6. See under *howlandi*.

Expanse: 35-42 mm., dwarfs rarely as small as 30 mm.

Dates: March, April, May, June and July.

Distribution: Texas, New Mexico, Arizona, southern Nevada, southern California and Lower California (Mexico). (Type of *decepta* labeled "Colorado.")

*mirifica* Henry Edwards

*Syneda mirifica* Henry Edwards. 1878. Pacific Coast Lepid., no. 29, p. 8.

Type locality: Virginia City, Nevada. Types: 2 ♀♀, Amer. Mus. Nat. Hist.

*mirifica* race *hastingsi* Henry Edwards

*Syneda hastingsi* Henry Edwards. 1878. Pacific Coast Lepid., no. 29, p. 8.

Type locality: Dalles, Oregon. Type: 1 ♀, Amer. Mus. Nat. Hist.

*Syneda hastingsi* var. *perpallida* Henry Edwards. 1881. Papilio, 1: 25-26.

Type locality: Summit Station, Sierra Nevada, California. Type: 1 ♀, Amer. Mus. Nat. Hist.

*mirifica* race *klotsi*, race nov. (see below)

Figures: Maculation: Pl. 4, figs. 14-18. Also colored figure of race *hastingsi* in National Geographic Magazine, 52 (1), pl. 12, fig. 6, 1927. Also the figure labeled "*howlandi*" in Holland's Moth Book (Pl. 30, fig. 33) looks certainly like this species and is probably one of the exceptionally contrasty specimens of *mirifica klotsi*. Photographs of types of *mirifica* and *hastingsi* in Edwards' bound copy of Pacific Coast Lepidoptera. Genitalia: Male: Pl. 9, figs. 7-8; Female: Pl. 11, figs. 1-5.

The most satisfactory way of separating this species from the preceding three species is by the spines at the apex of the fore tibiae. The male genitalia are usually distinct but vary in the direction of *howlandi*, sometimes puzzlingly so.

This species cannot be confused with any of the other species with spined fore tibiae. As for the races and the various names: *mirifica* is the southern and southwestern race with the maculation of the fore wing contrasty and the black markings of the hind wing light. The types of *mirifica* have the hind wing pinkish above, almost white at the base, and the undersides almost purely white (perhaps accen-

tuated by fading although the original description refers to the undersides as white). *Mirifica klotsi*, described below, is the eastern representative of the above, and is best distinguished from *mirifica mirifica* by the smaller size, the pink of the undersides of the hind wing, and the darker and less contrasty upper side of the fore wing (less white). *Mirifica hastingsi* is the race in the northwest in which the fore wing is less contrasty (like *klotsi* in this respect) and the hind wing and undersides with more black, the postmedial band being of almost uniform width throughout. The name *perpallida* is an individual variant of *hastingsi* in which the hind wing is yellow instead of reddish. There are two other specimens of *hastingsi* in the Henry Edwards collection (Amer. Mus. Nat. Hist.) from the lot that furnished the type of *perpallida*—they are more or less intermediate in color between the types of *perpallida* and *hastingsi* but nearer the latter. Also the author has a specimen of *mirifica klotsi* from Colorado with almost as nearly yellow a hind wing as the type of *perpallida*. There is no indication that *perpallida* is of racial status (as McDunnough places it in his new check list), particularly in view of the other two specimens from the same collection lot.

Genitalia: The male genitalia (Pl. 9, figs. 7–8) have the clasper of the left harpé bifurcated, the halves widely separated but in some specimens the costal piece is small or rudimentary or even absent (then resembling *howlandi*), the clasper of the right harpé single, variable in shape; clavus long with long basal lobes which are three to four times as long as broad; sacculus variable but in all slides studied with a definite terminal free prong on right harpé; aedaeagus with patch of small microtrichiae on the membranous dorsal side near the tip; vesica spined. The female genitalia (Pl. 11, figs. 1–5) have the dorsal sclerite of the ductus bursae moderately long; the ventral sclerite varying from a moderately thick band with median production (fig. 5) to a narrow sclerite (figs. 4, 3 & 1) to entirely absent (fig. 2).

Expanse: *mirifica*: 34–40 mm., usually over 36 mm.; *klotsi* & *hastingsi* 28–38 mm., usually 30–35 mm.

Dates: Mostly June and July but records from April to August.

Distribution: *mirifica mirifica*: California (Loma Linda, San Bernardino Co. and Hackstaff, Modoc Co.), Nevada (Reno and Virginia City) and Utah (Eureka and Dividend). Intermediates between *mirifica mirifica* and *mirifica klotsi*: Arizona (Dewey and Paradise). *mirifica klotsi*: Colorado, New Mexico, Kansas and Nebraska. *mirifica hastingsi*: northern California (Summit Station, Sierra Nevada), Oregon and Washington.

Early stages: egg and larva: Dyar. Proc. U. S. Natl. Mus., 25: 384-385. 1902. (Eggs from females caught at Denver, Colorado, accordingly race *klotsi*.)

Foodplant: *Eriogonum*.

*mirifica* race *klotsi*, race nov.

Figures: Maculation: Pl. 4, figs. 14-15. Female genitalia: Pl. 11, fig. 5.

Holotype male: Head, thorax and abdomen grey-brown; dark brown streaks through collar continuous with slightly lighter ones through patagia. Fore wing grey-brown, suffused with dark brown and grey scales, not contrastingly marked; basal line faint, double to middle of cell; t. a. line black, double, excurved with slight incurvation below cell and incurved below anal vein; median space grey with some brown and with two grey-brown median lines, the median area not contrasting strongly with the rest of the wing; reniform with light basal line followed by black line, filled with brown and with somewhat irregular diffuse black line outwardly, defined outwardly by white which extends along veins 3 and 4; t. p. line double, inner line black, following usual course, excurved around cell, angled out at vein 6 and at veins 3 and 4 where it is faint, incurved to base of reniform along and just below vein 3, slightly excurved in submedian fold and below anal vein; subterminal line light, defined by preceding dark ground and succeeding darker wavy line, angled in just below costa and incurved in discal and submedian folds; terminal area with dark patch at costa; faint wavy terminal line; cilia dark except at apex, with faint line through them. Hind wing salmon-red with usual discal spot; postmedian band interrupted at vein 4; terminal band separate from postmedian band at costa, narrowed at vein 5, ending at vein 2; cilia light smoky, darker at middle of termen. Beneath fore wing light with faint rosy flush; black markings as in *mirifica mirifica*; hind wing salmon-pink except along costa, veins lighter, discal spot and bands repeated from above but lighter.

Allotype female: Very nearly the same.

Other types: Similar with some variation in the degree of curving of the lines, in the shade of color of the hind wing which varies from salmon-red to faint pink and in one specimen is almost yellow, in the development of the postmedian band of the hind wing which in some specimens is complete (though narrower at middle), in others

interrupted across the cubital veins, and the contrastiness of the fore wing, most specimens having little contrast but a few being quite contrasty though none as much so as *mirifica mirifica*.

Holotype male: Fountain Valley School, Colorado Springs, Colorado, elevation 6,000 ft. (upper limit of upper Sonoran; cultivated area in otherwise arid plains), June 12, 1933. Collected by Dr. Alexander B. Klots.

Allotype female: Same data as holotype.

Paratypes: 2 ♀, same data as holotype; 1 ♀, same locality as holotype but taken July 7, 1935 (A. B. Klots); 1 ♂, Fort Collins, Colorado, June 14, 1920 (ex collection Colorado Agric. College); 1 ♀, Sedalia, Colorado, June 21, 1901 (H. G. Dyar); 3 ♂, 1 ♀, Denver, Colorado, May 28, 1901 (H. G. Dyar); 1 ♂, 1 ♀, Denver, Colorado, June 13, 1901 (H. G. Dyar); 1 ♀, Denver, Colorado, June 17, 1901 (H. G. Dyar); 1 ♂, Denver, Colorado, June 20, 1901 (H. G. Dyar); 1 ♂, 2 ♀, Denver, Colorado, no date; 1 ♀, Golden, Colorado, Aug.-Sept. (Rummel); 2 ♂, 2 ♀, Platte Cañon, Colorado, May (Oslar); 2 ♂, 13 ♀, Colorado (Bruce); 1 ♂, 4 ♀, Colorado (various sources but no further data); 1 ♀, Garden City, Kansas, June 10, 1935 (H. B. Walkden); 1 ♂, Deming, New Mexico; 1 ♂, Mesilla, New Mexico.

Location of types: Holotype, allotype and most of the paratypes in the collection of the U. S. National Museum; other paratypes in the collections of the American Museum of Natural History, British Museum, Canadian National Collection, Los Angeles Museum, Cornell University and of the author.

Distribution: Colorado, Nebraska, Kansas and New Mexico. Intermediates to *mirifica mirifica* in eastern Arizona.

This eastern or Rocky Mountain race is readily distinguished from race *hastingsi*, which it resembles in coloration of the fore wing, by the light postmedian band of the hind wing which becomes greatly narrowed or interrupted at the center. From *mirifica mirifica*, with which it intergrades in eastern Arizona, it is separated by the salmon-pink of the undersides of the hind wings and the more uniformly colored fore wing. The type of *mirifica mirifica* has the undersurfaces of the hind wing white or nearly so and the basal half of the upper surfaces of the hind wing white and the distal half with only a pink flush, but many specimens of *mirifica mirifica* have the entire upper surface of the hind wing uniformly reddish and only slightly lighter basally; accordingly this character is not adequate for the separation of race *klotsi*. Occasional specimens of *mirifica mirifica* also show a pinkish tinge to the undersides of the hind wings but always have very contrasty fore wings. Also race *klotsi* averages smaller than *mirifica*.

*eubapta* Hampson

*Drasteria eubapta* Hampson. 1926. Lepid. Phal. N. G. & Spec. Noct., p. 38-39.

Type locality: Yuma, Arizona (Clemence). Types: 1 ♂, 1 ♀, British Museum.

Figures: Maculation: Pl. 4, fig. 19. Genitalia: Male: Pl. 9, figs. 5-6; Female: Pl. 11, fig. 6.

A very rare species which may be distinguished from the other species with spined fore tibiae by the pure white hind wing and undersides, and by the fuscous postmedian band of the hind wing which extends to the termen at the costal margin and is connected with the faint discal spot and contrasts with the black spot at the termen between veins 2 and 4 ( $M_3$  and  $Cu_2$ ). The cilia of the fore wing are also distinctly checkered (white and rufous). A full description of the maculation is given by Hampson.

Genitalia: The male genitalia (Pl. 9, figs. 5-6) are not clearly separable from slides of the male genitalia of *mirifica* (*q. v.*). The female genitalia (Pl. 11, fig. 6) also are not separable from those of *mirifica* (*q. v.*).

Expanse: 30-38 mm.

Distribution: There are only nine specimens (3 ♂♂, 6 ♀♀) known. The author has studied five of these (2 ♂♂, 3 ♀♀). There are 2 ♂♂ and 3 ♀♀ collected by Clemence at Yuma, Arizona, April, 1910, one pair of which furnished Hampson's types, the other three specimens now being in the Canadian National Collection (ex Dod Collection); and 1 ♂ and 3 ♀♀ collected by Willett in the Imperial Valley, Imperial Co., California, March 10, 1932 (now in the collection of the Los Angeles Museum).

*graphica* Hübner

*Drasteria grafica* Hübner. 1808. Erste Zutraege Exot. Schm., p. 3 (non deser., cites figs. 11 & 12 not yet published); 1809. Zweite Zutr. Exot. Schm., figs. 11 & 12 (non. nom.); 1818. Zweite Zutr. Exot. Schm., 1: 18.

Type locality: Georgia. Types: lost but figured.

*Euclidia capiticola* Walker. 1858. Cat. Br. Mus., Heter., 14: 1461-1462.

Type locality: East Florida. Type: British Museum.

*Syneda grafica* var. *media* Morrison. 1875. Proc. Boston Soc. Nat. Hist., 18: 125.

Type locality: Florida. Type: Meyer Coll. (unknown to present author).

*Syneda faceta* Henry Edwards. 1881. *Papilio*, 1: 119.

Type locality: Indian River, Florida. Type: 1 ♀, Amer. Mus. Nat. Hist. (Not ♂ as given in original description and catalogue of American Museum types.)

*graphica* race *atlantica* Barnes & McDunnough

*Drasteria graphica* race *atlantica* Barnes & McDunnough. 1918.

Contrib. Nat. Hist. N. A. Lepid., 4: 118-119, pl. 19, figs. 1-2.

Type locality: Rock Beach, L. I., N. Y. Types: ♂ & ♀, U. S. National Museum.

Figures: Maculation: Pl. 5, figs. 1-3. Also colored figure of male in Holland's Moth Book (Pl. 30, fig. 30), and in original description of *graphica*. Photographs given by Barnes & McDunnough, Contrib. Nat. Hist. N. A. Lepid., vol. 4, pl. 19, figs. 1-2, 1918. Colored figure of larva (after Abbott MS) by Guenée, Sp. Gen. Noct., vol. 3, pl. 2, fig. 10, 1852. Genitalia: Both sexes figured in generic revision (Richards, 1936c).

The male of the nymotypical form and both sexes of *atlantica* may be readily recognized by Holland's colored figure, and all the forms by the photographs given by Barnes & McDunnough and herein. Southern females have the markings of the fore wings greatly reduced or obscured; they may be separated from all other nearly immaculate forms by the subterminal line which is represented by a series of light points on the veins and by the hind wing both above and below. Hind wing yellow and black; in some southern specimens reddish and black.

This species differs from its nearest congener, *occulta* Hy. Edw., by the subterminal line being a series of light, more or less connected spots (*graphica graphica*) or a light line defined by the preceding dark ground color and by a succeeding faint or distinct brown or greyish line (*graphica atlantica*), but some specimens of *atlantica* have this outer line nearly or quite obsolete.

Genitalia: The male genitalia (figured in generic revision, Richards, 1936c) have short harpés which are oblique at the apex; claspers single; clavus moderate with moderate basal lobes; sacculus well developed; aedaeagus without external spines; vesica spined. The female genitalia (see generic revision for figure) have the dorsal sclerite of the ductus bursae long; the ventral sclerite long and broad, with a slight median projection.

Expanse: 30–36 mm.

Dates: March to May in south; April to June and August in north.

Distribution: *graphica graphica*: southern Atlantic states, specimens seen from Florida, Georgia and North Carolina. *graphica atlantica*: northern Atlantic states, specimens seen from Massachusetts, Long Island (New York), Staten Island (New York) and New Jersey,

Early stages: Colored figure of larva (after Abbott MS) given by Guenée (Sp. Gen. Noct., vol. 3, p. 72, pl. 2, fig. 10. 1852). Larva of *occulta* erroneously described as of this species by Phipps and by Crumb (see under *occulta*).

This species is found mostly among the coastal sand dunes and flying out over the adjacent salt marshes.

*occulta* Henry Edwards

*Syneda occulta* Henry Edwards. 1881. Papilio, 1: 118–119.

Type locality: Recorded as Texas, see below. Type: 1 ♀, U. S. National Museum.

Figures: Maculation: Pl. 5, fig. 4. Also colored figure given by Phipps, Maine Agric. Expt. Sta., Bull. 356, 1930; and photograph by Barnes & McDunnough, Contrib. Nat. Hist. N. A. Lepid., vol. 4, pl. 19, fig. 3, 1918.

Differs from *graphica atlantica* by the more even appearance and by the subterminal line which is defined *only* by the contrast of the preceding dark ground color with the succeeding light terminal area. There seem to be no appreciable constant differences between the male and female genitalia of *occulta* and those of *graphica*, but the maculation is sufficiently different to warrant continuing to class them as distinct species.

Expanse: 32–38 mm.

Dates: May in New Jersey. June in New York and Maine.

Distribution: Maine, Massachusetts, New York (Long Island), New Jersey and Pennsylvania. The unique type of this species is labeled "Texas" (collected by J. Boll) but the present author questions this locality label as the many specimens he has studied have all been collected from Maine to Pennsylvania.

Early stages: Larva described first as "*alleni*," then as "*graphica*" but Dr. Phipps loaned the author his entire bred series and they are all typical *occulta* as also is the colored figure he published. However, as implied above, *graphica* and *occulta* may possibly not be distinct species although they appear to be. For description of



larva see: Phipps, C. R., Journ. Econ. Ent., 22: 137-140, 1929 (under name of "*alleni*"); Phipps, C. R., Bull. 356, Maine Agric. Expt. Sta., pp. 176-178, 1930 (under name of "*graphica*"); and Crumb, S. E., Bull. Brook. Ent. Soc., 27: 80, 1932 (larvae from Phipps; under name of "*graphica*").

Foodplant: Blueberry, a minor pest in Maine (Phipps).

*ingeniculata* Morrison

*Syneda ingeniculata* Morrison. 1875. Proc. Acad. Nat. Sci. Phila., 27: 435.

Type locality: Dallas, Texas. Type: Museum Comparative Zoology (Harvard).

Figures: Maculation: Pl. 5, figs. 5-6. Also photograph by Barnes & McDunnough in Contrib. Nat. Hist. N. A. Lepid., vol. 2, part 1, pl. 5, fig. 1, 1913. Male genitalia: Pl. 9, fig. 4.

Another rare and distinctive species. Even without looking for the spines on the fore tibiae it cannot be confused with anything else. Thorax and ground color of the fore wings bluish-grey; collar with two dark streaks; basal line double; t. a. line double, oblique to below cell then incurved; median area broad, not strongly contrasting; reniform defined only by preceding black basal line and black spot in center of outer edge; postreniform area small and concolorous; t. p. line not strongly angled out on veins 3, 4 and 6; subterminal line an irregular faint light line; terminal line reduced to a series of points between the veins; cilia and terminal area concolorous. Hind wing salmon-pink with the usual black markings.

Genitalia: The male genitalia (Pl. 9, fig. 4) have long rounded harpes; claspers single (in some slides with faint indication of what may be rudimentary costal piece to left clasper); clavus long with long basal lobes; sacculus with moderate shelf-like projection, on left harpé this is separate from the narrow marginal band-like distal part of the sacculus which lacks a terminal prong. The female genitalia are similar to those of *graphica* and *occulta*.

Expanse: 38-42 mm.

Distribution: Texas and Kansas.

*Bulia* Walker (= *Cirrhobolina* Grote)

A full revision of this genus with keys, descriptions, references and figures of genitalia has already been published (Richards, 1936b). Photographs and a new race are given herein.

*confirmans* Walker

Figures: Maculation: Pl. 5, figs. 7-9.

Distribution: Cuba, Jamaica, Haiti, San Domingo, Marguerite Island, British Guiana, Costa Rica and Venezuela.

*similaris* Richards

*Bulia similaris* Richards. 1936. Ann. Ent. Soc., Amer., 29: 433-434, figs. 8-9.

Type locality: San Benito, Texas. Types: ♂ & ♀, U. S. National Museum.

Figures: Maculation: Pl. 5, figs. 13-14.

Distribution: Texas and Baboquivari Mountains, Arizona.

At the time of description of this species the author noted that the specimens from California deserts were of distinct appearance and, to quote, were "perhaps worthy of a racial name." Since then a considerable number of additional specimens have been seen from other localities in the southwest, and these lead the author to propose a separate racial name for the specimens from the deserts of western Arizona, southern California and Lower California (Mexico).

*similaris* race **californica**, race nov.

This race (Pl. 5, fig. 14) is distinguished from the dark nymotypical race from Texas by the lighter color and slightly larger size. In the males the ground color of the fore wings is light cream (instead of dark brown) with black or dark brown maculation and some sprinkling of dark scales. In the female the fore wing is much more mottled in appearance; the ground color usually a light cream; the markings faint or obsolete; reniform distinct, sometimes filled in solidly with fuscous and then being a contrasting dark blotch on a light wing; frequently with light brown between reniform and t. p. line, below reniform and in terminal area (similar to variant *vulpina* of *deducta*).

This race is not as well differentiated in the male sex as in the female; accordingly a female has been selected as holotype.

Holotype female: Jacumba, San Diego Co., California, April 28, 1935 (G. P. Engelhardt); in collection U. S. National Museum.

Allotype male: Loma Linda, San Bernardino Co., California, April 16-23. (ex Barnes collection, in collection of American Museum of Natural History.)

Paratypes: The Californian specimens made paratypes of *similaris*, viz.: 7 ♂♂, 5 ♀♀, Loma Linda, San Bernardino Co., California, April and May; 1 ♂, 1 ♀, Palm Springs, Riverside Co., California,

April 16-23; 1 ♂, Sheep Creek, San Gabriel Mountains, California, April 25, 1931; and 1 ♀, San Diego Co., California, April.

Additional paratypes: 2 ♀♀, Indian Wells, Coachella Valley, California, April 26, 1938 (Miss P. W. Work); 2 ♀♀, same locality, April 29, 1938; 2 ♀♀, Cathedral City, Riverside Co., California, late April, 1938 (Miss P. W. Work); 1 ♀, Arizona; 2 ♂♂, 1 ♀, "Rosarito," Lower California, Mexico; 2 ♀♀, "Punta Prieta," Lower California, Mexico; 2 ♂♂, Jacumba, San Diego Co., California, April 28, 1935 (G. P. Engelhardt).

The author has also seen a dozen or so more specimens of this race in various collections.

Paratypes distributed to the U. S. National Museum, American Museum of Natural History, British Museum, Los Angeles Museum, Canadian National Collection, Cornell University Collection, and the collections of Mrs. V. H. Dos Passos and the author.

*deducta* Morrison

Figures: Maculation: Pl. 5, figs. 10-12. Also colored figures in Holland's Moth Book (Pl. 30, fig. 36) and in the National Geographic Magazine, vol. 52, no. 1, pl. 12, fig. 3, 1937.

Distribution: Arkansas, Colorado, Texas, New Mexico, Utah, Arizona, California and Mexico.

Foodplant: Mesquite (*Prosopis* sp.), bred by S. E. Crumb.

*Boryzops* Richards

*purissima* Dyar

*Iscadia purissima* Dyar. 1911. Proc. U. S. Natl. Mus., 38: 252.

Type locality: Misantla, State of Vera Cruz, Mexico. Type: 1 ♀, U. S. Natl. Mus.

Figures: Maculation: Pl. 5, fig. 20. Also colored figure of type given by Hampson, Cat. Lepid. Phal., vol. 11, pl. 186, fig. 15, 1912. Male genitalia: figured in generic revision (Richards, 1936c).

Since recording this species from a single specimen from Florida City, Florida (Richards, 1937), the author has seen another specimen from the same locality (in collection of Mr. Otto Buchholz) and has heard from Dr. F. M. Jones that he and Dr. Blatchley caught three specimens at the Royal Palm State Park, Florida, at bait in March and April.

The photograph published herein was kindly furnished by Dr. Jones.

*Lois* Dyar

*lorina* Druce

*Polia* (?) *lorina* Druce. 1890. Proc. Zool. Soc., p. 515.

Type locality: Presidio de Mazatlan, Mexico. Type: British Museum.

*Catocala juanita* Schaus. 1894. Trans. Amer. Ent. Soc., 21: 241.

Type locality: Paso de San Juan, Mexico. Type: U. S. National Museum.

Figures: Maculation: Pl. 5, fig. 19. Also colored figure given by Druce in Biol. Centr. Amer., Heterocera, vol. 2, pl. 94, fig. 15.

The synonymy is from Barnes & Benjamin (Proc. Ent. Soc. Wash., 28: 20. 1926). These authors doubtfully recorded this species from Florida. A single specimen has subsequently been captured at bait by Dr. W. S. Blatchley at the Royal Palm State Park, Florida, on April 12, 1927.

The photograph published herein was kindly furnished by Dr. Jones, who also furnished the author with the above record.

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## PLATE I

(All figures on this plate reduced to about seven-eighths natural size)

- Fig. 1. *Phoberia atomaris* Hbn. ♂. Specimen from Omaha, Nebraska, March 23, 1918 (R. A. Leussler).
- Fig. 2. *Litocala sexsignata* Harv. ♂. (This specimen the one of Edwards' cotypes that bears the type label of var. *deserta*.) Normally this species has less contrasty median and postreniform areas. Specimen from Arizona (in collection Amer. Mus. Nat. Hist.).
- Fig. 3. *Cissusa (Cissusa) spadix* Cramer. ♀. Specimen from Mississippi (Amer. Mus. Nat. Hist.).
- Fig. 4. *Cissusa (Cissusa) mucronata* Grote. ♀, compared with type. Specimen from McMinnville, Oregon, March 31, 1930.
- Fig. 5. *Cissusa (Cissusa) indiscreta* Hy. Edw. ♀, compared with type (t. a. and t. p. lines slightly heavier in type). Specimen from Paso Robles, San Luis Obispo Co., California, 3-5-38 (V. L. Clemence).
- Fig. 6. *Cissusa (Ulosyneda) valens* Hy. Edw. ♂. Females have the lines faint and with little or no suffusion around them. Specimen from Colorado, March.
- Fig. 7. *Melipotis (Lyncestis) acontioides* Gn. ♀. Specimen from Nevada, Iowa, May 29, 1915.
- Fig. 8. *Melipotis (Melipotis) agrotoides* Wlk. ♀. Cilia of hind wing all white, not visible in this photograph. Specimen from Brownsville, Texas, March 11 (Geo. Dorner).
- Fig. 9. *Melipotis (Melipotis) agrotoides* Wlk. ♂. Cilia of hind wing all white, not visible in this photograph. Specimen from San Benito, Texas, May 1-7.
- Fig. 10. *Melipotis (Melipotis) novanda* Gn. ♂. Cilia of hind wing mostly white, not visible in this photograph. Specimen from Hereford, Arizona, Sept. 22 (Barnes Collection).
- Fig. 11. *Melipotis (Melipotis) novanda* Gn. ♀. Cilia of hind wing mostly white, not visible in this photograph. Specimen from Baboquivari Mtns., Pima Co., Arizona, Sept. 15-30, 1923 (O. C. Poling, in Barnes Collection).
- Fig. 12. *Melipotis (Melipotis) contorta* Gn. ♂. White cilia not visible. Specimen from Indian River, Florida (ex Slosson Collection).
- Fig. 13. *Melipotis (Melipotis) contorta* Gn. ♀. White cilia not visible. Specimen from Biscayne Bay, Florida (ex Slosson Collection).



- Fig. 14. *Melipotis (Melipotis) prolata* Wlk. ♂. An excellent photograph. Females slightly larger and even more solidly black and immaculate. Specimen from Florida (ex Slosson Collection).
- Fig. 15. *Melipotis (Melipotis) januaris* Gn. ♂. Great variation in amount of contrast and strength of markings. Specimen from Florida City, Florida, July 20, 1934 (Mrs. L. E. Forsyth).
- Fig. 16. *Melipotis (Melipotis) januaris* Gn. ♀. Very variable (see text). Specimen from Miami, Florida, July 18, 1934 (Mrs. L. E. Forsyth).
- Fig. 17. *Melipotis (Melipotis) famelica* Gn. ♀. The characteristic green scales in the reniform naturally do not show. Specimen from Florida City, Florida, March 17, 1934 (Mrs. L. E. Forsyth).
- Fig. 18. *Melipotis (Melipotis) famelica* Gn. ♂. Specimen from Royal Palm State Park, Florida (photograph by courtesy of Dr. F. M. Jones).
- Fig. 19. *Melipotis (Melipotis) jucunda* Hbn. ♂. Technically this would be race *hadeniformis* though probably not same color form. Considerable variation but t. p. line always as here. Specimen from Olinda, California, June 24, 1933 (E. Walter).
- Fig. 20. *Melipotis (Melipotis) jucunda* Hbn. ♀. (This specimen is the unique type of "*Cirrhobolina tetrica* Hy. Edw.") Some females more maculate; t. p. line as in male.
- Fig. 21. *Melipotis (Melipotis) indomita* Wlk. ♂. Photograph too dark but does show maculation except interruption of t. p. line on veins 3, 4 and 6. Specimen from San Antonio, Texas, July 5, 1928.
- Fig. 22. *Melipotis (Melipotis) indomita* Wlk. ♀. Most specimens somewhat lighter. Specimen from San Antonio, Texas, June 10, 1933 (G. P. Engelhardt).
- Fig. 23. *Melipotis (Melipotis) fasciolaris* Hbn. ♂. Specimen from Jalapa, Mexico.
- Fig. 24. *Melipotis (Melipotis) fasciolaris* Hbn. ♀. Note t. a. line barely visible; the contrasting line is the medial line (compare ♂). Specimen from Orizaba, Vera Cruz, Mexico, June (Kearfott Collection, Amer. Mus. Natl. Hist.).
- Fig. 25. *Melipotis (Melipotis) cellaris* Gn. ♂. Sexes alike. Specimen from Brownsville, Texas, 2-11 (Geo. Dorner).



- Fig. 26. *Melipotis (Melipotis) perpendicularis* Gn. ♂. Unusually small specimen, also median area frequently broader. Specimen from Royal Palm State Park, Florida (photograph by courtesy of Dr. F. M. Jones).
- Fig. 27. *Melipotis (Melipotis) perpendicularis* Gn. ♀. A large, strongly maculate specimen (similar to drawing of type of *stygialis* Grote). Specimen from Hereford, Arizona (Barnes Collection).
- Fig. 28. *Melipotis (Melipotis) perpendicularis* Gn. ♀. (This specimen the type of *brunnearis* Gn., British Museum.) Shows type of immaculate maculation of this species. (Photograph by courtesy of Mr. W. H. T. Tams.)
- Fig. 29. *Melipotis (Melipotis) nigrobasis* Gn. ♂. Note subterminal line defined by only preceding black dashes near costa. Specimen from Brownsville, Texas, 2-11 (Geo. Dorner, in Barnes Collection).
- Fig. 30. *Melipotis (Melipotis) nigrobasis* Gn. ♀. Specimen from San Benito, Texas, Aug. 1-7 (Barnes Collection).
- Fig. 31. *Panula inconstans* Gn. ♂. Upper side on right, under side of same on left. Note solid brown hind wing and undersides. Female with markings light or obsolescent. Specimen from Pétionville, Haiti (O. Fulda).
- Fig. 32. *Forsebia perlaeta* Hy. Edw. ♀. This specimen light but some have subterminal and terminal areas dark (compare fig. 33). Specimen from Bill Williams Fork, Arizona, August (F. H. Snow).
- Fig. 33. *Forsebia parlaeta* Hy. Edw. ♂. Upper side on right, under side of same on left. Species varies from light grey to quite dark but never immaculate in male; median area contrastingly ochreous; hind wing white. Specimen from Wenden, Yuma Co., Arizona, July 5-13.
- Fig. 34. *Asyneda mendozina* Hmps. ♂, holotype (British Museum). The female of this species is nearly immaculate. (Photograph by courtesy of Mr. W. H. T. Tams.)
- Fig. 35. *Ianius mosca* Dyar ♀. Note small white orbicular spot. Sexes alike. Specimen from Alpine, Texas, Aug. 1-6, 1926 (O. C. Poling, in Barnes Collection).

PLATE II

(All figures on this plate natural size)

- Fig. 1. *Drasteria (Synedoida) scrupulosa* Hy. Edw. ♀, cotype (Amer. Mus. Nat. Hist.). Upper side on right, under side of same on left.
- Fig. 2. *Drasteria (Synedoida) inepta* Hy. Edw. ♀, cotype (Amer. Mus. Nat. Hist.). Upper side on right, under side of same on left (photograph of under side printed darker than upper side). Specimen from "Southern Colorado."
- Fig. 3. *Drasteria (Synedoida) inepta* Hy. Edw. ♀. (This specimen a cotype of *morbosa* Hy. Edw.) Specimen from "Southern Colorado."
- Fig. 4. *Drasteria (Synedoida) inepta* Hy. Edw. ♀. (This specimen the holotype of *violescens* Hmps., British Museum.) (Photograph by courtesy of Mr. W. H. T. Tams.)
- Fig. 5. *Drasteria (Synedoida) sabulosa* Hy. Edw. ♀, cotype (labeled "Type 2") (Amer. Mus. Nat. Hist.). A dark print; the specimen is grey, not brown.
- Fig. 6. Undersides of preceding (figure 5).
- Fig. 7. *Drasteria (Synedoida) sabulosa abrupta* B. & McD. ♀, compared with types. Upper side on left, under side of same on right. Specimen from "Arizona, 1923."
- Fig. 8. *Drasteria (Synedoida) nichollae* Hmps. ♀, holotype British Museum (photograph by courtesy of Mr. W. H. T. Tams).
- Fig. 9. *Drasteria (Synedoida) nichollae garthi*, race nov. ♂, holotype (see description).
- Fig. 10. *Drasteria (Synedoida) nichollae garthi*, race nov. ♀, allotype. Print rather poor, see description.
- Fig. 11. *Drasteria (Synedoida) pallescens* G. & R. ♂. Upper side on right, under side of same on left. Thorax and base of fore wing pinkish-grey; hind wing black and white. Specimen from Jacumba, San Diego Co., California, April 28, 1933 (G. P. Engelhardt).
- Fig. 12. *Drasteria (Synedoida) pallescens* G. & R. ♀. Upper side on right, under side of same on left. Specimen from Globe, Arizona, July 6, 1935 (Parker).
- Fig. 13. *Drasteria (Synedoida) fumosa brunneifasciata* B. & McD. ♀, compared with types. Upper side on left, under side



of same on right. Specimen from Mt. Lowe, California, Aug. 1, 1924.

- Fig. 14. *Drasteria (Synedoida) biformata* Hy. Edw. ♀, cotype (Amer. Mus. Nat. Hist.). Specimen somewhat rubbed as can be seen particularly near apex of fore wing. Upper side on left, under side of same on right. Lighting from behind causes maculation of upper side to show faintly on lower view.
- Fig. 15. *Drasteria (Synedoida) ochracea* Behr. ♀. Upper side on right, under side of same on left. Specimen from Wallace, Idaho, May 16, 1930 (O. Huelleman).
- Fig. 16. *Drasteria (Synedoida) ochracea* Behr. ♂. Hind wing of this specimen visibly torn at center. Specimen from Globe, Arizona.

PLATE III

(All figures on this plate natural size)

- Fig. 1. *Drasteria (Synedoida) divergens* Behr. ♂. Upper side on right, under side of same on left. Hind wing yellow and black. Specimen from Wallace, Idaho, Aug. 6, 1931 (O. Huelleman). (Compare Pl. 2, figs. 7 and 13.)
- Fig. 2. *Drasteria (Synedoida) divergens* form *socia* Behr. ♂. Hind wing yellowish with pink cast. Specimen from Los Angeles Co., California, Sept. 7, 1930 (J. A. Comstock).
- Fig. 3. *Drasteria (Drasteria) petricola petricola* Wlk. ♂. Upper side on right, under side of same on left. Note black on veins in terminal area on under sides. Specimen from La Sal Mtns., Utah, July 20, 1936 (A. B. Klots).
- Fig. 4. *Drasteria (Drasteria) petricola athabasca* form *crockeri* B. & Benj. ♀. Upper side on right, under side of same on left. Specimen from Beulah, Manitoba.
- Fig. 5. *Drasteria (Drasteria) hudsonica hudsonica* G. & R. ♂, type (Phila. Acad. Nat. Sci.). Upper side on right, under side of same on left. (Photograph by courtesy of Mr. J. W. Cadbury.)
- Fig. 6. *Drasteria (Drasteria) hudsonica* race (?) *seposita* Hy. Edw. ♀, cotype (labeled "Type 2," Amer. Mus. Nat. Hist.). The brown median shade line scarcely shows here.



- Fig. 7. *Drasteria (Drasteria) hudsonica* race. ♀. This is the specimen referred to in the text as probably representing *nubicola* Behr and *maculosa* Behr (see text).
- Fig. 8. Underside of preceding (fig. 7).
- Fig. 9. *Drasteria (Drasteria) hudsonica heathi* B. & McD. ♂. (This specimen the holotype of *pedionis* Hmps., British Museum.) (Photograph by courtesy of Mr. W. H. T. Tams.)
- Fig. 10. *Drasteria (Drasteria) hudsonica heathi* var. ♂. A large variant of the plains race. Upper side on right, under side of same on left. Specimen from Clear Lake, Cherry Co., Nebraska, July 25, 1911 (F. H. Shoemaker).
- Fig. 11. *Drasteria (Drasteria) hudsonica heathi* B. & McD. ♀. Specimen from Hebron, North Dakota, Aug. 12, 1930.
- Fig. 12. *Drasteria (Synedoida) edwardsi* Behr. ♂. Upper side on left, under side of same on right. Specimen from Menlo Park, California, May 24, 1932 (Kusche).
- Fig. 13. *Drasteria (Drasteria) perplexa* Hy. Edw. ♂. Upper side on right, under side of same on left. A lightly colored specimen from Paonia, Colorado, 1-5-1927.
- Fig. 14. *Drasteria (Drasteria) perplexa* Hy. Edw. ♂. Upper side on right, under side of same on left. A dark specimen from Paonia, Colorado, 6-19-1925.
- Fig. 15. *Drasteria (Drasteria) adumbrata adumbrata* Behr. ♂. Upper side on right, under side of same on left. Hind wing yellow and black. Specimen from Deerpark, Placer Co., California, July 13, 1909 (E. J. Newcomer).
- Fig. 16. *Drasteria (Drasteria) adumbrata alleni* Grote. ♂. Upper side on left, under side of same on right. Specimen from Mt. Katahdin, Maine, June 29, 1938 (A. B. Klots).
- Fig. 17. *Drasteria (Drasteria) adumbrata saxea* Hy. Edw. ♀, co-type (Amer. Mus. Nat. Hist.). Specimen from Colorado.
- Fig. 18. *Drasteria (Drasteria) adumbrata saxea* Hy. Edw. ♂. Contrasty, light specimen from vicinity of Warner Ranger Station, La Sal Mtns., Utah, elev. 9200 ft., July 8, 1933 (A. G. Richards, Jr.).
- Fig. 19. *Drasteria (Drasteria) stretchii* Behr. ♂. (This specimen labeled "Agrees with Behr's type, Henry Edwards." Amer. Mus. Nat. Hist.). Upper side on right, under side of same on left. Specimen from Nevada (Edwards' Collection number 14959).

## PLATE IV

(All figures on this plate natural size)

- Fig. 1. *Drasteria (Drasteria) pulchra* B. & McD. ♂, compared with type. The vermilion hind wing photographed white in this light print. Specimen from Jacumba, San Diego Co., California, April 28, 1935 (G. P. Engelhardt).
- Fig. 2. Underside of preceding (fig. 1) printed quite dark to bring out the faint discal spot.
- Fig. 3. *Drasteria (Aleucanitis?) grandirena* Haw. ♀. Hind wing and undersides black and white. Upper side on right, under side of same on left. Specimen from Big Indian Valley, Catskill Mtns., N. Y., July 28, 1913 (R. F. Pearsall).
- Fig. 4. *Drasteria (Drasteria) howlandi* Grote. ♀. A light print of the normal form; hind wing reddish-orange. Specimen from Fountain Valley School, Colorado Springs, Colorado, July 20, 1933 (L. E. Chadwick).
- Fig. 5. *Drasteria (Drasteria) howlandi* Grote. ♀. (This specimen the holotype of *exquisita* Hmps., British Museum.) (Photograph by courtesy of Mr. W. H. T. Tams.)
- Fig. 6. *Drasteria (Drasteria) howlandi* Grote. ♂. Upper side on right, under side of same on left. Hind wing almost yellow in this specimen. Specimen from Miles City, Montana, July 27, 1932.
- Fig. 7. *Drasteria (Drasteria) howlandi* var. ♀. A contrasty specimen, the color values good in this photograph (compare fig. 5). Upper side on right, under side of same on left. Specimen from Colorado (Amer. Mus. Nat. Hist.).
- Fig. 8. *Drasteria (Drasteria) howlandi* race. ♀. Upper side on left, under side of same on right. Specimen from Pateros, Washington, April 21, 1930 (see text).
- Fig. 9. *Drasteria (Drasteria) tejonica* Behr. ♂. Upper side on left, under side of same on right. Specimen from Dixieland, Imperial Co., California, April 20, 1922 (O. C. Poling).
- Fig. 10. *Drasteria (Drasteria) tejonica* var. ♂. Unique in the course of the t. a. line and the narrowness of the median space. The black banding of the hind wing and undersides are as in the synonymous *nigromarginata*. Specimen



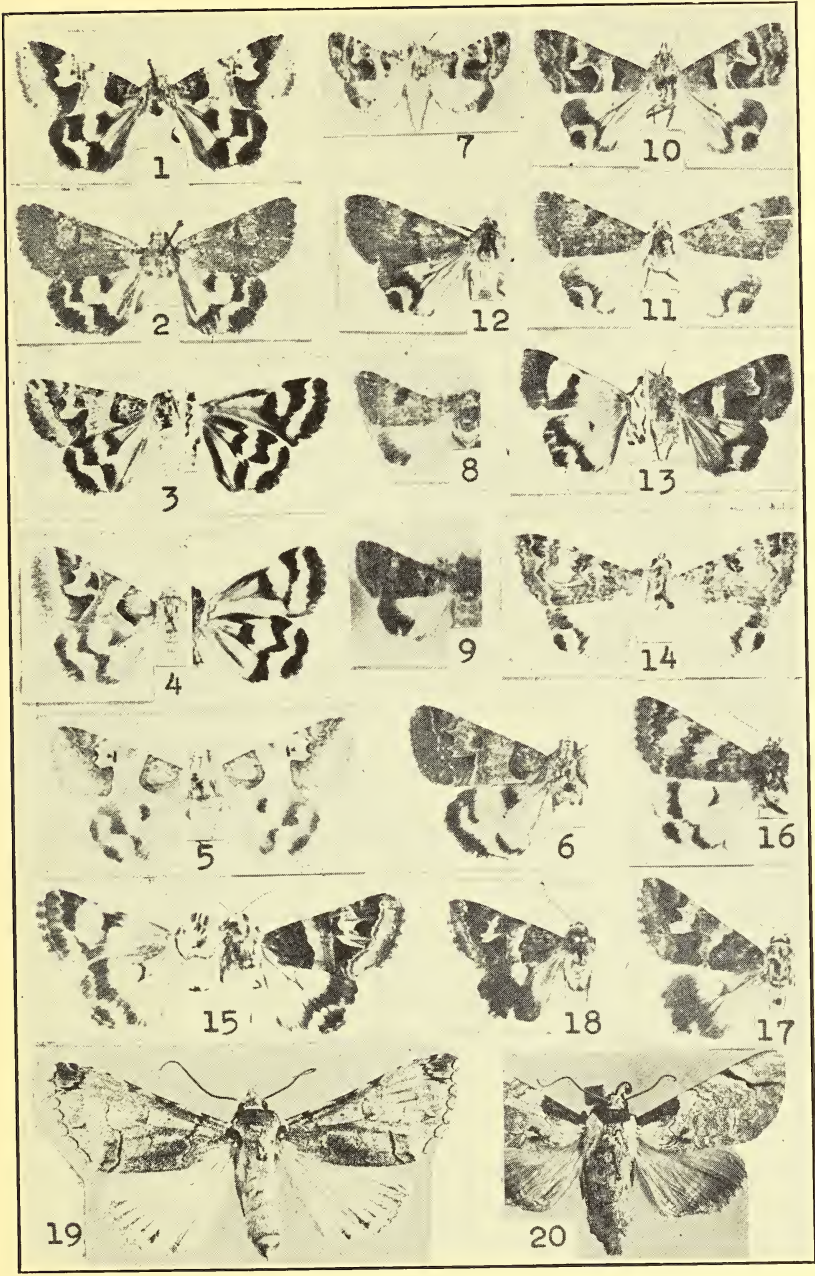


- men from "Rosarito," Lower California, Mexico, March 28, 1935 (ex collection Mrs. V. H. Dos Passos).
- Fig. 11. Under sides of preceding printed somewhat darker (fig. 10).
- Fig. 12. *Drasteria (Drasteria) tejonica* Behr. ♀. (This specimen labeled "Agrees with Behr's type, Henry Edwards." Amer. Mus. Nat. Hist.). Upper side on right, under side of same on left. Specimen from Havilah, California (Edwards' Collection number 14981).
- Fig. 13. *Drasteria (Drasteria) tejonica* Behr. ♀. Shows maculation of fore wing better than preceding. Specimen from Yuma, Arizona, April 25, 1935 (G. P. Engelhardt).
- Fig. 14. *Drasteria (Drasteria) mirifica klotsi*, race nov. ♂, holotype. Upper side on right, under side of same on left.
- Fig. 15. *Drasteria (Drasteria) mirifica klotsi*, race nov. ♀, allotype.
- Fig. 16. *Drasteria (Drasteria) mirifica hastingsi* Hy. Edw. ♀, holotype (Amer. Mus. Nat. Hist.). Right fore wing rubbed near apex; left fore wing above reniform.
- Fig. 17. Underside of preceding (fig. 16).
- Fig. 18. *Drasteria (Drasteria) mirifica mirifica* Hy. Edw. ♀, cotype (Amer. Mus. Nat. Hist.). Neither fore wing is perfect but comparison of the two sides shows all points.
- Fig. 19. *Drasteria (Drasteria) eubapta* Hmps. ♀, allotype (British Museum; photograph by courtesy of Mr. W. H. T. Tams).

## PLATE V

(All figures on this plate natural size)

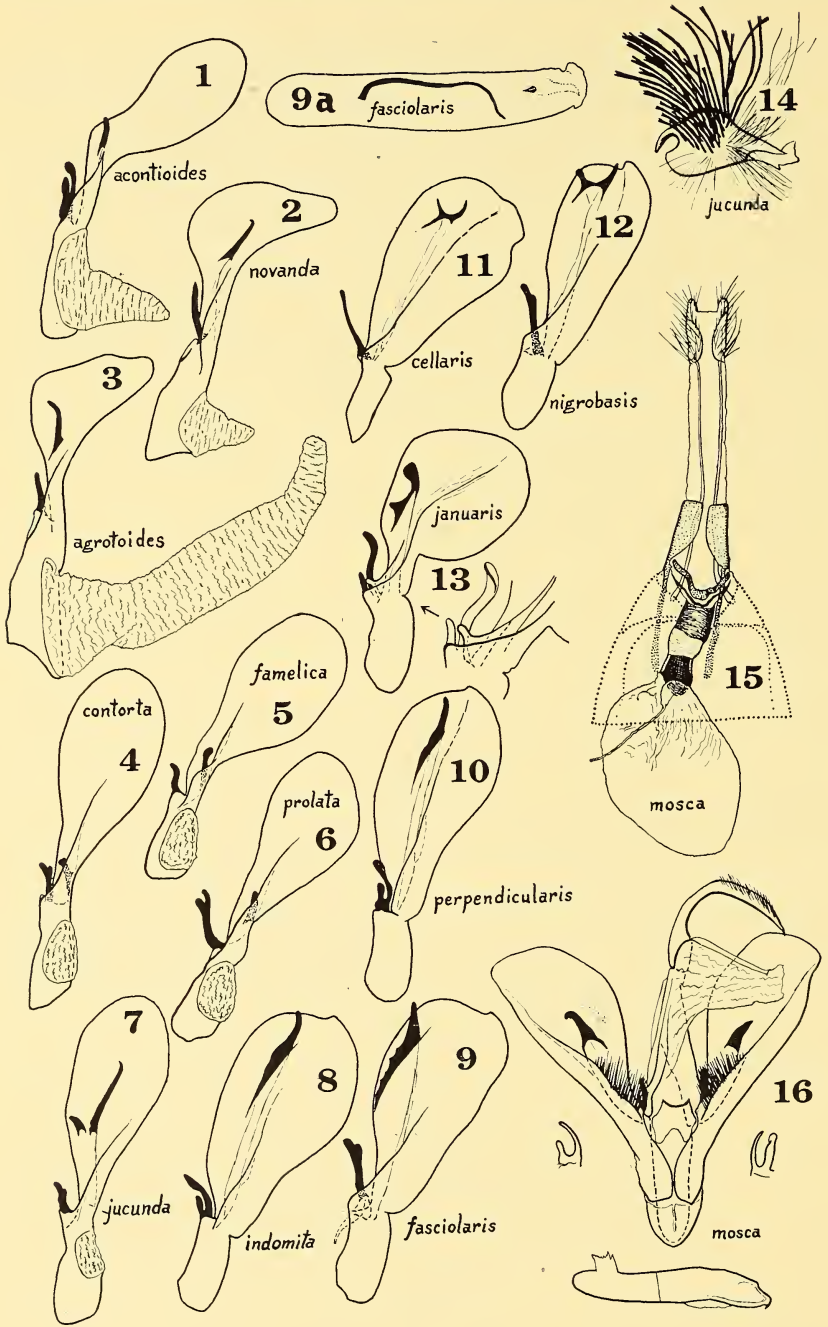
- Fig. 1. *Drasteria (Drasteria) graphica graphica* Hbn. ♂. Hind wing yellow and black. Specimen from Belleair, Florida (ex Slosson Collection).
- Fig. 2. *Drasteria (Drasteria) graphica graphica* Hbn. ♀. Hind wing yellow and black. Specimen from St. Petersburg, Florida.
- Fig. 3. *Drasteria (Drasteria) graphica atlantica* B. & McD. ♀. Sexes alike. Upper side on left, under side of same on right. Outer line defining subterminal line very faint in this photograph. Specimen from Pennequid Barrens, Coram, L. I., N. Y., June 2, 1921.
- Fig. 4. *Drasteria (Drasteria) occulta* Hy. Edw. ♀. Hind wing yellow and black. Upper side on left, under side of same on right. Specimen from Clementon, New Jersey, May 19, 1912 (J. H. West).
- Fig. 5. *Drasteria (Drasteria) ingeniculata* Morr. ♂. A good photograph. Specimen from Texas.
- Fig. 6. *Drasteria (Drasteria) ingeniculata* Morr. ♀. A dark female. Specimen from Texas.
- Fig. 7. *Bulia confirmans* Wlk. ♂ (This specimen holotype of *propria* Wlk., British Museum; this and following two figures by courtesy of Mr. W. H. T. Tams).
- Fig. 8. *Bulia confirmans* Wlk. ♀, holotype (British Museum).
- Fig. 9. *Bulia confirmans* Wlk. ♀ (This specimen holotype of *umbrosa* Wlk., British Museum).
- Fig. 10. *Bulia deducta* Morr. ♂, compared with type. Hind wing dirty white, lunule yellow. Specimen from Globe, Arizona.
- Fig. 11. *Bulia deducta* Morr. ♀. Light grey form. Specimen from Indio, California, May 14, 1921.
- Fig. 12. *Bulia deducta* Morr. ♀. This represents the synonymous *vulpina* Hy. Edw. Specimen from Baboquivari Mtns., Pima Co., Arizona, July 1-15, 1923.
- Fig. 13. *Bulia similaris similaris* Rich. ♂, paratype (Amer. Mus. Nat. Hist.). Females of this race similar to male. Upper side on right, under side of same on left. Specimen from Bee Co., Texas.
- Fig. 14. *Bulia similaris californica*, race nov. ♀, holotype.
- Fig. 15. *Drasteria (Aleucanitis) cailino* Lef. ♂. Upper side on right, under side of same on left. Hind wing and



- undersides black and white. Specimen from Digne, Bass. Alp., France (Staudinger & Bang-Haas).
- Fig. 16. *Drasteria (Aleucanitis) catocalis* Stgr. ♂. Specimen from Korla, Turkestan (Staudinger & Bang-Haas). Hind wing yellow and black.
- Fig. 17. *Drasteria (Aleucanitis) sesquilinea* Stgr. ♂. Hind wing dirty white, darker apically. Specimen from "Uramtschi, Thianshan" (Staudinger & Bang-Haas).
- Fig. 18. *Leucanitis picta* Christ. ♂. Specimen from "Navidustgn., S. E. Russia" (Staudinger & Bang-Haas).
- Fig. 19. *Lois lorina* Druce. Specimen from Royal Palm State Park, Florida, April 12, 1927, at bait (W. S. Blatchley). (Photograph by courtesy of Dr. F. M. Jones.)
- Fig. 20. *Boryzops purissima* Dyar. Specimen from Royal Palm State Park, Florida. (Photograph by courtesy of Dr. F. M. Jones.)

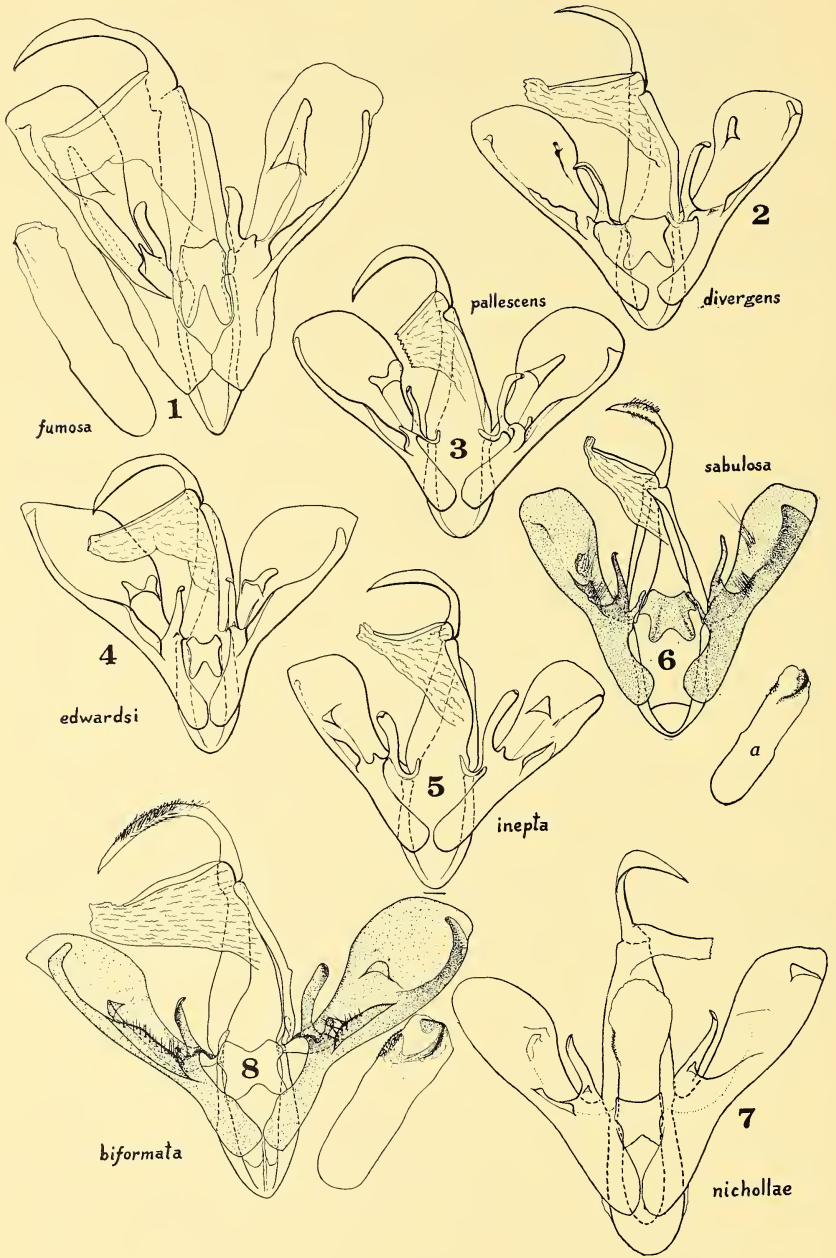
## PLATE VI

- Fig. 1. Right valve from male genitalia of *Melipotis (Lyncestis) acontiooides* Gn. Specimen from the vicinity of Chilpancingo, Guerrero, Mexico, November, 1929.
- Fig. 2. Same from *Melipotis (Melipotis) novanda* Gn. Specimen from Hereford, Arizona, Sept. 22 (Barnes Collection).
- Fig. 3. Same from *M. (M.) agrotoides* Wlk. Specimen from San Benito, Texas, May 1-7.
- Fig. 4. Same from *M. (M.) contorta* Gn. Specimen from Indian River, Florida.
- Fig. 5. Same from *M. (M.) famelica* Gn. Specimen from Pétionville, Haiti, May-June, 1930.
- Fig. 6. Same from *M. (M.) prolata* Wlk. Specimen from Florida (ex Slosson Collection).
- Fig. 7. Same from *M. (M.) jucunda* Hbn. Specimen from Hope, Arkansas, July 7, 1931 (Knobel).
- Fig. 8. Same from *M. (M.) indomita* Wlk. Specimen from Globe, Arizona.
- Fig. 9. Same from *M. (M.) fasciolaris* Hbn. Specimen from Pétionville, Haiti, May-June, 1930.
- Fig. 9a. Aedaeagus of *M. (M.) fasciolaris* Hbn. showing internal spine.
- Fig. 10. Right harpé from *M. (M.) perpendicularis* Gn. Specimen from Port au Prince, Haiti, Jan. 1-8, 1922.
- Fig. 11. Same from *M. (M.) cellaris* Gn. Specimen from Brownsville, Texas, 2-11 (Geo. Dorner).
- Fig. 12. Same from *M. (M.) nigrobasis* Gn. Specimen from Brownsville, Texas, 2-11 (Geo. Dorner, in Barnes Collection).
- Fig. 13. Same from *M. (M.) januaris* Gn., but with the dorso-basal parts including the clavus drawn at greater magnification alongside. Specimen from Florida City, Florida, May 22, 1933 (Mrs. L. E. Forsyth).
- Fig. 14. Lateral view of uncus of *M. (M.) jucunda*.
- Fig. 15. Female genitalia (ventral view) of *Ianius mosca* Dyar. Specimen from Alpine, Texas, Aug. 1-7, 1926 (O. C. Poling, in Barnes Collection).
- Fig. 16. Male genitalia of *Ianius mosca* Dyar. Aedaeagus drawn below and enlarged mesal views of clavi drawn on their respective sides. Specimen from Alpine, Texas, July 15-21, 1926 (O. C. Poling, in Barnes Collection).



## PLATE VII

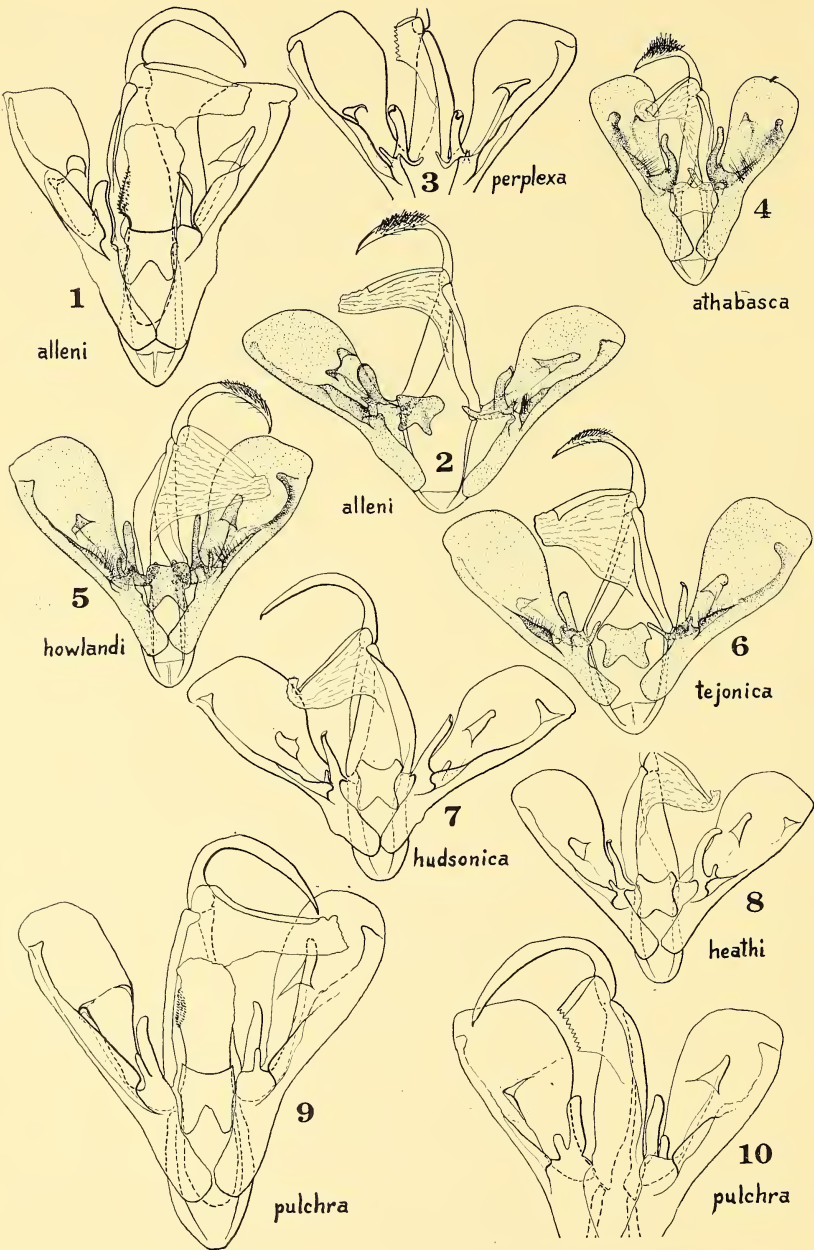
- Fig. 1. Male genitalia of *Drasteria (Synedoida) fumosa brunnei-fasciata* B. & McD. Aedaeagus of same drawn alongside. Specimen from Supai, Havaisu Canyon, Arizona, Aug. 2, 1934 (E. L. Bell, in Amer. Mus. Nat. Hist.).
- Fig. 2. Male genitalia of *Drasteria (Synedoida) divergens* Behr. Specimen from Southern Utah, June, 1900 (O. C. Poling).
- Fig. 3. Male genitalia of *Drasteria (Synedoida) pallescens* G. & R. Specimen from Zion National Park, Utah.
- Fig. 4. Male genitalia of *Drasteria (Synedoida) edwardsi* Behr. Specimen without data.
- Fig. 5. Male genitalia of *Drasteria (Synedoida) inepta* Hy. Edw. Specimen from Jemez Springs, New Mexico, Aug. 10, 1920 (Woodgate).
- Fig. 6. Male genitalia of *Drasteria (Synedoida) sabulosa* Hy. Edw. Fig. 6a. Aedaeagus of same drawn alongside. Specimen from Glenwood Springs, Colorado, 6-5-94 (Cornell Univ. Collection, ex Barnes Collection).
- Fig. 7. Male genitalia of *Drasteria (Synedoida) nichollae* Hmps. Specimen from Seton Lake, Lillooett, British Columbia, June 28, 1926 (in Canadian National Collection).
- Fig. 8. Male genitalia of *Drasteria (Synedoida) biformata* Hy. Edw. Cotype. Aedaeagus of same drawn alongside. (Amer. Mus. Nat. Hist.)





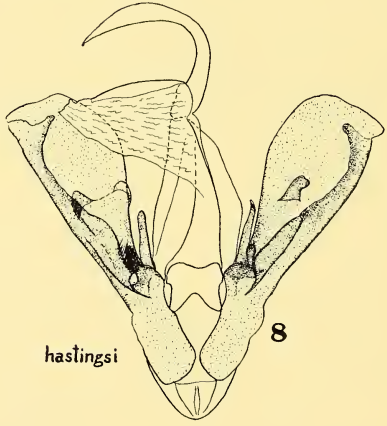
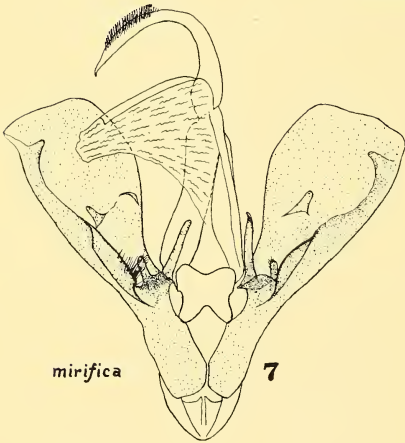
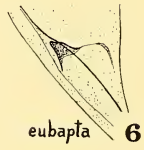
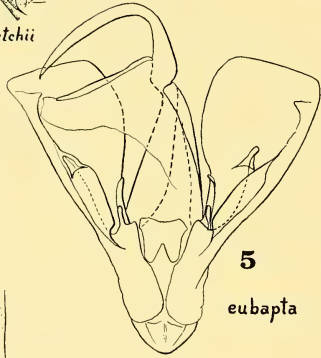
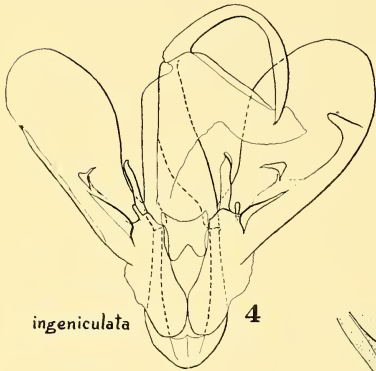
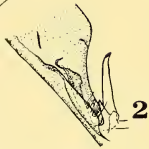
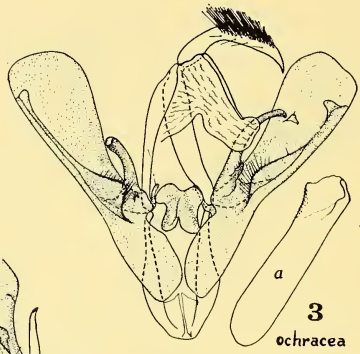
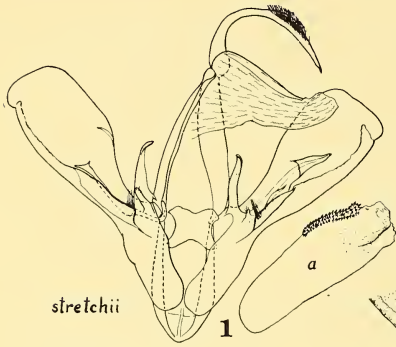
## PLATE VIII

- Fig. 1. Male genitalia of *Drasteria (Drasteria) adumbrata alleni* Grt. Specimen from Muskoka, Ontario, July 18, 1934.
- Fig. 2. Male genitalia of *Drasteria (Drasteria) adumbrata alleni* Grt. These genitalia very similar to those shown in figure 1, the seeming differences largely due to position of parts in mounting. Specimen from Peru, Adirondacks Mtns., New York, June, 1924 (in Cornell Univ. Collection).
- Fig. 3. Male genitalia of *Drasteria (Drasteria) perplexa* Hy. Edw. Specimen from Colorado (ex Colorado Agric. College Collection).
- Fig. 4. Male genitalia of *Drasteria (Drasteria) petricola athabasca* Neum. Specimen from Kelwood, Manitoba, July 1, 1924 (J. F. May). This specimen really form *crockeri*.
- Fig. 5. Male genitalia of *Drasteria (Drasteria) howlandi* Grt. Specimen from Three Forks, Montana, July 12, 1929.
- Fig. 6. Male genitalia of *Drasteria (Drasteria) tejonica* Behr. Specimen from Esmeralda Co., Nevada (ex Barnes Collection).
- Fig. 7. Male genitalia of *Drasteria (Drasteria) hudsonica hudsonica* G. & R. Specimen from Banff, Alberta.
- Fig. 8. Male genitalia of *Drasteria (Drasteria) hudsonica heathi* B. & McD. Specimen from Miles City, Montana.
- Fig. 9. Male genitalia of *Drasteria (Drasteria) pulchra* B. & McD. Specimen from Jacumba, San Diego Co., California, April 28, 1935 (G. P. Engelhardt).
- Fig. 10. Male genitalia of *Drasteria (Drasteria) pulchra* B. & McD. Same data as preceding.



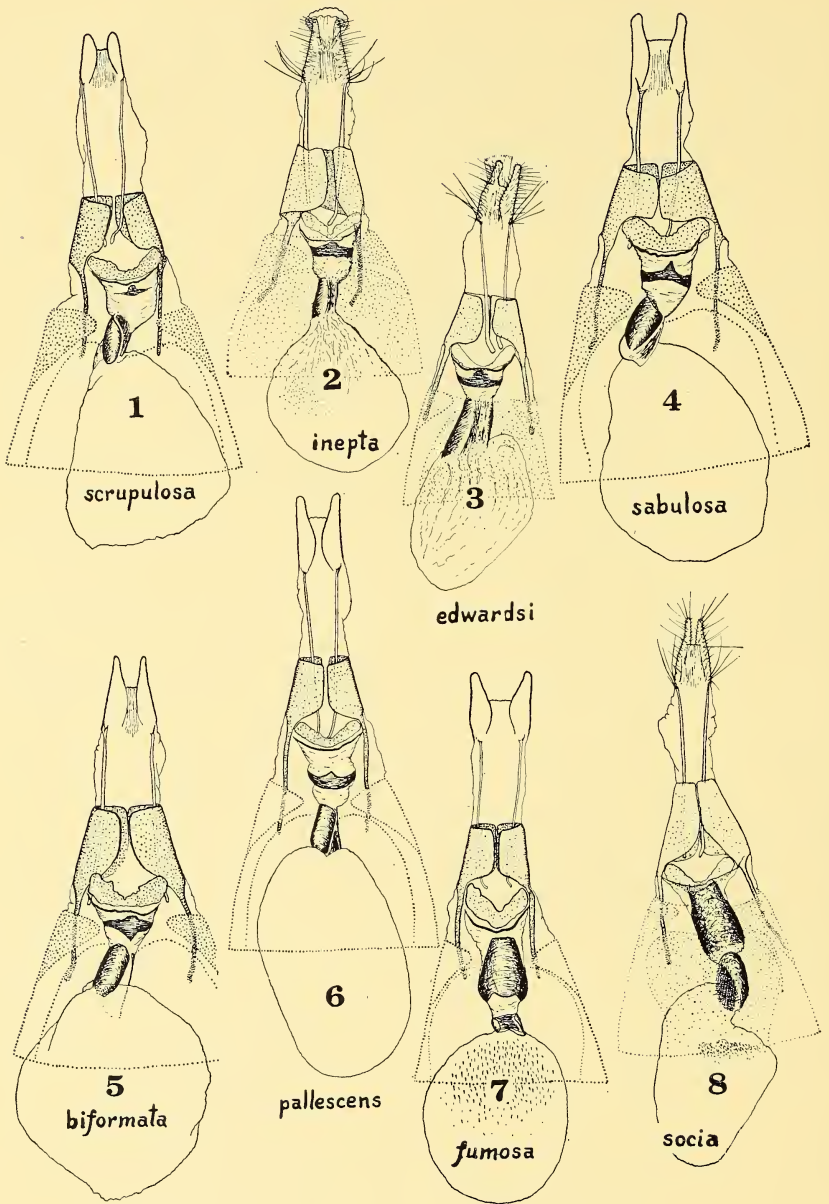
## PLATE IX

- Fig. 1. Male genitalia of *Drasteria* (*Drasteria*) *stretchii* Behr.  
Fig. 1a. Aedaeagus of same. Specimen from Nevada  
(In Henry Edwards' Collection at the Amer. Mus. Nat.  
Hist., and labeled "agrees with type, H. E.").
- Fig. 2. Portion of left harpé of another specimen of *Drasteria*  
(*Drasteria*) *stretchii* Behr. Specimen without data.
- Fig. 3. Male genitalia of *Drasteria* (*Synedoida*) *ochracea* Behr.  
Specimen from Globe, Arizona.
- Fig. 4. Male genitalia of *Drasteria* (*Drasteria*) *ingeniculata* Morr.  
Specimen from Texas.
- Fig. 5. Male genitalia of *Drasteria* (*Drasteria*) *eubapta* Hmps. n.  
Specimen from near Salton Sea, Imperial Valley, Cali-  
fornia, March 10, 1932 (Los Angeles Museum).
- Fig. 6. Portion of left harpé of specimen of *Drasteria* (*Drasteria*)  
*eubapta* Hmps. n. Specimen from Yuma, Arizona  
(same lot as types; in Canadian National Collection).
- Fig. 7. Male genitalia of *Drasteria* (*Drasteria*) *mirifica mirifica*  
Hy. Edw. Specimen from Loma Linda, San Ber-  
nardino Co., California, Aug. 8-16 (ex Barnes Collec-  
tion).
- Fig. 8. Male genitalia of *Drasteria* (*Drasteria*) *mirifica hastingsi*  
Hy. Edw. Specimen from Ft. Klamath, Oregon.



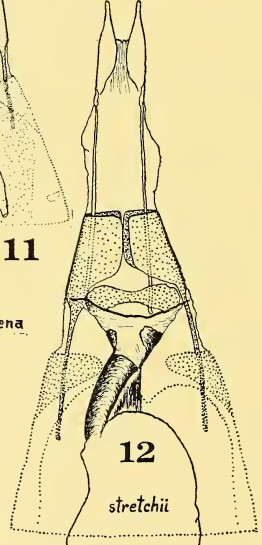
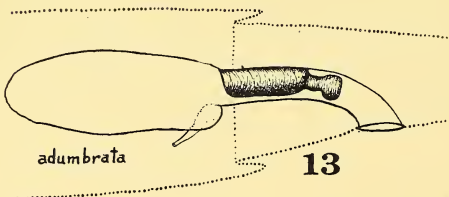
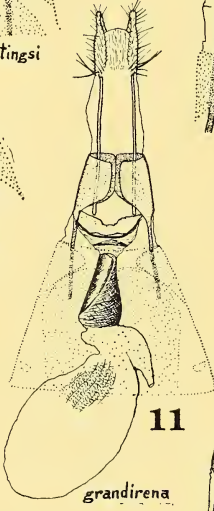
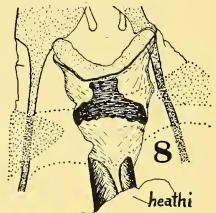
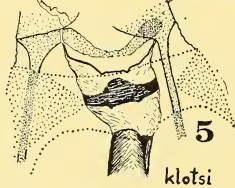
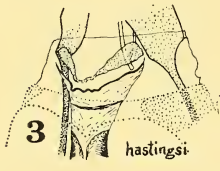
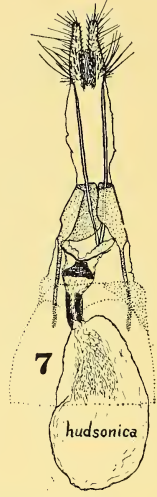
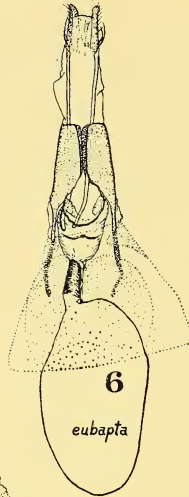
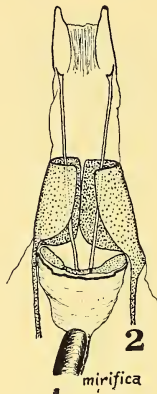
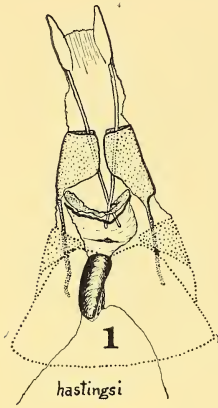
## PLATE X

- Fig. 1. Female genitalia of *Drasteria (Synedoida) scrupulosa* Hy. Edw. Cotype. (Amer. Mus. Nat. Hist.)
- Fig. 2. Female genitalia of *Drasteria (Synedoida) inepta* Hy. Edw. Specimen from Jemez Springs, New Mexico, July, 1920 (Woodgate).
- Fig. 3. Female genitalia of *Drasteria (Synedoida) edwardsi* Behr. Specimen from Menlo Park, California, July 10, 1932.
- Fig. 4. Female genitalia of *Drasteria (Synedoida) sabulosa sabulosa* Hy. Edw. This specimen a cotype from Southern Colorado (Amer. Mus. Nat. Hist.).
- Fig. 5. Female genitalia of *Drasteria (Synedoida) biformata* Hy. Edw. Cotype (Amer. Mus. Nat. Hist.).
- Fig. 6. Female genitalia of *Drasteria (Synedoida) pallescens* G. & R. Specimen from Miles City, Montana, July 27, 1931.
- Fig. 7. Female genitalia of *Drasteria (Synedoida) fumosa brunneifasciata* B. & McD. Specimen from Mt. Lowe, California, Aug. 1, 1924.
- Fig. 8. Female genitalia of *Drasteria (Synedoida) divergens* form *socia* Behr. Specimen from Verdugo, Los Angeles Co., California.



## PLATE XI

- Fig. 1. Female genitalia of *Drasteria (Drasteria) mirifica hastingsi* Hy. Edw. (This specimen the unique type of *perpallida* Hy. Edw.) Part of bursa omitted.
- Fig. 2. Female genitalia of *Drasteria (Drasteria) mirifica mirifica* Hy. Edw. Cotype (Amer. Mus. Nat. Hist.). Bursa omitted.
- Fig. 3. Vulval region of female genitalia of *Drasteria (Drasteria) mirifica hastingsi* Hy. Edw. Specimen from Pateros, Washington, April 21, 1930.
- Fig. 4. Same of another specimen (*hastingsi*) from Pateros, Washington, August 15, 1930.
- Fig. 5. Same of *Drasteria (Drasteria) mirifica klotsi*, race nov. Paratype from Colorado.
- Fig. 6. Female genitalia of *Drasteria (Drasteria) eubapta* Hmpsn. Specimen from Imperial Co., California, March 10, 1932 (in Los Angeles Museum).
- Fig. 7. Female genitalia of *Drasteria (Drasteria) hudsonica hudsonica* G. & R. Specimen from Bozeman, Montana, July 11, 1932.
- Fig. 8. Female genitalia of *Drasteria (Drasteria) hudsonica heathi* B. & McD. Specimen from Miles City, Montana, July 27, 1931. Vulval region only.
- Fig. 9. Female genitalia of *Drasteria (Drasteria) howlandi* Grote. Specimen from Ackmen, Colorado, Aug. 3, 1930.
- Fig. 10. Vulval region of female genitalia of *Drasteria (Drasteria) howlandi* var. Specimen from Pateros, Washington, April 21, 1930.
- Fig. 11. Female genitalia of *Drasteria (Aleucanitis ?) grandirena* Haw. Specimen from Rochester, New York, July 14, 1932 (A. G. Richards, Jr.).
- Fig. 12. Female genitalia of *Drasteria (Drasteria) stretchii* Behr. Compare figure 13. Specimen from Nevada (Amer. Mus. Nat. Hist.).
- Fig. 13. Lateral view of part of female genitalia of *Drasteria (Drasteria) adumbrata* Behr. Compare figure 12 which is a ventral view (the female genitalia of *adumbrata* and *stretchii* are not separable).





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# ENTOMOLOGICA AMERICANA

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## REVISIONAL NOTES ON THE DANAINAE (LEPIDOPTERA)

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ITHACA, NEW YORK

This paper consists primarily of a classification of the true Danaids, which I hope may give a clearer idea of their internal relationships and phylogeny. I have also included keys to the genera and to what I believe are the true species (save in the very large Old World genus *Euploea*, where the material in American collections is insufficient);—further, to the subspecies and leading forms in the New World fauna.

Hulstaert's revision in the *Genera Insectorum*, fasc. 193, 1931, is considered basic; and commentary, whether modifications or opinions, may be referred to it as a standard.

In the New World fauna, almost all the recognized forms have been examined, but only about a third of those in the Old World; I believe, however, that these are sufficient to validate the generic descriptions and general groupings.

### SUBFAMILIES

The primary character for the Danaids has been generally taken to be the preservation of 3rd A in the fore wing as a small but tubular vein. This is shared by the *Pierella* group of the Satyrinae, so that the character "subcosta not strongly swollen" must be added. I should consider personally the Danaids and Satyrids alike as groups of less than family value, rather subfamilies of the large family

Nymphalidae. Other useful characters are the naked shaft of the antenna and the pair of pencils at the apex of the male abdomen, but the former is shared by a few other Nymphalid genera (particularly the Acraeinae) and the latter is inconspicuous and confined to the male sex. The larva of the restricted Danainae is always naked with paired subdorsal filaments (save in *Clothilda*, apparently) and the pupa is stout, with the middle of the abdomen much swollen and terminal segments shortened.

On this definition the subfamily must include *Clothilda* (*Anelia*), a genus in fact close to *Lycorea* and *Ituna*, though not yet modified by mimicry (Bates, Bull. Mus. Comp. Zool. 78: 148, 1935). With it are universally associated two other subfamilies, which have the tubular 3rd A, though not the anal pencils,—the Ithomiinae and Tellervinae. Of the characters usually given to separate them the position of  $R_2$  is inconstant in both directions, the palpal differences are intangible, and the others are sexual; so I should prefer to make primary a neglected character of the middle and hind legs, and would offer the following

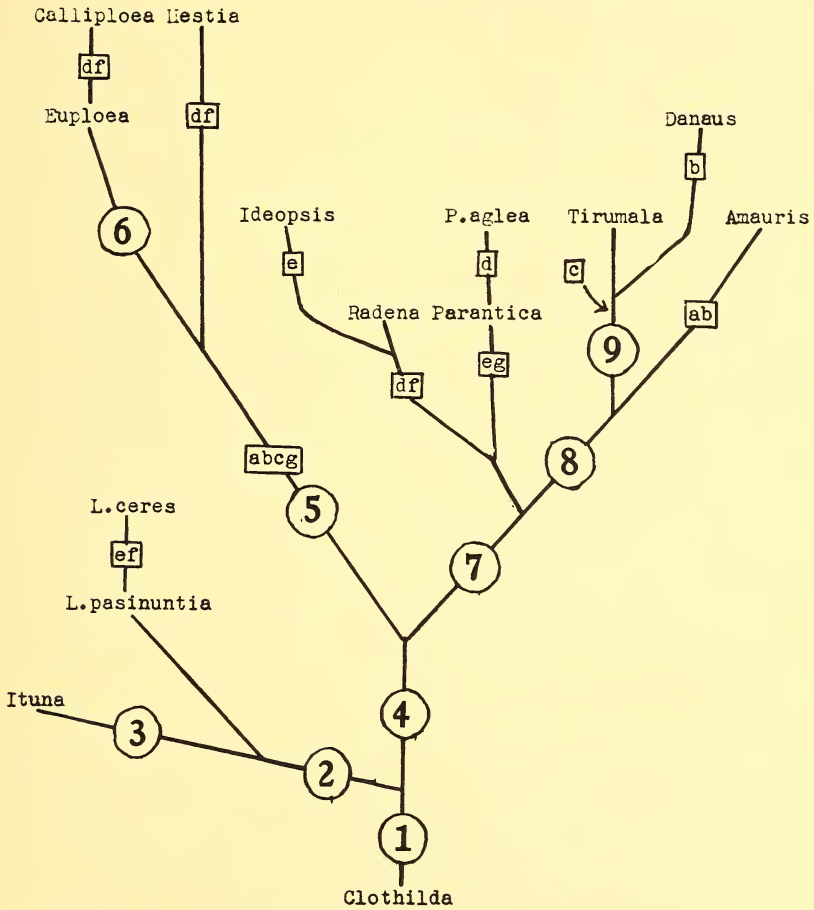
## KEY

1. Middle and hind tarsi, and less conspicuously hind tibiae, densely clothed with fine spines (among the scales) above as well as below, the tarsal spines below not ordered, or in vague transverse series; male abdomen without pencils ..... 2
- Tibiae and tarsi unarmed *above* or with a few irregularly scattered and much heavier spines on both tibiae (*Clothilda*) or hind ones only (*Danaus*, *Ideopsis*), spines of tarsi below in four longitudinal rows, male sex-scaling when present of dense mealy areas on hind wing, or inner area of fore wing below, without pencils;  $R_2$  generally free in fore wing; abdomen generally falling short of margin of hind wing; first segment of palpus moderate (variable); admarginal spots of hind wing two to an interspace (absent in *C. cubana*). Male abdomen with a pair of retractile terminal pencils.  
*Danainae*
2. Male sex-scaling obscure, on upper side of fore wing;  $R_2$  arising well before end of cell; first segment of palpus minute; fore wing broad with costal veins widely spaced; admarginal white spots one to an interspace. (Old World.)  
*Tellervinae*<sup>1</sup>
- Male with modified sex-scaling on costal area of hind wing above and also one or two hair-pencils; first segment of palpus moderate, reaching forward to middle of loop of tongue;

admarginal spots various; costal area with more crowded venation; R<sub>2</sub> stalked, except occasionally in the more primitive genera. (New World) ..... *Ithomiinae*<sup>1</sup>

SUBDIVISION OF THE DANAINAE

Adding *Clothilda*, we find eight genera almost universally accepted in this subfamily, and these eight are clearly homogeneous and on the whole well defined. Only in England (following Moore) and by a few American workers (following Scudder) are the two large and varied genera *Danaus* and *Euploea* subdivided. *Ideopsis* also,



<sup>1</sup> Not discussed further.

while doubtless homogeneous, is too close to *Danaus*, subgenus *Radena*, and should probably be reduced to a subgenus. *Amauris*, while equally close to *Danaus* in the imago, has a distinct larva.

The separation into a *Danaus* group, an *Euploea* group and an American group is also generally accepted. They may be treated as tribes: Danaini, Euploeini, Lycoreini. The accompanying diagram indicates what I believe to be their true relationships, and the characters by which they are generally distinguished. I have divided the

#### GENEALOGY OF THE DANAINAE

The height of the name indicates the degree of divergence from *Clothilda*, which is considered the most primitive surviving genus.

#### *Changes which take place only once*

1. Larva develops filaments on mesothorax; pattern of imago becomes simple.

2. Abdomen becomes fully as long as hind wing; pattern converges with Ithomiine type.

3.  $M_3$  and  $Cu_1$  of hind wing become approximate and ldev. of hind wing becomes vertical.

4. Larva develops filaments on 8th segment of abdomen; lower discocellular of hind wing becomes nearly straight.

5. Hind wing loses humeral cell, and humeral vein migrates out on Sc.

6. Sex-scaling developed on costal area of hind wing above and inner area of fore wing below.

7. Sex-scaling develops toward inner margin of hind wing above; tarsal claws enlarged and pulvilli vestigial.

8. Cells  $M_3$  and  $Cu_1$  of fore wing develop paired subterminal dots, as on hind wing.

9. Male with sex-pocket below  $Cu_2$  of hind wing.

#### *Changes which develop more than once*

a. Larva develops filaments on metathorax.

b. Larva develops filaments on 2d segment of abdomen (not yet in *Danaus erippus*).

c. Hair in cell of fore wing below lost (also a few *Parantica*).

d. Fore wing with Sc and  $R_1$  anastomosing.

e.  $R_2$  arising well back from end of cell.

f. Hind wing with udev. longest and nearly longitudinal.

g. Hind wing with ldev. much the shortest and vertical.

latter into two categories, those which have developed once only (numbered) and those which have appeared repeatedly (letters). For theoretical reasons it would seem better to consider the larva with many subequal pairs of filaments primitive (*Amauris* with five pairs) but it seems impossible to draw up a reasonably consistent tree on this basis. In every other way *Amauris* is as advanced as *D.* (*Parantica*) or more.

For the separation of the genera the characters are also generally agreed on, but there are some exceptional species that will give trouble in Hulstaert's key. We must allow for *Lycorea pasinuntia*, which has his key character for *Ituna*, for the species of *Euploea* and *Danaus* with Sc and R<sub>1</sub> anastomosing and the Asiatic species of *Danaus* with R<sub>2</sub> arising well back from the end of the cell, as in *Amauris*. Also *Clothilda* must be added, the long wings of a few *Danaus* (the Monarch and the Celebesian species, *e.g.*) must be allowed for; and the very gradual change of shape of the antennal club reduces its value. I prefer, therefore the following

## KEY

1. Middle and hind tarsi with large pulvilli and paronychia, and short, sharply curved claws ..... 2
- Middle and hind tarsi with long straight claws, curved only near the tip, and rudimentary pulvilli and paronychia ..... 6
2. Abdomen (in the spread butterfly) extending beyond hind margin of hind wings ..... 3
- Abdomen falling short of hind wings ..... 4
3. Hind wing with m-cu very short or absent; udev. also very short, and mdev. and ldev. continuing their general direction, much longer and subequal; scaling of light markings reduced, spaced and semierect; R<sub>2</sub> normally arising very close to end of cell ..... *Ituna*
- Hind wing with m-cu and udev. about as long as mdev. and ldev., the two latter set at a decided angle; scaling all similar and dense; R<sub>2</sub> normally arising about half the length of mdev. back from end of cell ..... *Lycorea*
4. Humeral cell of hind wing minute or slender, but present, humeral arising from its outer end practically opposite the forking of Sc and R; pattern of cell below complex, with wavy transverse bands, etc.; club of antenna strong (Central America).  
*Clothilda*
- Humeral cell absent; humeral vein arising from Sc well beyond its separation from R; cell of fore wing with a simple pattern of a few streaks or spots, or none (Old World) ..... 5

5. Large species, expanding well over 100 mm. (4 in.), Sc and R<sub>1</sub> of fore wing connected or anastomosing; hind wing with costal cell narrow, humeral vein turning sharply outward; ground white, the pm. spots when present rounded and separate. *Hestia*
- Sc and R<sub>1</sub> of fore wing separate except in one or two species expanding less than 75 mm. (*Calliploea*); hind wing with humeral cell broad, humeral vein transverse more than half its length, and then forked or turning abruptly out; ground almost always dark, with light markings, when light with the pm. area heavily blackish ..... *Euploea*
6. Hind wing with the upper discocellular longest, the middle shorter and curved, lower not extremely short, though straight; fore wing with Sc and R<sub>1</sub> anastomosing. (Larva with two pair of filaments) ..... 7
- Upper discocellular shorter, sometimes much shorter than middle or lower or both; Sc very rarely anastomosing with R<sub>1</sub> (*aglea*) ..... 8
7. Fore wing with R<sub>2</sub> more than half length of mdev. back from end of cell<sup>2</sup> ..... *Ideopsis*
- Fore wing with R<sub>2</sub> close to end of cell or even stalked. *Danaus (Radena)*
8. Hind wing with lower discocellular long, Cu<sub>2</sub> arising opposite M<sub>1</sub>; cell of fore wing hairy below. (Africa) (Larva with 4 or 5 pair of filaments) ..... *Amauris*
- Hind wing with lower discocellular much shorter than middle one or else without hair on cell of fore wing below; Cu<sub>2</sub> opposite R in the primitive species that have hair in the cell and lack the sex-pocket; none of the latter African. (Larva with 2 or 3 pair of filaments) ..... *Danaus* (residue)

*Clothilda* Blanchard

This genus is one of the curious types common to the Greater Antilles and Central America without close relatives elsewhere in the world. It stands apart from the rest of the Danainae and yet does not really approach any other subfamily of the Nymphalidae, the complex pattern being merely primitive, and not distinctively Nymphaline. The larva (as quoted by Gundlach and Bates from Poey) is without filaments, white, with black head, and it would seem, with the usual transverse stripes reduced to two on the prothorax. The pupa is Danaoid.

<sup>2</sup> Fails in *I. endora*, which has large round black spotting.



By good fortune all the forms have been examined, even the exceedingly rare *C. jaegeri* from the north coast of Haiti, in the Museum of Comparative Zoology. The key is fundamentally that of Salvin (Trans. Ent. Soc. London, 1869, 391-397) supplemented by Hall (Ent. 58: 161, 1925; 63: 13, 1930) and Bates (Bull. M.C.Z. 78: 148, 1935), but has been checked, modified and expanded.

## KEY

1. Fore wing with crimson at least below. Ground of upper side and outer half of fore wing below dark with pale post-medial spots down to  $M_2$ , then apparently joining the st. series,—the true lower pm. spots being red or partly pale and incorporated with the crimson base, and the true st. spots being minute above. Hind wing with pm. series mostly close to cell, with a small one in base of cell  $M_3$ , and st. series mostly diffuse (*Synalpe* Boisduval) ..... 2
- Ground tawny, without any crimson, the pm. and st. spots dark, not abruptly changing their character; hind wing below with pm. series far beyond cell, a large spot in  $M_3$ , and outlined with white, doubly on the pm. series (*Clothilda*) ..... 5
2. Under side with blurred bands, the postmedial slightly darker and slightly oblique in cells  $Cu_1$  and  $Cu_2$  when visible, hardly defined with slightly paler; black postmedial spots on the crimson of fore wing rounded or fusing, st. spots rounded, short and completely defined, terminals short and single on fore wing, diffuse or absent on hind wing (Antilles) ..... 3
- Pm. spots narrow, blackish, contrastingly defined with whitish, the bar in  $Cu_1$  and  $_2$  if visible strongly oblique; pm. spots L-shaped, extending out above  $Cu_1$  and  $Cu_2$ , st. spots extending out at least in cells  $M_3$ - $Cu_2$ , fusing with the double terminal spots, which are also double, yellow, and elongate on hind wing (Mainland) ..... 4
3. Postmedial and subterminal bands above white, continuous except for the black veins, the st. spot in cell  $M_2$  small, outside the band. St. of hind wing broad, continuous above, absent below, no crimson subcostal spot below (Cuba) ..... *cubana*
- Pm. and st. bands of fore wing yellow, more or less suffused; of small separate spots, the two spots in cell  $M_2$  equal; sub-terminal of hind wing absent above. Base of fore wing dull crimson with distinct black pm. spots. Terminal spots distinct (Haiti) ..... *jaegeri*

4. Hind wing with pm. lunules in cells R, M<sub>1</sub> and less definitely in M<sub>2</sub> above, also in M<sub>3</sub> and Cu<sub>1</sub> below; the wing above gradually paler toward outer margin, but dark on dorsal half. (northern Central America) ..... *t. thirza*
- Hind wing with a broad whitish postmedial patch on dorsal half, formed by the suffusion of the pm. lunules (Costa Rica and western Panama) ..... *t. insignis*
5. Hind wing with three series of black spots between the cell and the black border, the inner series incomplete (*numidia*) ..... 6
- Hind wing with only two series (the inner incomplete) the inner st. series being absent (*pantherata*) ..... 7
6. Inner series of spots on hind wing with a large spot in cell Cu<sub>1</sub>, terminal spots cream, large; chestnut shade on under side of fore wing in cell and below, contrasting (Haiti).  
*n. numidia*
- Inner series with the spot in cell Cu<sub>1</sub> usually minute; terminal lunules tawny and usually small, dark shading on under side of fore wing more diffuse (Cuba) ..... *n. briarea*
7. Inner row on hind wing of four distinct spots, the terminal spots distinct, pale tawny (Haiti & S. Domingo) ..... *p. pantherata*
- Inner row with distinct spots only in cells M<sub>1</sub> and M<sub>3</sub>, only a couple of tawny marginal spots toward costa (*numida* in error of Seitz 83: e4) (Cuba) ..... *p. clarescens*

*C. jaegeri*. I have only seen the series collected by Darlington in extreme northern Haiti, now in the M.C.Z. This species, *cubana* and the mainland types represent each other locally but are doubtless good species.

*C. thirza*. I have seen the type form only from Guatemala and Honduras, the variety from Costa Rica and Chiriquí, Nicaragua doubtless shows the intermediate conditions.

*C. numidia* and *pantherata*. These have been much confused, but can be easily separated by the presence of one or two rows of subterminal black spots. The respective races in Cuba and Haiti vary in the same way, so probably some form of Mullerian mimicry is involved.

*Ituna* Doubleday & Hewitson

This genus and the following are very close, and probably differ mainly because they have entered different mimicry groups (*Dir-cenna* and *Melinaea* respectively). They are frequently made a separate tribe or even subfamily, but in fact are very close to *Clothilda* except for the mimetic features. The key-character used by Hul-

staert fails in *L. pasinuntia*, but can be used in the modified form given in the key. The larva is about like that of *Lycorea*.<sup>3</sup>

The slight difference in venation makes us recognize two species, but they represent each other locally. The distinction of northern races marked with tawny, and southern ones which are black and translucent yellow only, is repeated in *Dircenna*, *Olyras*, *Eutresis* and *Aprotopus*. I recognize the following forms:

1. Hind wing with  $M_3$  and  $Cu_1$  almost invariably short-stalked; antenna with base of club as well as whole shaft black; light parts honey yellow (Brazil and Paraguay) ..... *ilione*
- Hind wing with  $M_3$  and  $Cu_1$  a little separated; antenna with the whole club yellow (*phenarete*) ..... 2
2. More than half of antennal shaft black; ground generally all honey yellow; hind wing with  $M_3$  and  $Cu_1$  arising extremely close together ..... 3
- More than half of antennal shaft yellow; ground of wings usually shaded with tawny;  $M_3$  and  $Cu_1$  generally a little further apart ..... 5
3. Basal half of fore wing solid blackish or only with narrow fully scaled reddish streaks ..... *l. lamirus (completa)*<sup>4</sup>
- Fore wing with a broad translucent whitish streak in basal part of cell, at least ..... 4
4. Fore wing streaky looking, like *Dircenna klugi*; a continuous translucent stripe from base of cell below  $Cu_2$  to near margin, the dark on Cu being linear and the st. spot practically absorbed in the stripe by the loss of the st. bar. Hind wing about  $\frac{3}{4}$  yellow in the specimen examined ..... *albescens*
- Fore wing much less streaky, the streak which starts from base of cell cut by black bars just beyond cell, subterminally, or both ..... *fenestrata*
5. Fore wing with a brown streak and hind wing with a brown triangular patch near inner margin; yellow on antenna tending to extend down to middle (E. Peru and Bolivia).  
*l. lanassa*

<sup>3</sup> Hempel, Chacaras e Quintaes 21 (4) : 373; Monte, Bull. agr. zoo. vet. Bello Horizonte 7 : 3-12;—summarized by Costa Lima in his Terceiro Cat. Ins. que vivem nos Plantas do Brasil, 206, Rio Janeiro, 1936. It feeds on *Ficus* like *Lycorea*.

<sup>4</sup> This analysis follows Haensch in Seitz ix, 116. Original descriptions are vague and types have not been examined. The forms are only partly local, and doubtless controlled by Mendelian factors.

- Fore wing with markings wholly black ..... 6
- 6. Bands more sharply defined, outer margin of hind wing more dentate; postmedial black band strong; about a third of antennae yellow (Eastern Peru to Bolivia) ..... *l. phenarete*
- Bands less sharply defined, outer margin of hind wing less dentate; postmedial band running out below; toward half of antenna yellow (western Ecuador) ..... *l. decolorata*

*Lycorea* Doubleday and Hewitson

There are two structurally distinct species, in fact *L. pasinuntia* will not run to *Lycorea* in Hulstaert's key, the cell of hind wing being too short. I must leave Fabricius' name *eva* uncertain, it is certainly not the *eva* of authors (*pasinuntia*), but might be an extreme form of *L. p. brunnea*. I have seen nothing at all like it. I believe the forms with normal structure (long cell) are all forms of a single species. *L. demeter* differs in the smoky cryptically colored under side, whereas all the other forms, even the Haitian, are colored about the same above and below. Curiously Hulstaert does not make much of *demeter*. The other forms of *ceres* merely ring the changes on the following characters: ground tawny or chestnut, median area of hind wing concolorous or yellow, band and border of hind wing separate or fused, fore wing with 3 or 4 apical spots (the fourth sometimes fused with the corresponding postmedial one), postmedial fascia continuous, only cut by the fine black veins, or separated into three spots by heavy black bars (rarely suffused with black). The black markings are narrower below than above, save in Haitian *cleobaea* and (faintly) in Cuban *demeter*.

Cornell has a striking aberration from the upper Cauca Valley, Colombia, with the black areas much reduced, mostly represented by heavy bars on the veins, and the rest of the postmedial black replaced by tawny. It is dwarfed but not as much as one normally marked specimen.

The following key will allocate the named varieties in the traditional way, but does not allow for many transitions and recombinations of characters. The forms of *ceres* are only partially racial: *demeter* from Cuba only; *cleobaea*, Hispaniola (though similar more lightly colored specimens occur on the mainland); *halia*, S. Brazil; *cinnamomea*, Tefte, Upper Amazons; but the Amazons also have *fasciata*, *ceres* and *referrens*; Obidos on the middle Amazons shares *referrens* with Bolivia; *ceres* is found on the lower Amazons, as well as Guiana, *fasciata* from the upper Cauca, Colombia, as well as the lower Amazons, and *discreta* from both Pará and southern Brazil;—

but *pales* may really be limited to S. E. Peru, Bolivia and the upper Juruá region. *L. c. atergatis* is found everywhere, and the few specimens I have seen labelled "Florida" (none very authentic) are of this form.

KEY

- 1. Lower discocellular vein of hind wing nearly vertical, angled above its middle; fore wing above with the yellow or tawny medial area as much beyond the cell as in it (*pasinuntia*) ..... 2
- Lower discocellular longer and strongly oblique inward; the yellow or tawny medial spots or fascia not extending beyond the cell on costal part of wing (*ceres*) ..... 5
- 2. Hind wing with a discal black loop, separate from the black border ..... 3
- Hind wing with the black discal loop and border fused into a large dorsal patch ..... 4
- 3. Medial fascia of fore wing yellow ..... (*p. eva* of authors)
- Medial area of fore wing tawny, concolorous ..... *p. concolor*
- 4. Medial fascia of fore wing yellow ..... *p. pasinuntia*
- Medial area concolorous tawny ..... *p. brunnea*
- Medial area black, the tawny limited to two basal streaks and two submarginal patches (according to original description,—not seen) ..... *p. eva* Fabricius
- 5. Under side of hind wing suffused with blackish, much darker than upper side, which is also rather dark (Cuba).  
*c. demeter*
- Under side of hind wing like upper side or with ground a little paler, the markings sharply defined and black ..... 6
- 6. Fore wing with a continuous median fascia, cut only by the fine black veins ..... 7
- Fore wing with three yellow spots (rarely tawny) separated by heavy black bars ..... 10
- 7. Middle part of hind wing, inside the black loop, yellow; three apical spots ..... *c. halia*
- Ground of hind wing all reddish ..... 8
- 8. Ground light mahogany brown; hind wing with separate loop and border (Lower Madeira) (not seen) ..... *c. transiens*
- Ground tawny ..... 9
- 9. Fore wing with three apical yellow spots, making a band; hind wing with black border and loop separate ..... *c. referrens*
- Fore wing with four apical spots; hind wing with border and loop separate ..... *c. fasciata*

- Fore wing with four spots; hind wing black, with reddish submarginal streak and streak in cell only .....*c. ceres*
- 10. Ground mahogany brown, sometimes almost black, the black loop and border tending to be suffused at least above; fore wing with four large yellow subapical spots, the lower sometimes connected with the corresponding postmedial spot.  
*c. cinnamomea*<sup>5</sup>
- Ground tawny ..... 11
- 11. Apical part of fore wing almost wholly black, with small yellow spots (but the one in cell  $M_3$  almost always distinct); the spot in end of cell also almost obliterated in the black area; black of hind wing on the contrary reduced and loop frequently broken ..... *c. pales*
- Fore wing with strongly developed yellow spots, including a large squarish spot in end of cell; loop of hind wing stronger ..... 12
- 12. Medial area of hind wing bright yellow, contrasting; four well developed subapical yellow spots; under side of hind wing with black banding rather heavier than upper side (Haiti).  
*c. cleobaea*
- Medial area of hind wing frequently tawny or shaded with tawny; black banding on under side of hind wing weaker than on upper side ..... 13
- 13. Medial area of hind wing concolorous tawny; four well developed subapical spots .....*c. atergatis*
- Medial area of hind wing somewhat yellowish, the subterminal spot of cell  $M_3$  of fore wing usually absent ..... *c. discreta*<sup>6</sup>

*L. pasinuntia* Dru. This is commonly called *eva* F., but the original description of *eva* is like nothing I ever saw, and may perhaps not even be a *Lycorea*. The forms are not local to any extent, though the specimens I have seen without yellow (concolor) are from the southwest of the area of distribution,—eastern Peru to Matto Grosso. Most specimens come from the Amazons and Guiana. *L. p. brunnescens* Tess. was based on a strain of concolor with the black markings on base of fore wing and disc of hind wing reduced, and may be compared with *L. c. pales*. The uncertain use of the name

<sup>5</sup> Two of the three specimens examined from Teffé are light mahogany, and would be transitional to *c. transiens*.

<sup>6</sup> Mainland specimens occasionally have the yellow in the loop of hind wing as light as in *c. cleobaea*, but the black banding of the under side is lighter and there are as often 3 as 4 subapical spots.

*eva* has caused a snarl in the Lep. Cat. *L. eva* of that work is made up mainly of *pasinuntia* ("eva" so far as not based merely on Fabricius' original description, *concolor*, *brunnescens*, etc.) but also of the original indeterminate "eva" of Fabricius and even *ceres* (the *ceres* of D. & H. being merely a catalogue citation of *ceres* Cr.)

*L. ceres* Cr. This species is more often called *cleobaea* Gdt., but *ceres* has many years priority and is definitely a race, no mere aberration. Hulstaert, and also Bryk in the Lep. Cat. 80, divide this into several species: *ceres*, *cleobaea*, *halia*; and have gone wrong on the localities of the few varieties that are really locally limited, giving Haiti as well as Cuba for *demeter* and Central America instead of Haiti for typical *cleobaea*. They also assign forms somewhat at random to their three "species," e.g., *discreta*, which is superficially almost like true *cleobaea*, and *domingensis* which is a strict synonym of *cleobaea*, to *halia*. It is a little curious that forms with a complete fascia on the fore wing (*demeter*, *referrens*, *fasciata*, *ceres*, *halia*) or with yellow band on hind wing (*cleobaea*, *discreta*, *halia*) occupy the extremes of distribution, but not in a strictly parallel way.

#### *Euploea* Fabricius

I make no attempt at a full analysis of this large genus. The forms are innumerable, there is no obvious clue to indicate which are true species, and less than half are available. As compared with typical *Danaus* it is about equally advanced on a different line, as shown by the primitive feet but more specialized humeral arrangement of hind wing and distinctive sex-scaling. As filaments of the larva increased it is evidently the one on metathorax that appeared before the one on A2, since the latter is still missing in the type group of *Euploea*. Presumably this increase in number of filaments is an orthogenetic tendency in the Danainae, for everything shows it took place independently in *Euploea*, *Danaus* and *Amauris*.

The pupa of *Euploea* lacks the sharp abdominal keel of typical *Danaus*, but too few of the more primitive *Danaus* are clearly figured to indicate if this is a tribal character or one that has arisen in the *Danaus* stock itself.

I repeat the subgenera recognized by Hulstaert in tabular form. They seem to be the most distinctive of the many "genera" proposed by Moore on details of male wing form and coloring.

#### KEY

1. No special sex-patch on hind wing (though usually a diffuse silky area) ..... 2

- Costal part of hind wing with a large area of velvety scales, with a yellowish androconial patch in center ..... 3
  - 2. No sex-scaling on fore wing above; cell with a recurrent vein; a single simple pair of short anal pencils ..... (*Vonona*) Moore
  - Fore wing with one bar of sex-scaling (sometimes indicated more by change of color than any distinctive change in structure. (*Crastia*) Hübner
  - Fore wing with two bars of sex-scaling ..... (*Stictoploea*) Hübner
  - 3. Fore wing without sex-scaling above ..... 4
  - Fore wing with a bar of sex-scaling below  $Cu_2$  (hardly more than a change of color in *E. leucostictos*); hind wing with androconial patch extending above cell; anal pencils complex. (*Salpinx*) Hübner
  - 4. Androconial patch in center of sex-area of hind wing small, in cell; anal pencils simple ..... (*Trepsichrois*) Hübner
  - Androconial patch large, extending in front of cell; four anal pencils ..... 5
  - 5.  $Sc$  and  $R_1$  of fore wing separate; a short M-spur in cell. (*Euploea*)
  - $Sc$  and  $R_1$  anastomosing; no M-spur ..... (*Calliploea*) Butler
- (*Vonona*)

The distribution of this subgenus covers the range of the genus. The reports of *Euploea* from the Ethiopian region appear to be incorrect, since while a few species are found in the isolated islands of the Indian Ocean—the Seychelles, Mauritius, Rodriguez and Bourbon,—none of them is authentically known from Madagascar.

About a third of the 45 species have been examined. They divide primarily into two groups, a primitive one with inner margin of fore wing straight (*helcita*) or nearly so, and one with the inner margin arched, and a distinct sex-patch on the under side. In each group we have species with well marked st. spots on the upper side in outlying areas, in the first group *goudoti* from Bourbon (Réunion), *euphon* from Mauritius and *desjardinsi* from Rodriguez, in the second *eichhorni* from Australia, *alecto* from New Guinea and their relatives.

The residue of the first group divide into species with the st. spots (beneath) in a regular series, so far as preserved, including *climene*, *obscura*, *batesi* and *wallacei*, with decreasing development of the st. spots; the others, typified by *helcita* and *cratis*, with the spot at  $M_2$  or  $M_3$  deeply offset inward. The second group contains three types: 1, *eichhorni* and *alecto* with a very large though obscure



patch of sex-scaling, covering the cell (best visible at 15 U 0; 30 U 0<sup>r</sup>), and well developed or even enormous st. spots on hind wing; 2, with the st. spot on the fore wing in cell R<sub>5</sub> (sometimes M<sub>1</sub> also) noticeably enlarged,—such as *moorei* and *crameri*; 3, without either of these features. This group includes *cameralzeman* with both wings blue, *modesta* with fore wing blue and hind wing bronze, and such species as *cerberus* and *malayica* with no distinct iridescence.

(*Crastia*)

A further specialization of the second group of *Vonona*, with a distinct spot of more or less specialized scales on the upper as well as under side of fore wing. It extends even further east, to Fiji, Tahiti and Samoa, but is represented in the Indian Ocean only by *rogeri* Geyer from the Seychelles, of which I have only the ancient record. Color forms parallel those of the other groups, as often noted, e.g., *eichhorni* and *eleutho* in north Queensland. The species may be divided into three groups; 1, those with the st. series of spots offset out at M<sub>2</sub>, the spot above it weak or absent and outer margin concave or notched at middle. (This includes *schmeltzi*, *eleutho* and *baudiniana*); 2, those with st. series even and strong blue iridescence,—*amymone* and part of *deione*, and 3, those with st. spots regular when distinct and no iridescent blue or violet (though *diana* has some matt violet on the dorsal area). In the latter group a few of the species have distinctive marks, e.g., *eurianassa*, with a continuous white st. band, cut only by the black veins; *tobleri* with under side of hind wing white, marked with black spots and veins, like *Hestia*; *abjecta* with subterminal spots in M<sub>3</sub> of both wings lengthened, dagger-like, but the pm. spots absent; *diana* with the pm. spots in cells M<sub>3</sub> and Cu<sub>1</sub> of fore wing much enlarged and conspicuous; *morosa* with stigma of fore wing far out toward margin (beneath farther out than the dot in cell Cu<sub>1</sub>); *alcathoe* with the st. spots of hind wing largely fused into a patch which reaches almost in to the cell; *andamanensis*, with ground clay color and white markings enlarged; *nechos* with enormous stigma on fore wing.

More than half of the 41 species listed by Hulstaert have been examined.

(*Stictoploca*)

I believe this subgenus is formed merely of the local races of a single plastic species, except for *E. martini*, in which the upper scent stripe is much smaller than the lower one. This species should be

<sup>r</sup> See Ent. News XL: 40–44, 1939.

transferred here from *Salpinx*. Hulstaert lists over 60 races and forms; the following key to his "species" will fairly represent the main racial types (exerges of Verity).

KEY

1. Upper scent stripe (♂) much smaller than lower one; sex-patch of hind wing velvety brown; st. spots conspicuous, more or less fused with the terminals, on a velvety black ground (Sumatra) ..... *martini*
- Upper scent stripe but little smaller than lower one ..... 2
2. Ground blue (N. India to Wetter and Japan) ..... *dufresne*
- Ground not blue, dull ..... 3
3. Fore wing dark brownish, with no trace of purple; hind wing with strong st. and terminal dots (S. India and Ceylon) .... *coreta*
- Both wings dark, very faintly purple in the best light; st. and t. dots absent or present only toward apex of fore wing (Moluccas and New Guinea) *melina* (with *immaculata*).
- With a complete series of st. dots, and with minute terminal dots below ..... 4
- St. series of one spot to a cell, broad and continuous on hind wing but spot M<sub>2</sub> of fore wing skipped (Wetter to Australia).  
*sylvester*
4. Larger, less spotted below; st. series on hind wing closer to outer margin (1/6 way in) (Aru) ..... *palla*
- Smaller, more spotted below on disc, but st. spots sometimes reduced; st. spots on hind wing farther from margin (New Hebrides) ..... *tristis*

(*Trepsichrois*)

This also comes pretty close to being a single species with local forms, but the different populations, while still almost wholly local, differ in their sex-scaling, and must be considered true species.

KEY

1. Border of hind wing blue, with pale blue st. spots, like fore wing; stigma of hind wing large, extending half way across cell and connected with a pale patch to base, the remaining sex-scaling obscure (Celebes) ..... *euctemon*
- Hind wing wholly dull, the fore wing often blue and contrasting; stigma smaller, extending about 1/3 way across cell and completely surrounded with black; sex-scaling (except perhaps in *cordelia*) thick and velvety ..... 2

2. Dull brown-black, without purple; sex-patch round, not extending to fork of R (Celebes, not seen) ..... *cordelia*
- Fore wing blue (except *M. semperi* from Philippines, which is large with a triangular sex-spot), larger ..... 3
3. Stigmal velvety scaling extending down into costal edge of cell  $M_3$  and sometimes even base of  $Cu_1$ ; stigma proper shorter, thicker and yellower (Lombok to Flores) ..... *gelderi*
- Stigmal scaling less extensive; stigma proper triangular, wedge-like or wing-like (India to Formosa and Java) ..... *mulciber*

(*Calliploca*)

This group is also composed of recent segregates, and no doubt was a single species not too long since, but the forms can now coexist, and therefore are fully established species. How many is not yet certain. The following key will separate most of the species, but the status of the forms on the islands between the Lesser Sundas and New Guinea is confused by the report of three on the small island of Babber. Possibly *hyems* and *visenda* are merely series of races, and the three colorings on Babber indicate the blend zone.

KEY

1. Fore wing with white pm. band, hind wing with white disc, both cut by broad black vein-lines (Celebes) ..... *hyacinthus*
- No portion of fore wing ground white; with small light spots only or white border ..... 2
2. Both wings with large white st. spots, one to an interspace, or suffused with white to border ..... 3
- White st. spots when present smaller, and two to an interspace, at least on dorsal half of hind wing ..... 5
3. Spots suffused into a very broad white border, but leaving some trace of large white st. spots in cells R and  $M_1$  of hind wing below (Key & Banda Ids.) ..... *hopfferi*
- Spots distinct or the lower ones suffused to margin by a narrower white border ..... 4
4. Fore wing with slight violet iridescence (Timor to Babber Ids.).  
*hyems*<sup>8</sup> and *menamoides*
- Fore wing without iridescence (Babber to Key Ids.) ..... *visenda*

<sup>8</sup> The forms with the white suffusing out toward the margin occupy the smaller islands in the middle of the range, well separated from the range of *hopfferi*.

5. White postmedial dashes on both wings below; st. spots of fore wing with the one at anal angle largest (Solomon Ids.).  
*pyres*
- No white pm. dashes below; st. series strongest toward costa of fore wing, often lost on hind wing ..... 6
6. Blue and white st. spots elongate, pointed at their outer ends (Saleyer, near Celebes) ..... *nautilus*
- Blue and white or white st. spots squarely or roundly cut off at outer ends, often small ..... 7
7. St. spots emphasized toward costa of fore wing above, often white overlaid with blue iridescence (widespread) ..... *tulliolus*
- St. spots not noticeably larger toward costa of fore wing, but tending to disappear toward inner margin of hind wing ..... 8
8. St. series complete on under side of hind wing (Moluccas).  
*trimenii*
- St. series with only the first four spots on hind wing below; abdomen beneath contrastingly striped with black and white ..... *salabanda* (Moluccas)  
*pumila* (New Guinea, etc.)  
*vulcania* (Vulcan Id. off New Guinea)

(*Euploea*)

As noted by Hulstaert, the nearly 50 forms probably represent only a single species, varying locally. They may be grouped in the following series (nominal species):

KEY

1. Ground generally light; pm. and st. spots generally small, the former practically lost in *c. celebica*, the latter in *c. corus* (India to Celebes) ..... *corus*
- Pm. spots larger than half the width of a cell, typically largest in cell  $Cu_1$ ; ground nearly black, the spots partly blue (Formosa and Mindanao) ..... *althaea*
- Pm. spots large and blue on costal half of wing, broken off and continued by the enlarged blue st. spots below (Sumbawa to Flores) ..... *eucala*
- Brown-black, the spots much reduced and blue, frequently only 2 or 3 st. spots (Moluccas) ..... *phaenarete*
- Fore wing heavily shaded with bright iridescent blue in pm. area, hind wing brown and spotted like typical *corus* (New Guinea and smaller islands) ..... *callithoe*
- All spots obsolescent or lost, ground brown-black, without blue,

or violet black with brown veins (*browni*) or heavily blue over disc of wing (*barippa*) (Bismareks and Solomons).  
*unibrunnea*

(*Salpinx*)

This is the third large and varied group of *Euploea*, the color forms running in general parallel to those of *Vonona* and *Crastia*. The distinguishing character is supposed to be the presence of both a patch of highly modified sex-scales on the hind wing and a bar on the upper side of the fore wing, but the latter in several species is hardly developed, being really only a discolored patch in such species as *leucostictos*. In contrast *E. midamus* has definitely developed special scales. A few of the species have striking special characters, such as the white patch in end of cell of *diocletianus* or the large buff discal patch of *usipetes*, but most need further study, not only to bring out the distinctions of superficially very similar species, but to determine even what are species.

*Hestia* Hübner

This genus needs little discussion, being easy to recognize, well defined structurally and universally accepted. The resemblance to *Ideopsis*, as now generally realized, is purely superficial, since *Hestia* shows all the special characters of *Euploea* except the sex-scaling, while *Ideopsis* is almost identical with the primitive *Radena* group of *Danaus*. It also has a weaker club to the antenna than any other Danaine, and narrower costal area of the hind wing. The larva is as in *Euploea*, with pencils on metathorax as well as 2d and 8th segments of the abdomen.

The genus is usually divided into two subgenera (*Hestia* and *Nectaria*) on the position of  $R_2$ , but *H. hypermnestra* is transitional, with the broad wings of *Nectaria* but the exact pattern of *Hestia*;  $R_2$  is most often as in *Nectaria* but individually variable. In both sections the base of  $M_1$  in cell of hind wing is marked with black, as in no other Danaine. The following key is intended to separate the recognized species. There is some instability in the characters for *idea*, *aza* and *urvillei*, but these represent each other locally, and are probably no more than subspecies.

KEY

1. Hind wing with two postmedial spots in cell  $Cu_1$ , and a spot in outer part of discal cell; cell  $Sc$  with 2 or 3 spots, the second always free from  $R$ ;  $R_2$  arising well before apex of cell (ex-

- cept sometimes in *hypermnestra*); ldev. of hind wing short (*Hestia*) ..... 2
- Hind wing with only a single pm. spot in cell  $Cu_1$  or none, and no spot in cell; cell Sc without spots, or if with two, the second farther out and in contact with the stem of R (*Nectaria*) ..... 4
2. Hind wing with only 2 spots in cell Sc ..... *hypermnestra*
- Hind wing with a third spot, sometimes small, resting on free part of R; fore wing with outer margin concave ..... 3
3. Outer margin not strongly concave; hind wing with ldev. about as long as m-cu and over half as long as mdev.; fore wing with inner black spot in fold much larger than outer, bar in cell a heavy oblique splash, except in very light specimens; both spots in cell Sc of hind wing below free from veins ..... *jasonia*
- Outer margin strongly concave and sinuous; ldev. of hind wing much shorter than m-cu and less than half as long as mdev.; fore wing with spots in fold subequal, spot in cell rounded and not oblique; basal spot in cell; Sc of hind wing resting on R except in very light specimens ..... *lynceus (logani)*<sup>9</sup>
4. Hind wing with regular rounded postmedial black spots (frequently connected in a zigzag band in Philippine specimens), and two rounded spots in cell Sc below<sup>10</sup> ..... 5
- Hind wing with streaks running in from border to postmedial region, without separate pm. spots, the spots in cell Sc almost always absent, but in typical *idea* small and on under side only ..... 6
5. Outer margin of fore wing strongly sinuate in male, distinctly concave at middle in female (E. Mindanao)<sup>11</sup> (not seen).  
*electra*
- Fore wing with outer margin convex in general course (Japan to Java) ..... *leuconoe*

<sup>9</sup> Fruhstorfer separates specimens with white ground color and small black spots as *logani* and Hulstaert follows him. Corbet and Pendlebury feel doubtful. Perhaps Fruhstorfer's earlier opinion that they represent wet and dry forms is correct, but only local study can determine.

<sup>10</sup> All the *Nectarias* represent each other locally and are doubtless recent segregates.

<sup>11</sup> As shown by the studies of the Rehms, based on the Orthoptera, eastern Mindanao has strong traces of a special fauna and was obviously a separate island in the not too distant past.

6. Hind wing without marginal chain-pattern, at most with slight dashes leading off from the vein-streaks; the border frequently fuscous or even black (Celebes, etc.) ..... *blanchardi*
- Hind wing with a marginal chain, composed of streaks on and between veins, crossed by a black st. line ..... 7
7. A continuous black band across fore wing; marginal chain usually continuous to anal angle (New Guinea, etc.) ..... *urvillei*
- Separate black spots across middle of fore wing, or a narrow and constricted band not reaching anal angle ..... 8
8. Subterminal line broken up on dorsal part of hind wing, only the more costal white spots completely enclosed (southern Moluccas) ..... *idea*
- Subterminal line continuous to anal angle, cutting off a complete series of white marginal spots (northern Moluccas) ..... *aza*

### *Ideopsis*

This is hardly more than a plastic species, since all the forms represent each other locally. The character of  $R_2$  becomes intangible in the western part of the range, leaving it separated from *Radena* by hardly more than habitus, but it is these western forms that are most modified in pattern by convergence with *Hestia*.

I cannot see the grouping advanced by Hulstaert, but am much more impressed by the distinctness of the eastern "exerge" typified by *vitrea*. The residue are more closely related, but the development of the pm. and st. spots suggests a grouping into three rather than two species, making a distinct group of the Javan *gaura* and the Eastern Mindanao *glaphyra* and *messala*, and possibly adding *costalis* from Nias.

### KEY

1. Postmedial line on hind wing continuous, strongest toward costa and far in toward cell, frequently ending abruptly at or just above  $Cu_2$ ; ground generally shaded with yellow but more strongly in the subterminal than the basal area, when there is any difference;  $R_2$  well back from angle of cell,  $M_1$  sometimes connate (Celebes to New Guinea, etc.) ..... *vitrea*
- Postmedial series of spots more or less distinct and rounded, at least on hind wing, not joining end of cell but frequently joined to the marginal pattern; yellow shading when present strongest toward base of wing;  $R_2$  usually nearer end of cell and  $M_1$  stalked ..... 2
2. Discal dots large and almost round, the one on hind wing extending down to base of  $Cu_1$ , postmedial spots rounded in both

- wings; st. dots in hind wing pear-shaped, joining the terminal dots in middle of each cell, on fore wing minute or obscure.  $M_1$  decidedly stalked (Indomalayan) ..... *endora*
- Discal spots smaller, oblong or irregular and tending to be less well set off from the venation; postmedial spots on fore wing arrow-head shaped, their tips connected to border; st. spots at least on hind wing triangular or mushroom shaped, the lateral ends with a strong tendency to connect to the black vein-stripes and thus to the margin, in dark forms producing a heavy black border with two small white spots to an interspace ..... 3
3. Pm. spots of fore wing very large in three lower interspaces, enclosing large white spots, small in cell  $M_2$ , and above that minute or indistinguishably incorporated in border; discal bar of fore wing elongate or suffused, connected with the first of the large pm. spots or running out on  $Cu_1$ ; male usually white, with lemon yellow basal shading, female more buffy;  $R_2$  usually well back from end of cell (Philippine Ids.) ..... *anapis*
- Pm. spots more regularly decreasing in size on fore wing, the discal bar not enlarged; marginal chain of hind wing usually with elements pretty completely fused (at least in male)  $R_2$  usually close to end of cell and  $M_1$  stalked (Java and Mindanao) ..... *gaura*

*I. anapis* Felder. Forms *glaphyra* and *messala* show neither the exaggeration of the discal dash nor the weakening of the margin of the hind wing of the other Philippine races, and should be rejected.

*I. gaura* Horsf. True *gaura* does not show  $R_2$  arising from the end of cell, as stated in Hulstaert's definition of sg. *Ideopsis*, and thus differs from *endora*, which has been confused with it. Using the characters here given *gaura* is much closer to *anapis* than to *endora* (*daos*). I should list as races of it only *glaphyra* and *messala* from Mindanao. *I. costalis* from Nias is somewhat transitional, and it is most probable that all are a single species, in spite of the differences of  $R_2$  and pattern. This is obviously the primitive stock from which the other three types are derived.

*L. endora* Gray. I should use this name to include the strikingly spotted species from the whole Indomalayan region except the Philippines and Java. *Daos*, *perakana*, *ardana*, *sonia*, *endora*, *nigrocostalis* and *costalis* have been examined, and only the latter is transitional to *gaura*. The pm. spots differ in position as well as form, being definitely farther from the margin.



*L. vitrea* Blanchard. In this complex Hulstaert separates off *ribbei* and *inuncta* as species, but their range is included in that of *vitrea* and they differ only by the lack of yellow in the ground. *Ribbei* is from the islands off Celebes, *inuncta* from those off New Guinea. Fruhstorfer would also separate *klassika* Mart. from Ceram as a species. In it the fore wing is black except for limited yellow markings. The rest of the Moluccas have fairly normal *vitrea* races.

#### *Danaus* Linnaeus

Regardless of technical rules this name was proposed by Linnaeus, in a sense inclusive of the present one, was definitely characterized as a major subdivision of a genus, and since then has been continuously in use, with only minor variations of spelling (*Danais*, *Danaida*). Those who follow a recent decision of the Commission must forget this use and credit the name to Kluk, as Hemming has done.

Of the numerous subdivisions proposed, four are sharply definable on characters of both sexes, and I believe it will give a much clearer idea of the genus to treat only these four as subgenera. They are: *Danaus* (*Anosia*, *Limnas*, *Tasitia*, *Nasuma*), *Tirumala* (*Melinda*), *Parantica* (*Ravadaba*, *Chittira*) and *Radena*. The first two and last two each make a pair, and may possibly be separately derived from their common ancestor (which would also be that of *Amauris*) since the first two agree against the last two in having two subterminal dots to each interspace in both wings, and having developed the sex-pocket. The subgenera may be keyed as follows.

#### KEY

1. Hind wing with either upper discocellular very long or lower very short, the middle and lower meeting at a distinct angle; fore wing beneath with much loose hair in base of cell Sc and costal part of discal cell (except *pumila* and *melusine*); st. spots one to a cell at least on fore wing, lying in the center of each cell (lost by fusion with terminals in *pumila*); male sex-sealing diffuse or concentrated along veins. (Larva spotted as far as known; pupa with a rounded keel on abdomen or none) ..... 2
- Hind wing with upper discocellular vein shortest, middle in line with lower (except *chrysippus*), the lower at least twice as long; subcostal area and cell of fore wing on under side closely sealed (except on veins); male with a sex-pocket below  $Cu_2$ ; fore wing with two st. spots to a cell in both

- parts of both wings (rarely with a single spot far above the center of the cell by the loss of lower one). (Larva transversely striped; pupa with a sharp abdominal keel) ... 3
2. Cell of hind wing with udev. much lengthened, longer than either mdev. or ldev. which are not far from equal and bent at a moderate angle; mdev. moderately bent near middle; fore wing with Sc and R anastomosing. Postmedial light spots in cells  $M_3$  and  $Cu_1$  simple. Male with a diffuse mealy area wholly below the fold ..... (*Radena*)
  - Cell of hind wing with ldev. less than half as long as mdev. as a rule, vertical and meeting it at a sharp angle; udev. variable, rarely as long as mdev. (very short in *melusine*); mdev. bent well above middle; fore wing with Sc and  $R_1$  approximate, but anastomosing only in *aglea* (s.l.); postmedial spots in cells  $M_3$  and  $Cu_1$  more or less distinctly divided (very rarely lost in the light ground). Male with areas of highly specialized sex-scaling, usually across  $Cu_2$ , if lower very conspicuous ..... (*Parantica*)
  3. Fore wing with Sc and  $R_1$  well separated and parallel; subterminal spots close to margin on both wings, pm. spots simple when distinct; male sex-pocket close to  $Cu_2$ , not more conspicuous below than above. (Larva except *erippus* s.l. with 6 filaments) ..... (*Danaus*)
  - Fore wing with Sc and  $R_1$  approximate; st. spots far back from margin in both wings, in the fore wing so far back as to eliminate the spot in cell  $R_4$ ; sex-pocket far from  $Cu_2$  and surrounded by an area of special scaling above. (Larva with 4 filaments) ..... (*Tirumala*)

(*Radena*) Moore

The key defines this group adequately. The three nominal species are extremely close but overlap widely in distribution. Hulstaert is inclined to transfer several of the "races" of *juventa* which coexist with more ordinary forms to *oberthurii*, but gives no tangible characters. The following key makes the conventional separation.

KEY

1. Basal part of wings with an extended white area, in strong contrast with the almost wholly blackish outer third ..... 2
- Basal part with heavy veins, the outer part with extensive light markings, not contrasting ..... *similis*
2. Fore wing with a transverse pm. white band, cut off from the

inner marginal area by a heavy black bar on  $Cu_1$ , a similar bar also on  $Cu_2$ ; terminal spots very weak or absent, but inner st. spots well developed and outer pm. again absent (Sumba and Sumbava) ..... *oberthuri*

- White area not so distributed, being continuous to near apex or more or less limited to dorsal part of wing; terminal dots normal, conspicuous ..... *juventa*

(*Parantica*) Moore

In the more normal species of *Parantica* the postmedial area of the fore wing is crossed by a black bar, cutting the pm. spots into two series, at least in cells  $M_3$  and  $Cu_1$ . In *Radena* there is always a single long spot in each of these cells. But this character often fails, e.g., in *pumila*, and males of *vitrina*, *gloriola*, *periphias* and *schenki*.

I should make two principal divisions of *Parantica*, rather than three, basing them on the position of the sex-patch, whether or not there is a conspicuous oval patch bisected by  $Cu_2$ . The true *Paranticas* have the patch, and also the majority of species put by Fruhstorfer in *Ravadeba*; but in *Chittira*, and the curious *melusine* and *pumila* (placed by Fruhstorfer in *Ravadeba*) the sex-scaling is almost wholly below the fold. The latter are also queer in losing the hair on the under side of the fore wing, and most of the smaller markings.

KEY

1. Fore wing with Sc and  $R_1$  anastomosing; pattern much like *D. albata* ..... *aglea*
- Fore wing with Sc and  $R_1$  merely approximate ..... 2
2. General color of hind wing pattern brown, much warmer than fore wing; sex patch variable in different races, sometimes almost wholly below  $Cu_2$  (tytioides) ..... *sita*
- Dark pattern of fore and hind wings the same color ..... 3
3. Outer part of hind wing and border of fore wing mostly black above, the cell  $M_3$  of fore wing in particular almost wholly black (the hind wing may be lighter when the fore wing is almost wholly black) ..... 4
- Border of hind wing narrower, usually with white terminal and subterminal spots; cell  $M_3$  of fore wing usually with two good sized spots of the light ground (white, green, yellow or hyaline) ..... 7
4. Cell  $Cu_1$  light for at least the basal  $2/5$ , not even with suffused dark veins, the border broader below  $Cu_2$ ; no hair in cell of fore wing below ..... 5

- Cell  $Cu_1$  also mainly black, with two small white spots, the border narrow below  $Cu_2$ ; cell of fore wing below hairy ..... 6
- 5. Ground transparent white; st. white spots conspicuous above (New Guinea, etc.) ..... *melusine*
- Ground transparent yellow; st. spots invisible above on both wings, but some of them present below (New Caledonia to New Hebrides) ..... *pumila*
- 6. Wings squarish; hind wing white with spotted black border (not seen) ..... *weiskei*
- Wings elongate, sinuate; hind wing blackish, except for white cell, a ray beyond it and st. white spots ..... *fumata*
- 7. Subterminal spots on upper half of hind wing double (at least with the one in cell  $M_2$  almost wholly and that in  $M_1$  partly divided) ..... 8
- St. spots in upper half of hind wing single, at least the one in  $M_1$ , that in  $M_2$  sometimes partly divided ..... 11
- 8. Ground of hind wing at least bright yellow ..... 9
- Ground of both wings white, greenish or bluish ..... 10
- 9. Postmedial area in cells  $M_3$  and  $Cu_1$  of hind wing also divided in two ..... *aspasia*
- Post medial areas simple, but black border much widened, reaching 2/3 way in to cell in female and further in male ..... *cleona*
- 10. Sex-patch astride of  $Cu_2$ ; fore wing shorter; white streaks in cells  $R_5$  and  $M_3$  broadly separate; at least traces of black streaking in cells and fold ..... *eryx*<sup>12</sup>
- Sex-patch in anal area; white in cells  $R_5$  and  $M_1$  separated from each other and the neighboring areas by the black veins only. Wings dominantly white ..... *albata*
- 11. Ground of wings yellow or heavily shaded with yellow toward base ..... 12
- Ground of wings not yellowish ..... 13
- 12. Hind wings of male with cell reaching 2/3 way to margin, ground transparent bright yellow; cell  $Cu_1$  of fore wing mostly of the light ground ..... *schenkii*<sup>13</sup>
- Cell of hind wing normal, scaling dense, buffy; cell  $Cu_1$  of fore wing mainly dark ..... *menadensis*<sup>14</sup>

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<sup>12</sup> If correctly determined in our collection, *D. maghaba* agrees with *eryx*, in the characters given above, but with as much white as most *albata*.

<sup>13</sup> Apparently the more eastern representative of *vitrina*.

<sup>14</sup> Perhaps a local representative of *luzonensis*.

- 13. Dominantly black, even in basal part of wings (sex-patch astride of Cu<sub>2</sub>) ..... 14
  - Cells in basal part of wing dominantly of the ground color, though the discal cell is often invaded with black from the costal side ..... 15
- 14. Large, with two postmedial spots or dots each in cells M<sub>3</sub> and Cu<sub>1</sub> of hind wing ..... *crowleyi*
  - Small, only the basal of these two spots preserved, the rest of the cell very heavily black ..... *nilghiriensis*
- 15. Border of hind wing not wider than distance between it and end of cell; markings of under side of hind wing dead black.
  - vitrina* group
  - Border of hind wing extending far in toward cell; markings of under side with a distinct brown tint ..... 16
- 16. Body blackish, under side grayish with a slight olive tint; spot in cell M<sub>1</sub> of fore wing short and broad, 4 or 5 times as long as wide, less than twice as long as the rounded spot in cell M<sub>2</sub>, and filling the width of its cell; st. spot in M<sub>2</sub> minute or absent; separate pm. spots in cells M<sub>3</sub> and Cu<sub>1</sub> of hind wing. Sex-patch astride Cu<sub>2</sub> ..... *phyle*
  - Body tawny; spot in cell M<sub>1</sub> of fore wing about 3 times as long as spot in M<sub>2</sub>, slender, not filling its cell, and defined by wide dark stripes above and below; st. spot in cell M<sub>2</sub> normal ... 17
- 17. Chestnut below; fore wing sinuate with extended apex, streak in cell M<sub>1</sub> extending 2/3 way to margin; sex-patch large, astride Cu<sub>2</sub> ..... *melaneus*
  - Deep umber below, almost as dark as upper side; fore wing hardly sinuate, the streak in M<sub>1</sub> only extending 3/5 way to margin; sex-patch on 2d A ..... *luzonensis*

*D. (P.) aspasia* F. The yellow and white races do not seem to be consistently distributed. I have seen white ones from Sumatra, Borneo and Celebes; yellow ones from Java, Engano and Nias.

*D. (P.) vitrina* Fld. This appears to me a good species as against the preceding, to which Hulstaert sinks it. Of the numerous forms, typical *vitrina* from the Philippines is transparent white, while *gloriola*, *citrina*, *periphias* and *schenki* are yellow.

*D. (P.) gloriola* Butler, which is at hand, should be a distinct species from *vitrina*, as indicated by the extremely large cell in hind wing of male. *Talboti* Huls. certainly goes with it, to judge by the figure in Gen. Ins. (1: 7), but I cannot say how many other of the "*schenki*" forms.

*D. (P.) cleona* Stoll. The different wing-form, heavier scaling

and coarser pattern indicate this is also a good species from the Moluccas and Celebes. If National Museum determinations are correct *luciplena*, *tigrana* and *lutescens* belong to it.

*D. (P.) melusine* Bdv. This species and *pumila*, which is obviously related, are the only exception found to the rule that all *Danaus* species without scent pockets have hair on the under side of the fore wing near the base. *Marcia* of Joicey and Talbot differs so much from *melusine* that I should be inclined to rate it as a species. It will tend to run out of the key and go down to 15, but shows its relation to *melusine* in the large single st. spots (on hind wing as well as fore wing) and contrast between the nearly black filled cell  $M_3$  and largely transparent cell  $Cu_1$ ;  $Cu_2$  is again dark, as in *pumila*, but the veins are heavily black-lined.

*D. (P.) maghaba* Fruh. looks almost exactly like *aglea*, and may be an *aglea* form, as generally placed, but it has Sc and  $R_1$  separate, and as I have drafted the key will run to *eryx*. The two species are much closer in pattern than they look.

*D. (P.) melaneus* Cr. and *luzonensis* Fld. The key characters here used would redistribute the forms of this group, but in a way I believe more natural than those of Fruhstorfer and Hulstaert. As determined in the National Museum, *banksii*, *praemacaristus*, *panaitius* and *larissa* belong to *luzonensis*, also I believe the "aglea" of Piepers and Snellen's Rhopalocera of Java, pl. 13: fig. 20. On the other hand his fig. 19 ("larisca") is a pretty obvious *melaneus*. The different sex spots show that two real species are involved.

In sum this subgenus needs drastic revision, as to subdivision, species boundaries and species content; or else a very high proportion of records, both published and unpublished, are based on misdeterminations.

(*Tirumala*) Moore

The survival of an area of sex-scaling about the pocket and the position of the pocket in line with the fold are primitive characters; the exaggerated form of the pocket, curved  $R_1$  of fore wing and migration inward of the st. spots are specializations, as compared with typical *Danaus*. The few species divide into an African group (*Melinda*) and an Asiatic group which has secondarily invaded Africa (*petiveranus*) but all are closely related.

#### KEY

1. Submedian area of fore wing solid color, except for a subterminal

and one or two marginal spots; fore wing with outer margin more sinuous and apex extended (*Melinda*) (Africa).

*formosa*

- Submedian area with a large median pale spot at least; outer margin less sinuous and apex blunter (*Tirumala*) ..... 2
- 2. Cell of hind wing wholly of the pale ground, without black central streak or wedge; basal part of submedian area also clear except in very dark specimens; abdomen mostly white.

*choaspes*

- Cell of hind wing with a central black streak, often forked; submedian area with a heavy black streak; abdomen red-brown or black ..... 3

- 3. Postmedial spots in cells  $R_5$  and  $M_1$  and subterminal in  $M_2$  rounded, roughly twice as long as wide ..... 4

- Pm. spots in  $R_5$  and  $M_1$  and subterminal in  $M_2$  streak-like, three or four times as long as wide (Asia) ..... 5

- 4. Ground decidedly green; submedian area of fore wing with a single green spot above fold, or with a slender separate sub-basal streak below fold also (Africa) ..... *petiverana*

- Ground white, usually with very faint or no green tinge; submedian area with a large double spot, composed of an oval spot above, and a longer streak below the fold (Asia and Islands) ..... *limniace*

- 5. A pale species; cell as well as interspaces about it dominantly light green and marginal pattern well developed; or if darkened with outer part of cell divided into three green stripes by two black stripes (Indochina and Nicobars) ..... *gautama*

- Basal half of wings dominantly light green, save that the cell of the fore wing is dominantly blackish; outer half mostly blackish, contrasting; body redder (Philippines and Celebes) ..... *ishmoides*

- Markings about evenly developed, the marginal pattern usually complete; cell of fore wing dominantly black, the outer green spot single, or once emarginate on outer side; submedian area darker, its two green antemedial streaks separate or connected by both joining the postmedial spot (widespread) ..... *melissa*

*D. (T.) formosa* Godm. This still stands in our lists as three species. I think in fact few would deny it is made up of four local forms of one; the fore wing darkening and hind wing becoming duller from *formosa*, through *neumanni* and *mercedonia* to *morgenii*; but *formosa* and *mercedonia* overlap, so perhaps two species are present,—*formosa* with more spotting on hind wing and brighter base of

fore wing, *mercedonia* with no pm. yellow spots on hind wing and dark brown on fore wing.

*D. (T.) petiverana*, etc. If Martin is right there are four species in this group in Asia, all existing together in the Celebes. Determinations are confused, partly through failure to realize the wide range of *melissa* forms, but I think the characters given in the key will usually work. *D. petiverana* is evidently not quite a modern immigrant to Africa, since it combines features of both the commoner Asiatic species, e.g., the green color of *melissa* with the shorter thicker spots of ground, of *limniace*.

(*Danaus*) Linnaeus

This group is commonly divided into five, but three of these are composed of a single aberrant and variable species each (*Anosia* with *erippus*, *Nasuma* with *ismare* and *Limnas* with *chrysippus*). The other two names merely represent the Old World and American members of a single homogeneous series, which show no differences of structure, pattern or larva. The following key separates what I consider to be distinct species. I believe my analysis of the American forms is correct, but am not quite so sure in the case of the Old World *lotis* group. The chief divergences from Hulstaert are the reallocation of the American normal series to three names only instead of six or seven; the combining of the northern Monarch with *erippus* (whose distribution is quite incorrectly given) associating *cleophile* with the *gilippus* rather than the *erippus* subgroup, and the realignment of the Old World species which have both tawny and white in the patterns of the under side as discrete elements.

KEY

1. Cell of hind wing lengthened, by the lengthening of the lower halves of mdev. and ldev., extending more than  $\frac{2}{3}$  way to margin; fore wing long, with sinuate outer margin. Tawny, with black border and veins and white spotting; rarely with a white spot in cell M<sub>1</sub> (Larva with 4 filaments) (*Anosia*) 2
  - Cell of hind wing not extending  $\frac{2}{3}$  way to margin, the outer part not lengthened ..... 3
2. Inner margin of fore wing tawny, or somewhat darkened in females with very dark ground, never much darker than ground ..... *erippus*<sup>15</sup>
  - Inner margin of fore wing black below A, strongly contrasting ..... *megalippe*<sup>15</sup>
3. Fore wing elongate and outer margin sinuate; white postmedial

<sup>15</sup> Probably conspecific.



- spots beyond cell formed of two similar series of streaks, the one in cell  $Cu_1$  small, all diffuse and concolorous with the whitish ground; a conspicuous white apical spot. No brown or tawny (*Nasuma*) ..... *ismare*
- Fore wing short and blunt, white postmedial spots beyond cell and in cell  $Cu_1$  sharply defined when distinct, frequently contrasting with a tawny ground; apical white spot less conspicuous (Old World) or absent (New World) (Larva with 6 filaments) ..... 4
  - 4. Mdev. of hind wing sharply angulated above middle and marked by a conspicuous black spot; veins not marked with black (*Limnas*) ..... *chrysippus*
  - Mdev. of hind wing moderately bent about middle and not marked with a black spot; veins of Old World species conspicuously striped with black (*Danaus*) ..... 5
  - 5. White postmedial spots in cells  $M_1$  and  $M_2$  of the shape of longitudinal oblongs, commonly only separated by the fine black veins, much larger than the white spots just beyond the cell, and forming part of a conspicuous oblique fascia (Old World) ..... 6
  - White pm. spots in cells  $M_1$  and  $M_2$  rounded, always well separated, and similar to the ones just beyond cell (mostly New World) ..... 11
  - 6. Under side of hind wing with a series of tawny postmedial spots, largely enclosed in black, and contrasting with the white or whitish ground; the terminal area brown; veins of hind wing above thin ..... *affinis*
  - Ground of under side of hind wing more often tawny, never with a series of definite discolorous tawny spots, though sometimes shading imperceptibly from white into tawny; ground of terminal stripe black; veins of upper side heavily black .. 7
  - 7. Fascia pointing at the pm. spot in cell  $M_3$ ; the latter opposite the outer end of the spot in cell  $M_2$  when that spot is long (as usual) ..... *genutia*
  - Fascia further out, the pm. spot in cell  $M_2$  opposite its inner end, or obliquely in from it when small;—its *outer* end continuous with the upper st. spot ..... 8
  - 8. Under side nearly evenly deep chestnut brown (with the usual white spots) the terminal area concolorous, the upper side almost as even (New Guinea) ..... *molyssa*<sup>16</sup>

<sup>16</sup> The National Museum has a race or closely related species from Sumbava, intermediate to *haruhasa*; under a ms. name of Neumoegen's.

- Terminal stripe of hind wing below black, contrasting with disc ..... 9
- 9. Veins of hind wing above broadly black, much broader than on fore wing; under side with broad shades of tawny, as in some *genutia* forms ..... 10
- Veins of hind wing above thinner than on fore wing, linear in center of wing. All specimens seen with deep mahogany ground, and mostly with sharply defined white spots and rays about end of cell below ..... *philene*
- 10. Ground at least of fore wing tawny or brown ..... *melanippus*
- Ground of both wings white ..... *lotis*
- 11. Body black above with yellow rings. Fore wing with white spotting reduced, the pm. with 4 dots (in cells M<sub>1</sub>-Cu<sub>1</sub>) only, and the st. and t. dots also obsolete, except for a strong apical dot below; ground fuscous shading into dull clay.  
*haruhasa*
- Body even or broadly shaded, usually red-brown, rarely black (*cleophile*), or white when the hind wings are white; markings of fore wing as strong as on hind wing; the st. and t. dots numerous ..... 12
- 12. Old World. Apical white dot much more conspicuous than the others; ground dark red-brown, evenly laid on ..... *mytilene*
- New World. Apical white dot not or scarcely enlarged, not at all distinctive; ground of fore wing light enough so that the blackish border contrasts decidedly ..... 13
- 13. Ground of abdomen and inner margin of fore wing black.  
*cleophile*
- Abdomen and inner margin of fore wing tawny or brown, concolorous ..... 14
- 14. Under side of hind wing with a series of small contrasting white postmedial spots ..... *plexaure*
- Under side with a series of very large, faintly paler spots.  
*eresimus*
- Under side with no trace of *postmedial* markings, sometimes with white spots grouped about end of cell ..... *gilippus*

*D. erippus* Cramer. The famous milkweed butterfly, or Monarch, is in a complete state of nomenclatorial snarl, since the oldest references to it were invariably confused with other related or similar species. Linnaeus included it in *plexippus*, but that name is claimed by the Old World *genutia* with at least equal right. I am inclined to drop it as of hopelessly uncertain identity; whatever the name may

have meant to Linnaeus it is certainly a composite. Next we have *erippus* of Cramer, an undisputed name, but belonging to the extreme southern representative of the group generally treated as a distinct species. Then comes *archippus*, but this was intended for the Viceroy, and its use for the Monarch must be treated as a homonym, or more probably a misdetermination. Next comes Hübner's "Verzeichniss." He proposes the name of *menippe*, including in it the North American race of the Monarch, but unfortunately his first citation under it is Cramer's figure of *erippus*;—he transfers the name *erippus* to *berenice*. If we accept Kirby's restriction (in Hübner's Samml. Exot. Schm. ed. ii, vol. 3, p. 4) this is the name we must use for the northern Monarch, otherwise it is nameless. On a later plate (ii, pl. 220, 1826) Hübner proposes the name *megalippe* for the race from northern South America.

The following key brings out the normal differences between the three chief races, but they intergrade completely. The northern one is well known to be a migrant, but the central one varies so much from place to place that it is evidently sedentary as a rule. Austin Clark reports (in lit.) that race *megalippe* exists in a definite colony in eastern Virginia. If so its failure to be lost among the normal Monarchs shows it must be sedentary here.

Of the minor names, *fumosus* Hulst. was intended for an aberration of the North American race; in fact it is the dominant female also in the races from Lima, Peru, and Vieques Id. and St. Thomas. From the latter island Butler gave it the name of *leucogyne*. In Porto Rico only a few miles away, the female is normal. The name *americanus* Gund. was given to a suffused aberration, *nivosus* Gund. (not *nivosus* G. & S.) to one with white ground.

Haensch overlooked the name *megalippe*, and renamed it *nigripus*. Hulstaert also failed to recognize the synonymy, and besides gives Central and South America and the Antilles wrongly for *erippus*, which seems in fact to occur only south of the Amazon.

## KEY

1. Inner margin of fore wing concolorous, or somewhat suffused with darker brown (South America from Pará south) ..... *erippus*
- Inner margin of fore wing black ..... 2
2. Postmedial spots of fore wing light tawny, but little paler than ground (U. S.; Cuba and Mexico—with the following; introduced widely in Old World) ..... *e. menippe*
- Postmedial spots of fore wing cream or white; the border more solidly black (West Indies to Amazons and Peru, perhaps sporadic colonies in U. S.—Virginia) ..... *e. megalippe*

*D. cleophile* Godart. This species has always been compared with the preceding, on account of the black body and inner margin of the fore wing, but in wing-form, venation and presence of a postmedial white spot in cell  $M_1$  of fore wing it agrees with the following. The latter spot is absent in a single specimen seen and minute in two more. The species differs from all the other Danai known to me in having a large contrasting pale patch in the fork of Sc below, though *D. affinis* has a white splash at the same place. Hulstaert gives the locality as "Antilles" but all the specimens I have seen with authentic locality are from Haiti and San Domingo. A stray female labelled "Jamaica, Thaxter" looks exactly like normal Haiti specimens and is doubtless the victim of an accident in labelling.

*D. gilippus* Cramer. As Bates notes (The Butterflies of Cuba, Bull. M.C.Z. 78 (2): 146, 1935) this is certainly a single locally variable species, covering the *gilippus*, *berenice*, *hermippus*, *xanthippus* and *cleothera* of Hulstaert and others. M. LeCerf has kindly lent me an authentic *cleothera* from the Paris Museum, and it is plainly this species, not *eresimus* as apparently assumed by Hall in describing *kaempfferi*. The distribution of the races is erratic, especially in the Antilles, where the Haitian *cleothera* has nothing special in common with the Cuban *berenice* or Jamaican *jamaicensis*, and these latter represent the two extremes of the *berenice* "exerge."

There are three main groups of races; the *berenice* group, rather evenly Indian red, with weak veins and little white spotting; the true *gilippus*, with similar ground color, but much white spotting about end of cell, and the *cleothera* types with more orange-tinted ground and heavy dark veins. The first two occupy the ends of the distribution area, while the third is typical of the middle, but areas interlock, and there is a good deal of blending of the two northern types in the Andean region. Hall gives the absence of the lower discal spots on under side of fore wing as a point to distinguish *kaempfferi* (i.e., typical *cleothera*) from the other races; the difference holds normally but not strictly, like so many racial differences.

## KEY

1. Hind wing above with a group of 3 to 6 white spots about discocellulars. Ground pale Indian red with narrow but distinct black veins (Brazil, from Pará south) ..... *gilippus*
- Hind wing above without white spots at end of cell, below at most with weak spots, or with white streaks along the veins<sup>17</sup> ..... 2

<sup>17</sup> The National Museum has a female from Loja, Ecuador, and one without locality that are transitional, with the group of white

2. Ground color mostly orange-ochre to tawny, the apex and costa contrasting dark red-brown; veins heavily dark ..... 3  
 – Ground color rather Indian red, without orange tint, varying from light leather color to deep mahogany, the costa as a rule not noticeably darker ..... 4
3. Fore wing at least on under side, with white pm. spots in cells  $Cu_1$  and  $Cu_2$  (Colombia to Trinidad)<sup>18</sup> ..... *xanthippus*  
 – Fore wing without these two spots (Haiti) *cleothera (kaempfferi)*
4. Hind wing with black veins thickened, strongly contrasting, the white edging when present suffused ..... 5  
 – Hind wing with black veins linear, not at all contrasting, the accompanying white lines when present, also linear ..... 6
5. White spotting on fore wing moderate (Colombia) *hermippus*<sup>19</sup>  
 – White spotting of fore wing very large, the pm. spots larger than the space between them, the st. dots also enlarged at middle of wing (W. Colombia to N. Peru) ..... *nivosus*<sup>19</sup>
6. Ground deep mahogany red (Fla., Cuba, Bahamas, and Isle of Pines; Costa Rica and Panama)<sup>20</sup> ..... *berenice*  
 – Ground pale Indian red, the veins of hind wing normally edged with white (Arizona to Costa Rica)<sup>20</sup> ..... *strigosa*  
 – Ground evenly pale leather brown, the black border frequently obsolete; generally small (Jamaica) ..... *jamaicensis*

I judge *thersippus* Bts., from Panama to be merely the normal dark *berenice* like the Costa Rica specimens examined. If there is any difference it will serve for the Costa-Rican subrace, *berenice* for that from Florida and the Antilles. I take *centralis* J. & T. to be

spots, but a still paler color, approaching *nivosus*. They probably represent a case of parallel variation, not continuous with the general area of *g. gilippus*.

<sup>18</sup> Omitted from Kaye's list, but in the Hope Museum from La Brea, Trinidad; also reported by Joicey and Talbot, as *centralis* J. & T.

<sup>19</sup> These forms intergrade and interlock in distribution and also interlock with *g. xanthippus*; but any one block of specimens runs relatively constant. The National Museum also has an ultra-form of *nivosus* from Cuzco, Peru, with the ground almost wholly white except the cell of the fore wing, and the st. and t. spots also much enlarged.

<sup>20</sup> The difference in color is more striking when viewed in an extremely dim light, then the ground of *berenice* goes black, while *strigosa* seems even paler.

merely *xanthippus*, since my specimen from Pitotán, Venezuela, not too far from the type locality, is as light as normal *xanthippus*.

*D. plexaure* Gdt. This species replaces *eresimus* locally, but the difference is so striking that I treat it as a good species. The Tring Museum reports a specimen transitional to *gilippus*, but I have never seen one. Pará to Corrientes, Argentina.

*D. eresimus* Cramer. The color forms of this show a distinct tendency to parallel those of *gilippus*,—except its type race, which matches the range of *D. plexaure*. While the key difference is clean-cut, and almost always easy to see, it is frequently overlooked (I suppose because it is visible only below) and few collections show pure series. The series that I treat as *e. eresimus* can be further divided, especially in the shade of brown ground, for instance Cuban specimens are much darker than those from Haiti and Jamaica. These lighter ones are perhaps *kaempfferi* Hall, but he does not mention the spots below, and the description suggests *cleothera* rather than *eresimus*. The new race from the Middle Amazon is the most distinct of all. Most of the specimens seen may belong to a single collection (they were distributed through dealers) but very few have locality labels of any value.

KEY

1. Wings above heavily shaded with black between the two series of marginal spots and along border, at least; hind wing below warmly colored, tawny to red-brown ..... 2
- Wings above with black shading confined to extreme margin and costa; hind wing above with outer part noticeably lighter tawny, below leather brown without orange or red tint; white markings conspicuous, sometimes with the st. and t. dots on fore wing partly fused (Amazons).....**dilucida**, n. ssp.
2. Hind wing with subterminal as well as terminal white dots conspicuous, apex of fore wing more black, hind wing more tawny (arid West Peru and West Ecuador) .....*erginus*
- Hind wing with subterminal dots largely lost, terminal series sometimes incomplete; ground usually even brown, with less black in apical area (Florida to Amazons) ..... *eresimus*

*Danaus eresimus dilucida* (Stgr. ms.), new race.

Ground mahogany brown, shading into bright tawny toward anal angle of fore wing and on outer third of hind wing; apex of fore wing also lightened. White spots in the usual positions, pure white, large and strongly contrasting, the ground about

them somewhat darkened toward costa but not black; st. and t. series fairly complete on fore wing, the middle st. ones somewhat enlarged, and occasionally joining the corresponding terminal ones; outer margin shading into dark brown. Hind wing with the pm. spots of under side repeated as vague pale shades, and also sometimes with similar pale shades about end of cell; st. dots mostly faint or obsolete in the tawny ground, but terminals more distinct, usually a complete series but not really white. Beneath, fore wing except apex as above, but with even less dark shading; apex and hind wings pale dull brown, with fine black veins; the st. and t. spots in a complete series and white on both wings, the ground not at all darkened around them. Postmedial patches on hind wing pale dirty buff, not at all shaded with paler or defined with darker, sometimes with smaller similar spots grouped at end of cell. Expanse 60-80 mm.

Type male and 3 paratypes, Santarem, Amazonas, Brazil (F. Knab) in U. S. National Museum; 12 other paratypes without authentic localities in U. S. National Museum, Museum of Comparative Zoology and Cornell University Collection. One is labelled "Amazon" one "Brazil" and two bear the determination "*dilucida*."

Cornell has one specimen of *eresimus* from Bocas, Panama, with the ground evenly as dark as the local *berenice*, and the usual white pm. spots in cells  $M_3$  and  $Cu_1$  lost. It may possibly represent a fourth distinct race. From Godman and Salvin's remark in the *Biologia* they probably included such specimens in "*cleothera*."

The Old World species of true *Danaus* appear to be a homogeneous group, though hardly worth a subgenus (*Danaus* against *Tasitia*) as the only tangible difference is the emphasized apical dot on the fore wing. The key separates most of the species along the lines recognized by Hulstaert, except in the case of *genutia* (*plexippus*). This is certainly two species, marked by the different relation of the white fascia and the spot in  $M_3$ , the fascia being continued by the postmedian spot in *genutia*, the subterminal in *philene*. I have entered the names of *molyssa* and *mytilene* in the key, but believe them only rather divergent pattern-types of *philene*. *D. ismare kotoshonis* Mats. (*kotoshoensis* on the plate) in *Ins. Mats.* iii 4: 1, is obviously not a form of *ismare* but a normal *Danaus*. I believe it is *affinis*, though the under side is neither described nor figured.

*D. genutia* Cr. Normal forms of this species run as far east as Tenimber in the Lesser Sunda Ids., but stop short of the Celebes, which have a couple of large races with the pm. fascia more erect than the others (though the spot in  $M_3$  is in line) and the cell of the

hind wing white. From the Moluccas and east the *philene* group of forms come in.

*D. philene* Cr. Fruhstorfer makes three species out of this complex, Hulstaert combines all three with *genutia*, as *plexippus*. While Fruhstorfer gives genitalic differences in "Seitz" he sometimes allowed too little for individual variation and the characters should be checked. Typical *philene* is Moluccan, but *philene*-like forms reappear in eastern New Guinea; the intervening strains, mainly from Dutch New Guinea, tend to be darker. For analysis see Fruhstorfer in Berl. Ent. Zeit. 44: 64-83, 1899; Iris 19: 161-202, 1906; Seitz' Macrolep. World 9: 197-199, 1910.

*D. melanippus* Cr. and *lotis* Cr. are hardly more than representative species, but the distributions interlock, and Fruhstorfer reports both from the Natuna Ids. In some strains of *lotis* the veins are no darker on the hind wing than the fore wing, but only when both are very heavily shaded.

*D. affinis* F. Hulstaert questions the distinctness of this species from *philene*. I believe the latter is rather the representative of *genutia*, while *affinis* overlaps the distribution area of both and remains distinct. The orange spotting on the border below varies in extent, but so far as I have seen is always separated either by a black line or a *sharp* change of color from the paler areas of ground color. Many of the races have been assigned without any note of this character, and I suspect some of the names should be interchanged between *affinis* and *genutia-philene*.

*D. haruhasa* Doh. A very distinct species from *melanippus* and *lotis*, between which it now stands. The wings are lengthened and coloring dull. It plainly belongs to the Celebesian fauna in characters, but instead is found in the Lesser Sunda Ids., which generally when they have special forms vary in the opposite direction. Note *Cethosia myrina* and *lamarcki justa*.

*D. (Limnas) chrysippus* L. This species needs no comment.

*D. (Nasuma) ismare* Stoll. The usual exaggerated type to be expected in the Celebes. Matsumura's race *kotoshonis* must be excluded, being a normal *D. (Danaus)*. The wing form suggests *Anosia*, but the more important characters do not, and I fully believe the larva will be found similar to *genutia*, with 6 filaments.

#### *Amauris* Hübner

A slight variant of *Danaus*, intermediate in most characters between *D. (Danaus)* and *D. (Parantica)*. It would hardly have



been held so long were it not for the different caterpillar and the fact that no primitive *Danaus* are found in Africa to make the connection. Of the four main subgroups it comes nearest to typical *Danaus*, though it lacks any trace of the pocket, and therefore cannot be derived from it.

Aurivillius' analysis in the *Rhopalocera Aethiopia* 34-40, and in Seitz 13: 73-78, is so complete that further comment would be out of place.

## PLATE XII

*Explanation of Symbols**Danaus erippus*

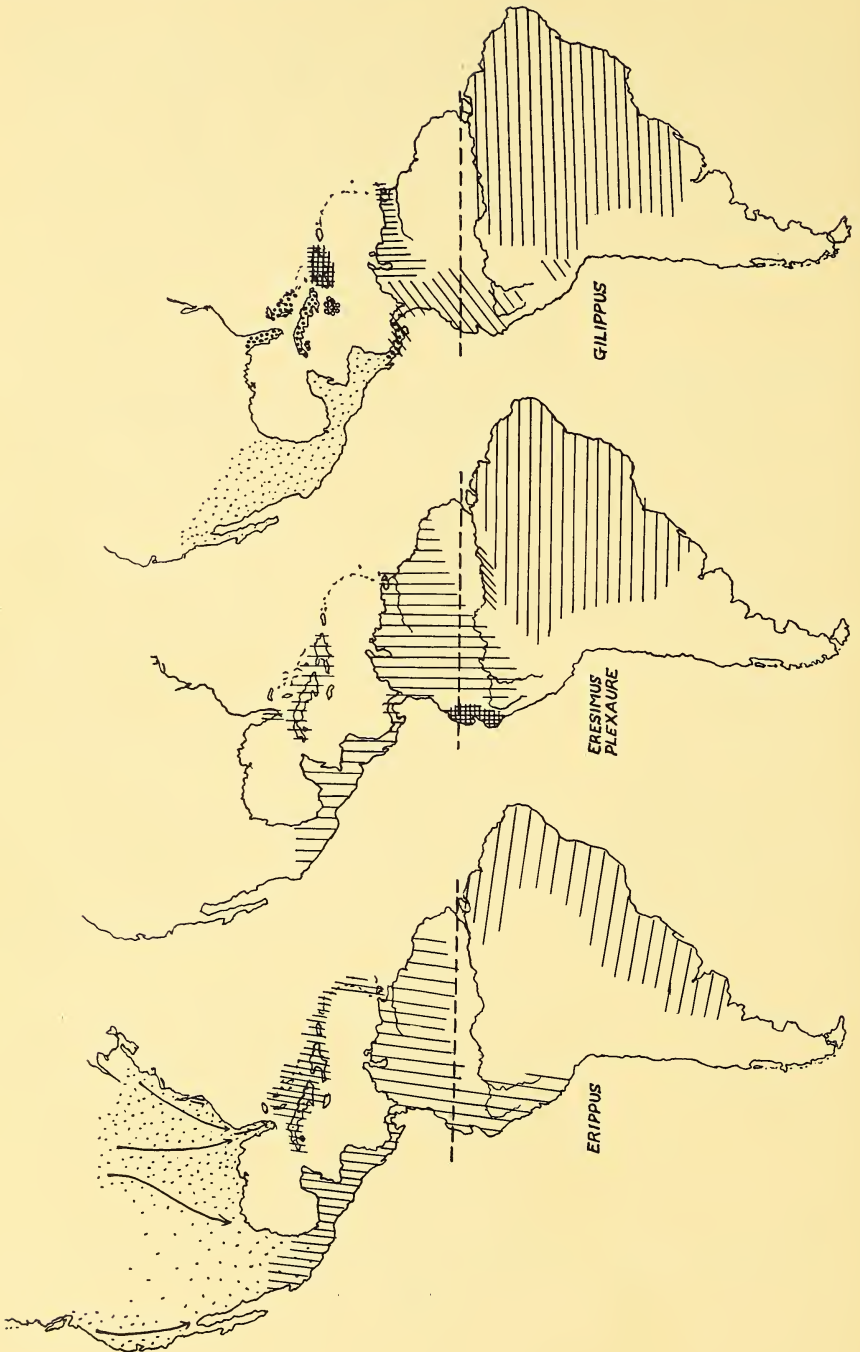
|                   |                          |                           |
|-------------------|--------------------------|---------------------------|
| Dotted            | <i>menippe</i> (Monarch) | } <i>megalippe</i> exerge |
| Vertical ruling   | <i>megalippe</i>         |                           |
| Horizontal ruling | <i>erippus</i>           | <i>erippus</i> exerge     |

*D. eresimus* and *plexaure*

|                   |                 |                   |
|-------------------|-----------------|-------------------|
| Vertical ruling   | <i>eresimus</i> | } <i>eresimus</i> |
| Cross-hatched     | <i>erginus</i>  |                   |
| Oblique ruling    | <i>dilucida</i> |                   |
| Horizontal ruling | <i>plexaure</i> | <i>plexaure</i>   |

*D. gilippus*

|                   |                     |                           |
|-------------------|---------------------|---------------------------|
| Dotted            | <i>strigosa</i>     | } <i>berenice</i> exerge  |
| Heavy dots        | <i>berenice</i>     |                           |
| Open circles      | <i>jamaicensis</i>  |                           |
| Cross-hatched     | <i>cleothera</i>    | } <i>cleothera</i> exerge |
| Oblique ruling    | <i>nivosus</i> etc. |                           |
| Vertical ruling   | <i>xanthippus</i>   |                           |
| Horizontal ruling |                     | <i>gilippus</i> exerge    |



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# ENTOMOLOGICA AMERICANA

VOL. XIX

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A SYNOPSIS  
OF THE  
HEMIPTERA—HETEROPTERA  
OF

America North of Mexico

BY J. R. DE LA TORRE-BUENO

PART I

Families Scutelleridae, Cydnidae, Pentatomidae,  
Aradidae, Dysodiidae and Temitaphididae

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## PREFACE

For the average entomologist, the determination of Heteroptera is becoming more and more difficult. Descriptions of species multiply; and it becomes almost impossible for anyone without an extensive library and much time to spare to do the work. This Synopsis is intended to lighten the labor and research demanded for naming specimens.

The arrangement of the families and genera follows closely Van Duzee's 1917 Catalogue. Species within genera may be systematically arranged in the collection in their linear order according to Van Duzee, or by any monograph since that date. Nomenclature also adheres closely to this Catalogue. Where any changes have been made, they follow synonymies or descriptions since that time, except where such changes have not been established satisfactorily or are matters of opinion, in which cases Van Duzee has been accepted. This Synopsis introduces *no* innovations of its own, either in classification or in nomenclature—the author believes that all such changes should be made only in monographic, revisional or avowedly synonymical work, thoroughly documented and reasonably established. Such changes should also be independent of personal bias or prepossession, and thus completely objective.

Synonymy is already sufficiently cluttered with "emendations" and new names, the fruit of personal likes and dislikes or of the application of rules which should not and do not apply. Changes should neither be made nor accepted just because some type, or alleged type, is lost or destroyed. As an example of such methods, take *Gerris*: Because this name was applied to sundry genera in various families, Stål rejected it and termed the water-striders *Hygrotrechus*, just for that reason. If this idea be applied universally, stability in nomenclature vanishes, rules or no rules. Manifestly, such a point of view leads to endless change, because anyone can pick out a number of generic names which have been variously employed, reject them, and establish an entirely new series of such names.

Meditate on what would happen to *Cimex* Linné if the principle of lost types were applied to that name! There is no type extant; it does not agree with the original description since it does not have four wings; and the name has been indiscriminately employed in other families. Let us, therefore, in the modern manner term it *Bedbugius*; let us call the pentatomid genera *Feldbugius*, *Wanzenus*, ad lib. But there is far too much work to be done in insect bionomics to waste time in such preciosities.

The only departure from the Van Duzee arrangement is in the Subfamily Thyreocorinae, in which McAtee and Malloch are followed in the order of the genera and in the nomenclature. The keys for this group closely follow theirs, except for the changes necessary to restrict them to the genera and species north of Mexico only. The McAtee and Malloch keys are hard to use in practice; and these recasts will be found no simpler.

In general, these keys in the Synopsis are either original or expanded recasts of extant keys, in a uniform manner. The author's indebtedness to the many writers past and present, whose work has so largely helped in their preparation, is here sincerely acknowledged. These number Stål, Horváth, Uhler, Hungerford, Barber, Van Duzee, Parshley, McAtee, and Malloch—men whose pioneer work has laid the broad foundation on which their successors may build.

#### INTRODUCTION

The purpose throughout this Synopsis has been to use only such characters and structures as are readily accessible, plainly visible, and clean-cut; in other words, to be clear. Wherever it has not been done, it has been because no specimens were in hand and the characters have been abstracted from descriptions. So far as possible, all keys have been tested for workability in actual practice, with specimens in hand.

The use of abstruse or hidden characters hard to put into words, such as genitalia, trichobothria, intestinal caeca, hami in the hind wings, venation of hind wings, etc., etc., has been avoided. Such characters in themselves are taxonomically perfectly valid and are in no way questioned. But they demand special techniques, not commonly known; they are time-wasting; and at best uncertain except in the hands of the most expert entomologists, which few of us are. Furthermore, many of us working with heretofore not seen forms, need at hand a ready and comprehensible means of naming such specimens without undue labor.

In working up these keys, it has been found that there are no comprehensive ones for any major group—far too often references in catalogues are to other catalogues, or even only to bare faunal lists; some of these refer only to the original generic or specific characterizations, which become more succinct and fragmentary as we go back in time. As an example, go back 100 years to the Hope Catalogue, by Westwood. Nowhere in these pentatomid descriptions do we find a structural character, with the sole exception of the length! Now and then we come across descriptions within the last 20 years which do not mention even that!

Certain of these descriptions, ancient and modern, run something like this: "Similar to *suppositus* (ante) but larger; may not be a different species; length, 7 mm." In Van Duzee's Catalogue there are many questioned references to Walkerian species. A number of these had to be omitted from the keys because of their uncertainty. Again, the sole reference is to Walker; and while to judge from the extended records, the species might seem to be widespread, nowhere has anyone seen fit to make a new or intelligible description. In the end, this leaves us entirely dependent on some named specimen, which may have been misidentified at that. It would be prolix to list examples, but anyone who has access to Van Duzee's great Catalogue may find them there by the dozen. When it comes to the ancients, without particularizing names, let us take one well-known species. There are seventeen references to this, beginning with Fabricius in 1775 and ending with Zimmer in 1912. Five of these references are to bare faunal lists; the remaining seven antedate Stål! And its four synonyms with another ten references, go back to Fabricius in 1803 and Palisot de Beauvois in 1805, coming down to Walker in 1867 and Stål in 1868. In none of these is there an adequate description of the species! The first good description of the species is Stoner's, in *Scutelleroidea of Iowa*, in 1920! In the interval between, we either took it on faith, or we endeavored to dig it out of this early fog! Or take another species. This has four references—to Westwood's original description in 1837, to Dallas 1851, to Stål 1872, and to Herrich-Schaeffer 1853 (a synonym), and to three faunal lists, one annotated. And nothing since!

The principal purpose of this Synopsis is to overcome these difficulties, which have done so much to retard the progress of hemipterology here and abroad.

Consider: there are only four adequate synopses of Heteroptera extant—Saunders, for the British Isles; Puton for France; Fieber for Europe; and Stål for Africa! Everything else is monographic work for families or genera, or else is scattered descriptions of single species or of groups of species. Even *Biologia Centrali Americana* goes but little further than this fragmentary descriptive stage!

#### *Structures*

This Synopsis is intended to be a ready, simple, accurate and direct means by which to identify unknown specimens. The better to carry out this purpose, here follows an explanation or description of the structures used in the keys. These apply to the Heteroptera only. General terms are not included; such may be found in full in



“A Glossary of Entomology,” published by the Brooklyn Entomological Society. While this is true also of the names of structures, these are here defined more strictly, or explained more at length. For ready reference, these structures are listed alphabetically, rather than in the natural sequence or relation of the structures one to the others.

To further clarify the terms, diagrammatic but true figures are also given. These figures are to be used as guides to the structures and parts, and are not to be considered as exact reproductions of any one specimen. Their purpose is to bring out structure, form and position. The number of the *figure* showing the structure follows its definition. In these figures and in the keys, all segments are numbered from *base* to *apex* in Roman numerals (I, II, etc.).

(NOTE: It has not been possible to give the width, and in some instances, the length, of species unknown to me from specimens, because one or the other is not given in the original or other descriptions.)

*Abdomen*—the third and last of the three major divisions of the insect body; used in the keys in that sense *only*. (Figs. 1 and 2.)

*Anastomosing*—running into each other and touching, or merging into one.

*Abdominal groove*—in Pentatomoidea (and in other groups), a linear median longitudinal channel on the venter, in which the rostrum lies, in certain instances, when it is extended onto the venter.

*Acetabulum*—the cup-shaped cavity in each of the thoracic sterna into which a coxa fits.

*Alveolus*—a cell similar to that of a honeycomb.

*Antennae*—the paired, long, segmented anterior appendages of the head; the feelers. (Figs. 2, 7, etc.)

*Antennal tubercles*—the elevated places or structures from which the antennae arise, to which these are connected by a joint. (Fig. 7.)

*Anteocular*—on the head, in front of the eyes.

*Apex*—that part of any organ or structure farthest from the body, from its point of attachment, or from its own base.

*Apical*—of the apex, or at or near it.

*Appendage*—any part, segment, structure or organ attached to the body or to any main structure by a joint; such as legs, antennae, arolia, etc.

*Apterous*—wholly without wings.

*Areola, areole*—any small closed cell; specifically on the wings, especially in the membrane of the hemelytra in Heteroptera.

- Arolia*—cushion-like pads on the tarsi, between the claws; sometimes reduced to bristles.
- Armature*—the spiny, hard, chitinous outgrowths or processes of the legs, wings or body of an insect.
- Asymmetrical*—unevenly developed on either of the two sides about an axis.
- Asymmetry*—an uneven development in the two sides of any body segment or segments, or in any appendage.
- Articulation*—the place or joint where segments are united to each other, or by or at which they are attached to the body; a joint.
- Basal*—at or pertaining to a base, or to the point of attachment to or nearest to, the main body.
- Base*—that part of any segment nearest to the body or to its point of attachment; of the head, its attachment to the thorax; of the segments of the thorax, that part nearest to the abdomen; of the scutellum, that part at the suture between it and the pronotum; of the abdomen, that part at its attachment to the thorax; of the abdominal segments, that part nearest to the thorax; of the genital segment, that part at its attachment to the abdomen.
- Body*—the trunk; the thorax and abdomen taken together, as distinguished from the head.
- Brachium*—the cubitus, which see.
- Brachypterous*—short-winged.
- Bucculae* (sing., *buccula*)—the more or less elevated ridges or plates on the under side of the head, on each side of the rostrum. (Figs. 1 and 17.)
- Callosity, callus*—a thick swollen lump on the hard outer parts of the body; a somewhat flattened elevation.
- Carina*—an elevated ridge, not necessarily high or sharp; a keel.
- Cell*—any area of the wing between or bounded by veins, any closed area; any part of the membrane of the hemelytra surrounded by a vein or veins. (Figs. 6, 7, 14, 15.)
- Cilia* (sing., *cilium*)—a long, slender, pointed hair, similar to an eyelash; series of such hairs arranged in tufts or single lines, or fringes.
- Claval suture*—the suture at the base of the hemelytra which separates the clavus from the corium. (Fig. 7.)
- Claval vein*—the longitudinal vein or thickening of the clavus, running close to, nearly parallel or at a slight angle to the claval suture. (Fig. 7.)
- Clavus*—the long, pointed cell in the hemelytra, lying close to the lateral margin of the scutellum when the wing is closed (Figs. 2, 7, 16.)

- Claw*—the hook-like structure or appendage at the apex, or near the apex, of the last tarsal segment. (Figs. 2, 8.)
- Clypeus*—the middle part or division of the head, to which the rostrum is attached or from which it arises, bounded laterally by the juga. (Figs. 2, 10, 16.)
- Closed cell*—in the hemelytra, a cell entirely surrounded by a vein or veins; specifically, in the membrane, a cell cut off before reaching the margin by the peripheral vein, the vein which goes entirely around the membrane at a short distance from its margin or edge in certain groups. (Figs. 7, 15.)
- Collar*—the narrow, ring-like anterior part of the prothorax, next to the head, generally set off by a groove. (Figs. 7, 10, 16, 17.)
- Collum*—see neck.
- Commisure*—the straight line of meeting of the hemelytra at the clavus and behind the apex of the scutellum. (Figs. 6, 7, 16.)
- Compound eye*—the large lateral eye on each side of the head, made up of a varying number of small eyes or lenses, termed *ommatidia*. (Figs. 1, 2.)
- Connexivum*—the prominent, more or less flattened, margin of the abdomen in the Heteroptera, at the juncture of the dorsal and ventral plates. (Fig. 2.)
- Coriaceous*—leather-like, thick, tough and stiff.
- Corium*—the thickened basal part of the hemelytra, as distinguished from the membrane, the thin, more or less transparent apical part. (Figs. 2, 5, 6, 7, 10, 15, 16, 17.)
- Costa, costal vein*—the vein extending along the outer margin of the hemelytra. (Fig. 7.)
- Costal area*—the area in the hemelytra lying between the costal vein and the costal margin.
- Costal margin*—the outer margin of the hemelytra.
- Coxa*—the small basal segment of the leg; the first segment of the leg which forms the connection with the body, that is, with the thorax. (Figs. 1, 10, 11, 17.)
- Coxal cavity*—the acetabulum, q.v.
- Coxal cleft*—a slit in the wall of the acetabulum, perpendicular to its edge. (Fig. 17.)
- Crown*—in the eggs of certain Heteroptera, the series of erect filaments surrounding the upper or micropylar end.
- Ctenidia* (sing., *ctenidium*)—combs of short flat spines. (Fig. 3.)
- Cubitus*—the vein on the corium nearest the claval suture, continued on the membrane to bound the areoles; also called brachium. (Fig. 7.)

- Cuneus*—the small triangular or wedge-shaped area at the end of the embolium of the hemelytra. (Fig. 7.)
- Disc, discal area*—in any surface, the middle area; all the area within a margin.
- Discal elevation*—in Tingitidae, the middle area of the hemelytra, raised above the surrounding areas. (Fig. 11.)
- Discoidal cell*—any outstanding closed cell in the wings.
- Dorsum*—the back; the upper surface; the upper surface of the abdomen, as distinguished from the lower, termed the venter.
- Embolium*—the narrow area along the outer margin of the hemelytra. (Fig. 7.)
- Empodium*—a process or structure set between two claws. (Fig. 8.)
- Epistoma*—the lower face between the mouth (or rostrum) and the eyes; the clypeus in Heteroptera.
- Evaporative area*—a more or less marked area about an ostiole and its canal, generally dull and more or less striated or pitted.
- Exocorium*—a narrow lateral area of the hemelytra; the outer margin of the corium.
- Eyes*—the compound eyes, q.v.
- Feet*—in general, the legs; the tarsi with the claws. (Fig. 2.)
- Femur* (pl., *femora*)—the first long segment of the leg, following the coxa and trochanter; the third segment from the foot, counting the tarsal segment and its parts as one. (Figs. 2, 6, 17.)
- Flabella*—flattened extensions of the margins of the body.
- Fossorial*—adapted or formed for digging; applied to the thick and spiny front legs of certain Cydnidae.
- Fracture*—in Miridae, the suture or indentation in the hemelytra separating the cuneus from the corium. (Fig. 7.)
- Frenum* (pl., *frena*)—the lateral groove in the under side of the margin of the scutellum into which fits or catches the channeled locking device on the upper edge of the clavus. (Note: This definition corrects that in "A Glossary of Entomology," p. 107.)
- Front*—the anterior part of the head between the bases of the antennae and below, or in front of, the ocelli. (Fig. 2.)
- Fulcrum*—see trochantine.
- Gena* (pl., *genae*)—the cheeks (*not* the jugum); that part of the head on each side, below the eyes, extending to the gular suture. (Fig. 10.)
- Genital segment*—the complicated last segment of the abdomen, characteristic of the sexes. (Fig. 1.)
- Glandular opaque spots*—in Lygaeidae, two or three spots on the sides of the venter on the fourth segment (segment IV), near the spiracles of ventral segments III and IV. (Fig. 17.)

*Gula*—the throat; the sclerite forming the central part of the head beneath, laterally bounded by the genae.

*Gular suture*—the suture separating the gula from the gena on each side.

*Hamus*—a hook; specifically, the spur or short vein, sometimes acute, going or projecting into the middle cell of the hind wing in Heteroptera. (Fig. 14.)

*Head*—the first of the three main divisions of the insect body, which bears the rostrum and sense organs. (Figs. 1, 2, etc.)

*Hemelytra, hemiclytra*—the anterior wing in the Heteroptera, which has the basal part more or less hardened and coriaceous and the apical part membranous; sometimes entirely membranous, as in the Tingitidae and Enicocephalidae; the first spelling is used throughout; the terms *elytra* and *tegmina* are rejected. (Fig. 1, etc.)

*Hood*—in Tingitidae, that part of the pronotum which extends more or less over the head. (Fig. 12.)

*Humerus*—the shoulder; in Heteroptera, the outer lateral angle of the prothorax. (Figs. 1, 2.)

*Humeral angle*—see humerus above.

*Insertion*—the point or place at which a movable part is inserted or set into another.

*Joint*—the flexible point at which any two segments are united.

*Juga* (sing., *jugum*)—the lateral lobes of the head at each side of the tylus. (Figs. 2, 16.)

*Keel*—a carina, q.v.; an elevated ridge on a structure.

*Leg*—one of the jointed segmented appendages for walking or swimming, from the coxa to the claws. (Fig. 2.)

*Linear*—line-like; extremely narrow and long.

*Lobe*—any prominent rounded process on a margin or on a structure.

*Lunate vitta*—see strigose lunate vitta.

*Macropterous*—long or large winged; in Heteroptera, having fully developed wings.

*Median furrow*—in Heteroptera, an impression which separates the embolium from the rest of the corium.

*Membrane*—any thin tissue; in Heteroptera, the thin more or less transparent apical area of the hemelytra, as distinguished from the opaque corium. (Fig. 2, etc.)

*Mesosternum*—the lower side of the mesothorax.

*Metasternum*—the lower side of the metathorax.

*Mesothorax*—the second ring of the thorax, which bears the middle legs and the hemelytra or first pair of wings.

- Metathorax*—the third or posterior ring of the thorax, which bears the hind or third pair of legs and the hind wings.
- Micropterous*—small winged; in the Heteroptera, having very small wings as compared to the fully developed wings in the species; sometimes wrongly used in the same sense as brachypterous.
- Moniliform*—beaded like a necklace; specifically, of antennal segments.
- Mucro*—a straight or curved, stout, pointed process.
- Mucronate*—terminating in a sharp point or mucro.
- Neck*—the contraction of the head back of the eyes, where it connects to the thorax; the collum. (Fig. 16.)
- Notum*—the back or tergum.
- Occiput*—the back of the head between the vertex and the neck.
- Ocelli* (sing., *ocellus*)—the simple eyes, of which there are two in certain families of the Heteroptera, generally set on top of the head, near the large compound eyes. (Fig. 2.)
- Orificial canal*—ostiole canal, q.v.
- Omphalium*—in certain families of the Heteroptera, the elevated median stink-gland-opening in the metasternum posteriorly; an unpaired median ostiole.
- Ostiole*—in the Heteroptera, one of the lateral openings of the scent gland in adults, on the metasternum, near the coxae; in the nymph, these openings are paired and dorsal on the abdomen. (N.B.—In general, this is the most certain way to distinguish nymphs from apterous adults). (Fig. 1.)
- Ostiole canal*—a furrow, groove or channel, sometimes with high sides, leading from an ostiole. (Figs. 1, 17.)
- Ostiole peritreme*—the thickened and sometimes furrowed border or area about an ostiole. (Fig. 9.)
- Ovipositor*—the egg-laying structure, generally a sharp slender piece or complex structure hidden in a slit at the end of the abdomen beneath.
- Pala*—the shovel-shaped, or scoop-shaped anterior tarsal joints in Corixidae. (Fig. 4.)
- Paranota*—in Tingitidae, the flattened or laminate margins of the pronotum, more or less upwardly bent. (Fig. 12.)
- Peritreme*—the horny area, sometimes raised, surrounding a spiracle or other body opening. (Fig. 9.)
- Pleuron* (pl., *pleura*)—the side of the thorax; the side of any segment of the body, lying between the dorsum and the sternum.
- Proboscis*—the rostrum, q.v.
- Pronotum*—the dorsal or upper part of the prothorax.

- Prosternum*—the lower or ventral surface of the prothorax, between the anterior legs.
- Prothorax*—the first or anterior segment or ring of the thorax; it bears the anterior legs, but *no* wings; in Heteroptera, commonly termed “the thorax”; cf. *pronotum*.
- Radius*—the third of the longitudinal veins of the hemelytra. (Fig. 7.)
- Rostrum*—the segmented, long structure in Heteroptera, arising from the anterior part of the head, in which the modified mouth-parts (stylets) are carried. (Figs. 1, 10, 11, 17.)
- Scutellum*—the more or less triangular part of the mesonotum, generally lying between the bases of the hemelytra; in some groups more or less rounded and overlapping them or covering them completely. (Figs. 2, 6, 7, 10, 12, 16, 17.)
- Segment*—a ring or division of the body or any of its appendages, lying between areas of flexibility.
- Spiracle*—the opening of the respiratory system in the body-wall, in the segments; stigma. (Figs. 1, 10, 17.)
- Stenopterous*—with short or narrow but complete wings.
- Sternum*—the middle part of the lower surface of the thorax, between the coxal cavities; the entire ventral division of any segment.
- Stigma* (pl., *stigmata*)—a spiracle, q.v.
- Stink-gland*—the internal structure which secretes the malodorous protective fluids in the Heteroptera, opening externally by an ostiole.
- Strigil*—in Corixidae, a structure on the abdomen above, usually shaped like a currycomb. (Fig. 5.)
- Strigose lunate vitta*—in Lygaeidae, a crescent-shaped roughened area or stripe on the venter, running lengthwise on segments II and III. (Fig. 17.)
- Structure*—any of the parts of an insect, but particularly the appendages and growths therefrom.
- Stylet*—one of the highly-modified trophi or mouth parts of the Heteroptera, enclosed in the rostrum, sometimes visible.
- Subcostal area*—in Tingitidae, the narrow part or section of the hemelytra next to the costal area. (Fig. 13.)
- Sutural area*—in Tingitidae, the area of the hemelytra occupying the inner and apical regions, narrow in the short-winged forms, expanding into the apical area in the long-winged; corresponds to the membrane of the hemelytra in the other families.
- Suture*—a seam or impressed line indicating the division of distinct parts of the body-wall.

- Swimming hairs*—in the aquatic Heteroptera, the hair fringes of the swimming legs.
- Tarsus* (pl., *tarsi*)—the foot; the jointed appendages consisting of several, generally 2 or 3, segments, lying at the ends of the tibiae and bearing the claws and pulvilli. (Fig. 2.)
- Tergal*—at the upper part or dorsal surface of an insect; pertaining to that part or aspect.
- Tergum*—the upper part, back or dorsum of the body of any insect, or of any body segment.
- Thorax*—the second of the three main divisions of the insect body, bearing the legs and wings. In the Heteroptera it is sometimes used for the prothorax.
- Tibia*—the part of the leg between the tarsus and the femur; the second of the two principal segments of the leg. (Fig. 2.)
- Trochanter*—a small variously shaped segment in the leg, lying between the coxa and the femur. (Fig. 10.)
- Trochantine*—the basal part of the trochanter when it is divided into two parts; in older works on the Heteroptera termed the *fulcrum*. (Fig. 10.)
- Tylus*—the anterior central lobe of the head in Heteroptera, bounded laterally by the juga, from which it is separated by lateral sutures. (Figs. 2, 16.)
- Trichobothria*—symmetrically arranged seta-bearing structures on the venter in many Heteroptera.
- Vein*—one of the thickenings of the wings of insects, which serve to stiffen them.
- Venter*—the lower surface of the abdomen as a whole.
- Ventral spine*—in certain Pentatomoidea, a more or less acute projection from the first or second ventral segment, directed toward the head and lying between or toward the coxae. (Fig. 1.)
- Vertex*—the top of the head between the eyes, the front and the occiput. (Fig. 2.)
- Xyphus*—a spinous or triangular process in the mesosternum of many Heteroptera.

### *The Keys*

These keys are arranged in the form of pure dichotomies—that is, in directly contrasting couplets. They are also on a uniform plan. The given order of the structures as named is the same in each of the two members of a couplet. It will be noted that in one or the other term of a couplet, certain parts are enclosed in parentheses. These enclosed parts contain supporting characters, additional to the key



characters. These secondary characters are designed to cut off as far as possible any similar form that might lead to that member of the couplet.

Couplets are all numbered from 1 on. In some long keys next to the serial number of the couplet there is another number in parentheses; this is the number of the antecedent couplet which led to this point. This is given to make it simple and easy to go back to the antecedent couplet for any purpose.

## ORDER HEMIPTERA

## SUBORDER HETEROPTERA

## KEY TO THE FAMILIES

(The Old World Families Leptopodidae, Aëpophilidae and Helotrephidae are not included in this key; the first will run to Saldidae, and the last to Pleidae herein.)

1. Eyes, ocelli and scutellum absent; clypeus forming a movable apical lobe; at least head with ctenidia; hemelytra always short, without membrane; rostrum 3-segmented, shorter than the head; length, 2.5–4 mm.; parasitic on bats.

## XXIII. POLYCTENIDÆ Westwood 1874

Eyes always present, although the two ocelli may be absent; scutellum always present, although in some groups concealed; clypeus not forming a movable lobe; rostrum visibly 3- or 4-segmented; no ctenidia on head or thorax; apterous, brachypterous, stenopterous or macropterous; of varying food habits ..... 2

- 2 ( 1). Antennae shorter than the length of the head, simple, digitate or palmate, generally hidden in foveae beneath the head; metasternal orifices or ostioles absent; aquatic or littoral forms (*CRYPTOCERATA* Fieber 1851) ... 3

Antennae as long as or longer than the head, fully exposed; with or without metasternal orifices or ostioles; land, littoral and water surface forms (*GYMNOCERATA* Fieber 1851) ..... 10

- 3 ( 2). *With* ocelli, which are set *between* the large compound eyes; legs long and slender, adapted for running; not over 12 mm. long; species living on the margins of ponds or streams, usually found running over muddy places or concealed among pebbles and in the shore sand, in small holes made in the mud or sand ..... 4

Without ocelli between the compound eyes; hind legs generally flattened and fringed with swimming hairs (except in *Pleidae*, where the hind tibiae are round, and spiny or setose); of varying lengths, from 2 mm. to 40 mm. or 50 mm. or over; subaquatic species; predacious or phytophagous ..... 5

- 4 ( 3). Antennae free and visible, simple, 4-segmented; all legs long and slender; velvety-looking insects, black, marked and mottled with blue and yellow; rostrum long and slender, extending behind the posterior coxae; length, 3.5-5 mm.; predacious.

XXXIV. OCHTERIDAE Kirkaldy 1906

Antennae very short, simple, digitate or palmate, 3- or 4-segmented, concealed in foveae under the head; anterior legs raptorial; anterior femora stout or incrassate; rostrum short and stout, not extending much beyond the anterior coxae; rough-surfaced insects, mottled and colored in dull hues to harmonize with the sandy shores on which they live; size averaging 6-12 mm.; egg broadly oval, deposited loosely in the sand; predacious on other small insects.

XXXV. NERTHRIDAE Kirkaldy 1906

(*Gelastocoridae* Kirkaldy 1897)

- 5 ( 3). Posterior tarsi with only *one* claw; anterior femora greatly incrassate; insects less than 18 mm. long; (hind tibiae fringed with swimming hairs) ..... 6

Posterior tarsi with *two* claws ..... 7

- 6 ( 5). Head overlapping the thorax dorsally, scutellum concealed or visible; back flat or but slightly convex; more or less smooth and shining insects, marked in linear or vermiculate patterns of yellow, browns and black; rostrum short, unsegmented, or at most with two segments, concealed beneath the epistoma; membrane of the hemelytra *without veins*; metathorax with parapleura; second pair of legs long, slender, third natatorial, fringed with swimming hairs; ventral segments of male asymmetrical; venter without long hairs or a ventral longitudinal keel; anterior tarsi 1-segmented, more or less flattened, palaeform; length, 2-12 or 14 mm.; cling to objects at the bottom of the water by the middle legs, which have long claws; eggs pedunculate, attached to water-plants or to certain crustaceans; feed on algae,

which they scrape off objects by means of the broadened anterior tarsi.

## XLI. CORIXIDÆ Leach 1815

Head *not* overlapping the thorax, inserted into it; back quite convex and boat-shaped; anterior femora more or less rounded, with a single claw, tarsi *not* palaeform; body more or less dull on the upper surface, which is covered with a fine micropubesence (*Notonecta*), or glassy and shining, with a few scattered fine hairs (*Buenoa*); variously colored, but not in yellows; front coxae inserted at the posterior margin of the prosternum; abdomen with a median ventral longitudinal keel, from which arise long hairs to meet a similar series arising from the sides of the abdomen; anterior legs more or less rounded, prehensile, the tibiae in *Buenoa* fringed with stiff bristles; anterior tarsi with *one* claw; length, 5–18 mm.; predacious, swim back down.

## XXXIX. NOTONECTIDÆ Leach 1815

7 ( 5). Hind tibiae not flattened, nor furnished with swimming hairs; anterior femora not thickened; two claws of posterior tarsi small; body very convex, boat-shaped; hemelytra entirely coriaceous, sometimes connate; with neither abdominal keel nor hairs; length not over 3 mm.; eggs inserted into the soft tissues of water-plants; predacious on Entomostraca and other small aquatic organisms.

## XL. PLEIDÆ Fieber 1851

Posterior tarsi with two large and conspicuous claws; anterior femora greatly thickened; anterior tarsi with only one large claw in the adult (for North American genera only), or with two *minute* claws (*Abedus*) ..... 8

8 ( 7). Small insects, not over 20 mm. long; (rostrum without filiform appendages; posterior coxae cardinate); membrane of the hemelytra large and conspicuous, but *without veins*; (hind legs *not* flattened for swimming, fringed with stiff hairs or spines; predacious; length, 6–20 mm. or over; eggs ellipsoid, fastened to water plants).

## XXXVI. NAUCORIDÆ Fallén 1814

Large insects, more than 12 mm. long and generally larger; membrane of the hemelytra sometimes vestigial but always *with veins* ..... 9

- 9 ( 8). Abdomen with two *long non-retractile filaments* at the apex (the two halves of a respiratory tube) ; hind legs round, slender (*Ranatra*) or thick and more or less angulate (*Nepa* and *Curicta*), fringed or not with sparse, long, fine hairs, not flattened for swimming ; rostrum projecting forward from head, not bent under it ; eggs ellipsoid, with two filaments apically (*Ranatra*), 7 (*Nepa*), or 15 (*Curicta*), inserted into soft or decayed plant tissues in the water ; live concealed among water plants at or near the surface, or under stones and debris at the bottom in shallow places ; length, including air-tube, over 20 mm. ; predacious.

XXXVII. NEPIDAE Latreille 1802

Abdomen with two *short more or less retractile strap-like* terminal abdominal appendages, for respiration at the surface when submerged ; hind tibiae flattened for swimming and heavily fringed on one edge with long hairs ; rostrum stout or slender, bent under the head ; eggs more or less ellipsoid, fastened about the stems of water plants (*Benacus*), or deposited under stones or other objects in damp places on the shore (*Lethocerus*), or on the back of the male by the female (*Belostoma Abedus*) ; over 10 mm. to 40 or 50 mm. long ; highly predacious.

XXXVIII. BELOSTOMATIDAE Leach 1815

- 10 ( 3). Head shorter than the length of the pronotum and the scutellum taken together .....11  
 Head much longer than the pronotum and scutellum taken together ; very slender insects with thread-like antennae and legs, all tarsi with *two terminal* claws ; rostrum long and slender ; compound eyes set about the middle of the head ; mostly apterous but sometimes brachypterous or macropterous ; more or less 12 mm. long ; eggs long and spindle-shaped, attached by one end singly to plants growing out from the water, just above the water-line ; found walking on the surface of the water, in still ponds or marshes, near the shore ; predacious on Entomostraca and small insects entrapped in the surface film.

XXX. HYDROMETRIDAE Billberg 1820

- 11 (10). At least the anterior tarsal claws set above the apex of the last tarsal segment, which is cleft, the claws of the other two pairs of legs at the apex of the last tarsal

segment; body more or less velvety in appearance, especially on the lower side, which is clothed with a thick sericious pile; omphalium (unpaired median stink-gland opening) present; littoral forms, living on the surface of water .....12

All tarsal claws terminal, *i.e.*, at the apex of the last tarsal segment, which is *never* split; rostrum slender and straight, or quite thick and sometimes curved, always lying under the head when at rest; body not velvety beneath; stink gland openings (ostioles), when present, paired, metasternal; land insects only .....13

- 12 (11). Apex of posterior femora extending greatly beyond the apex of the abdomen; anterior coxae remote from the middle coxae, middle and posterior coxae close together; rostrum short and stout, bent under the head; apterous, brachypterous, or macropterous; 7 to nearly 25 mm. long; *row* about on the surface of the water by means of the middle legs, supported by the front legs and steered by the hind pair; eggs more or less oval, glued to water plants growing at the surface; highly predacious.

XXXI. GERRIDAE Amyot & Serville 1843

Apex of posterior femora extending but *slightly* beyond the apex of the abdomen (except in the Antillean *Microvelia longipes*, in which they are very much longer); coxae placed at about equal distances apart (except in *Rhagovelia*, in which the terminal tarsal segment of the second pair of legs is split lengthwise for some distance, with a group of long feathery hairs within the split); length 2 mm. or less to 8 or 10 mm. or over; eggs deposited in vegetation at the surface, attached by glue in clusters or rows; highly predacious; walk on the water by steps, row only when in great haste, except *Rhagovelia*.

XXXII. VELIIDAE Amyot & Serville 1843

- 13 (11). Antennae 5-segmented, *not* counting any intercalary minute segments (apparently 4-segmented in *Merragata* through the fusion of two joints into one) .....14
- Antennae 4-segmented, *not* counting any minute intercalary segments, nor the segments of the many segmented last segment in certain groups .....15
- 14 (13). Antennal segments I and II stouter than the remaining seg-

ments; body velvety-looking; minute in size, from less than 2 mm. to slightly over 2 mm. long; ordinarily found walking in humid places about the shores of bodies of fresh water (*Naeogeus*) or on the underside of floating vegetation (*Merragata*).

XX. NAEOGEIDAE Kirkaldy 1902

- Antennal segments I stout, II slender (margin of head carinate above insertion of the antennae; insect more or less shield-shaped); *not* velvety in appearance; strictly land insects; small to large in size (more or less 2 mm. to 25 mm. or over in length) .....38
- 15 (13). Apex of rostrum in a sulcus, cross-striated for stridulation; rostrum short, more or less stout, curved under the head, 3-segmented; insect not less than 5 mm. long, up to 25-30 mm.; found mostly on vegetation or under loose bark, or under stones; predacious on other insects, or haematophagous on man and animals (*Triatoma*) .....16
- Apex of rostrum *not lying* in a stridulatory sulcus, rostrum 3- or 4-segmented; of varying lengths, from more or less 2 mm. to 30 mm. or over ..... 17
- 16 (15). Apical segment of antennae stout, fusiform; anterior legs greatly modified, very stout, raptorial; body more or less angulate, especially the pronotum (*Phymata* and allies), or smooth-margined (*Macrocephalus*); hemelytra narrower than the abdomen, on which they lie in a depression; colors mostly black and greenish or yellow; length about 6-10 mm.; eggs more or less oval, deposited in masses glued together; highly predacious; generally found concealed in flowers, with other insects and spiders seized in their front legs.

XVII. PHYMATIDAE Laporte 1832

Apical segment of the antennae filiform, very slender, sometimes consisting of a number of faintly separated or indicated minute segments; anterior legs more or less similar to the others, although the anterior femora may be more incrassate than the others; legs simple, spiny or hairy; eggs with a cap, deposited in clusters fastened together on plants, or with a crown of filaments, deposited singly in the earth; mostly moderate sized or large insects, 5 or 6 mm. to 30 mm. or more in length; highly predacious.

XVIII. REDUVIIDAE Latreille 1807

- 17 (15). Hemelytra reticulately veined, veins more or less elevated, which gives the insect a more or less lace-like or pitted (Piesmidæ) appearance; small insects *not* over 6 mm. long; phytophagous .....18  
 Hemelytra *not* netted-veined; or both wings absent or reduced in the adult .....19
- 18 (17). Juga free, longer than the tylus, surpassing the apex of the head; membrane of the hemelytra *not* netted-veined; rest of dorsum pitted, including the corium of the hemelytra; small species, not greatly over 3 mm. long; found on the under surface of leaves; phytophagous.

## XIV. PIESMIDÆ Amyot &amp; Serville 1843

Juga not prominent, not longer than the tylus; head sometimes spinose above, the spines retrorse or not; hemelytra of the same membranous texture throughout, much reticulated, veins prominent; head with a more or less large membranous hoodlike structure above; rarely longer than 5 mm.; eggs deposited singly but close together in clusters on the underside of the leaves of the food-plant, or inserted singly close to the main ribs of the leaf; phytophagous.

## XV. TINGITIDÆ Laporte 1832

- 19 (17). Pronotum divided into three lobes; head long and constricted behind the eyes; hemelytra entirely membranous and transparent, with a few distinct longitudinal veins; delicate narrow insects, not over 6 mm. long; predacious (?); found flying in swarms like midges.

## XVI. ENICOCEPHALIDÆ Stål 1860

Pronotum never divided into more than two lobes; hemelytra present, composed of corium and membrane; head in general short, except in a few *Lygaeidae* .....20

- 20 (19). Rostrum with *three visible* segments, or actually only 3-segmented .....21  
 Rostrum with *four* segments, all visible, segment I short ..28
- 21 (20). Body convex ventrally, above flat or slightly concave (in the apterous form); greenish in color; entire hemelytra, when present, membranous, with the principal veins coarse and prominent in the corium, the membrane without veins, corium slightly thickened; about 6 mm. long; eggs long, ellipsoid, curved at the opercular end, inserted into floating vegetation by means of an ovi-

positor; predacious; live on floating plants (water lilies, duck-weed beds, etc.).

XXI. MESOVELIIDAE Douglas & Scott 1867

Body thin, more or less flattened, venter not or but slightly convex, in the apterous not concave above; color not green or greenish (in American forms); terrestrial or living in damp places on the banks and shores of waters; hemelytra when present, with corium and membrane. 22

- 22 (21). Tarsi two-segmented ..... 23  
 Tarsi three-segmented ..... 26  
 23 (22). Ocelli present; membrane without veins; claws *with* arolia; arboreal; on under side of leaves of the royal palm; phytophagous; 1.8–2.5 mm. long.

XIII. THAUMASTOCORIDAE Reuter 1912

Ocelli absent; membrane, when present, with veins; claws *without* arolia (in American species); live under bark or concealed in Termite nests; length, 3 mm. or over. 24

- 24 (23). Tylus at end of a deep incision which extends posteriorly from the anterior margin of the head; bucculae forming no appreciable rostral sulcus; margin of the body furnished with lobes, separate or fused, which form a practically continuous lamina encircling the entire insect; more or less 3 mm. long; live in Termite nests.

VI. TERMITAPHIDIDAE Myers 1924

Tylus forming the anterior projection of the head; bucculae forming a rostral sulcus; margin of the body more or less simple or furnished with well-separated lobes or crenulations; much flattened species from 3–12 mm. long, sometimes over; live in colonies under loose bark of dead or living trees, or under scales on the trunk or limbs of living ones; eggs ellipsoid, fastened in clusters either to the underside of the bark or scale, or to the wood itself under the bark; supposed to feed on fungi ..... 25

- 25 (24). Postocular part of head behind the eyes scarcely wider than the anteocular part; eyes very prominent; antennal segment I short, stout, the base suddenly narrowed into an extremely short, oblique style; trochanters connate with the femora; abdominal stigmata placed near the basal margins of the ventral segments.

IV. ARADIDAE Spinola 1837



Postocular part of the head wider than the anteocular; eyes scarcely or very slightly prominent beyond the postocular part of the head; antennal segment I with the base barely, or less abruptly, narrowed; trochanters distinct; abdominal stigmata remote from the basal margins of the abdominal segments.

V. DYSODIIDAE Reuter 1912

- 26 (22). *With ocelli* .....27  
*Without ocelli*; (wings reduced and showing as small scales under the posterior margin of the pronotum, without a membrane; more or less 3 mm. long; parasitic on man and other mammals or on birds).

XXII. CIMICIDAE Latreille 1804

- 27 (26). Hemelytra *with* a cuneus; membrane in the macropterous *without* long closed cells, sometimes without veins; macropterous, brachypterous or apterous; not over 4 mm. long; predacious; found on plants or under loose bark of dead trees.

XXIV. ANTHOCORIDAE Amyot & Serville 1843

Hemelytra *without* a cuneus; membrane with four or five *long closed* cells; generally macropterous, sometimes brachypterous; rostrum long and slender, segment I short and stout; length over 2 mm. to about 8 mm.; predacious; live on the shores of bodies of water, or in muddy places, one group on sea beaches; eggs elliptical cylindrical, hidden among leaves of shore mosses or under leaves of grass.

XXXIII. SALDIDAE Amyot & Serville 1843

- 28 (20). *Without ocelli* .....29  
*With ocelli* (except certain Lygaeidae, which are readily distinguishable by wing venation and structure) .....31  
 29 (28). Membrane of the hemelytra with *two large* cells at the base, next to the corium, from which arise about *eight* longitudinal branching veins; hemelytra without a cuneus; somewhat stout forms; length from about 6 or 8 mm. to 12 or 14 mm.; phytophagous.

XII. PYRRHOCORIDAE Fieber 1860

Membrane with *one or two small* basal cells, very rarely with longitudinal veins; cuneus distinct; size from more or less 2 mm. to 10-12 mm. long; phytophagous or predacious; live on plants ..... 30

- 30 (29). Segment I of rostrum longer than broad, extending gener-

ally somewhat beyond the posterior margin of the head; membrane with two basal cells, or, rarely with one.

XXIX. MIRIDAE Hahn 1831

Segment I of rostum *little or not longer* than broad, extending posteriorly not further than the middle of the eyes; membrane with one basal cell; length, 2.8-4 mm.

XXVIII. TERMATOPHYLIDAE Reuter 1884

- 31 (28). Hemelytra *with* a cuneus; small mirid-like forms .....32  
 Hemelytra *without* a cuneus, *not* mirid-like; large or small .....33

- 32 (31). Head porrect or vertical; rostrum 4-segmented; antennal segments III and IV without long hairs, II longer than the others taken together; membrane of the hemelytra with one or two closed cells; less than 2.8 mm. long; arboreal, living on lichens.

XXVII. ISOMETOPIDAE Fieber 1860

Head usually strongly declivent; rostrum 3-segmented; antennal segments III and IV usually very slender and beset with numerous long spreading hairs; membrane absent or poorly defined; without ostioles; less than 1.8 mm. long; terrestrial, in damp places.

XXV. DIPSOCORIDAE Dohrn 1859

- 33 (31). Anterior legs *not* raptorial, generally similar in structure to the others; anterior femora sometimes incrassate and armed with a few *teeth*; rostral segment I generally longer than wide .....34

Anterior legs raptorial, with spiny tibiae and femora, the spines set in rows, which mesh when the joints are flexed one on the other for grasping; anterior femora more or less incrassate, their spines sometimes replaced by close-set even setae; rostral segment I short; proportionally comparatively narrow; length from 6-12 mm. or slightly over; eggs long, cylindrical, more or less curved toward the opercular end, inserted in grass stems; predacious; hunt in vegetation, principally grasses and sedges and small weeds, some are arboreal.

XIX. NABIDAE Costa 1852

- 34 (33). Body and legs extremely slender, linear; antennae geniculate, with two segments apically enlarged; eyes *distant* from the base of the head; femora apically enlarged; 3-18 mm. long; eggs ellipsoid, inserted in plants; phytophagous.

X. NEIDIDAE Kirkaldy 1902

Body and legs *not* extremely slender; antennae *not* geniculate nor linear, nor with two apically enlarged segments ..... 35

- 35 (34). Membrane of hemelytra with numerous more or less anastomosing veins; antennae set high on the head, usually above a line drawn from the middle of the eye to the anterior end of the buccula ..... 36

Membrane with five usually simple longitudinal veins, which are neither branched nor anastomosing; antennae set low in the head, below, or on, a line drawn from the middle of the eye to the apex of the buccula; 1 mm. to 15-18 mm. long, sometimes more; hemelytra sometimes absent or reduced; predacious or phytophagous; live on plants, run about on bare places on the earth, or hide under fallen leaves and other debris.

#### XI. LYGAEIDAE Schilling 1829

- 36 (35). Metasternal orifices (ostioles) generally obsolete, when present set between the middle and posterior coxae near the median line, with two diverging furrows running outward; colors usually light, with closely scattered small pits dorsally; membrane more or less hyaline; length, less than 10 mm.; phytophagous.

#### IX. CORIZIDAE Mayr 1868

Metasternal orifices distinct, set further outward from the median line; colors usually dark; generally over 10 mm. long ..... 37

- 37 (36). Head much narrower and shorter than the pronotum; bucculae extending to behind the insertion of the antennae; length from 10 mm. to 30-50 mm.; eggs (those known) more or less angulate, with a metallic lustre, deposited on leaves or stems of plants; phytophagous; generally live on plants, some species on the ground.

#### VII. COREIDAE Leach 1815

Head much wider than the anterior margin of the pronotum, the vertex much wider than the scutellum; bucculae anterior to the insertion of the antennae; 10-15 mm. long; eggs (*Protenor*) angulate, metallic shining brown, dropped singly; certain nymphs (*Alydus*) run on the ground in company with ants, which resemble them in color, size and form; phytophagous.

#### VIII. ALYDIDAE Amyot & Serville 1843 (CORISCIDAE Blatchley 1926)

- 38 (14). Scutellum generally large, covering almost the entire abdomen, usually very convex; if the scutellum is smaller and flatter, then the tibiae are very spinose; pronotal angles not toothed ..... 39

Scutellum of moderate size, rarely covering the entire abdomen, the tip more or less narrowed; if the scutellum covers the abdomen, then the colors of the insect are bright and contrasting, or there is a prominent tooth or point just before the lateral angles of the pronotum; tibiae not strongly spinose, even though there may be *small* spines or spine-like hairs along them; from 5 mm. to 20-30 mm. long; eggs barrel-shaped, the upper end surrounded by a circle of filaments, glued in clusters to leaves or plant stems; phytophagous or predacious (subfamily ASOPINAE).

III. PENTATOMIDAE Leach 1815

- 39 (38). Tibiae thickly spinose with strong dark spines; corium narrow or acute or rounded apically; length, 2-8 mm.; black, brown or metallic blue in color; phytophagous; live on plants or under leaves and debris, or dig into the loose earth at the base of plants.

II. CYDNIDAE Billberg 1820

Tibiae not strongly spinose; corium broad at apex; length, 4-16 mm.; brownish, dark or light colored, variegated sometimes with black; live on trees, shrubs and in grasses at the roots, some in the loose earth about the roots.

I. SCUTELLERIDAE Leach 1815

Family I. **SCUTELLERIDAE** Leach 1815

KEY TO SUBFAMILIES

- A. Venter in males and females with an elongated finely and densely striated stridulatory area (sometimes not very evident) on each side of the disc, traversing at least ventral segments IV and V; (transverse incisures of the ventral disc either straight or sinuate, sharply curved on each side; ostioles evident, prolonged or not in a groove).

Subfamily TETYRINAE Stål 1873

- B. No striate stridulatory ventral areas in either sex.

Subfamily ODONTOTARSINAE Stål 1872-

## Subfamily 1. Tetyrinae Stål 1873

## KEY TO GENERA

1(2 & 3). Pronotum *with* a *distinct* transverse impression at about the middle; head as well as the upper part of the body, quite convex .....2

Pronotum *without* a transverse median impression; head frequently only slightly convex .....3

2 (1). Lateral margins of the head and especially of the pronotum, denticulated; head strongly declivous, very obtuse, with the tylus more elevated than the juga, shorter than the pronotum, which is not twice as wide as long; eyes prominent.

V. *Acantholoma* Stål 1867, p. 168

Lateral margins of the head and pronotum entire, *not* denticulated; head less declivous, more gradually elongate, frequently at least as long as pronotum, which in general is at least twice as wide as long; eyes scarcely prominent.

IV. *Camirus* Stål 1862, p. 168

3 (1). Ostioles as near to the sides of the sternum as to the posterior coxae, or nearer to the sides than to the coxae, very rarely prolonged into a sulcus .....4

Ostioles further, sometimes only slightly, from the sides of the sternum than from the posterior coxae, most frequently extended in a sulcus or canal .....6

4 (3). Scutellum exposing the costal margin of the hemelytra *at the base only*; edges of the body not depressed, convex up to the lateral margin; (body glabrous above; edges of the abdomen entire, not erose).

III. *Chelysoma* Bergroth 1891, p. 167

Hemelytra with the costal margin exposed to *beyond the middle*; edges of the venter depressed, margins sharp, the apical margins of the segments somewhat produced .....5

5 (4). Scutellum not concealing the extreme edge of the abdomen nor covering it completely; head entirely rounded anteriorly; pronotum and scutellum spotted with red.

II. *Pachycoris* Burmeister 1835, p. 167

Scutellum leaving the connexivum exposed; head obliquely truncate anteriorly on each side; pronotum and scutellum *not* spotted with red.

I. *Tetyra* Fabricius 1803, p. 166

- 6 (3). Ostioles not prolonged into a canal, or the canal barely indicated; tibiae with *two* grooves or sulci on the upper aspect, which are separated by a marked longitudinal ridge; (ventral segment VI of the male produced so as to conceal the genitalia).

VI. *Diolcus* Mayr 1864, p. 168

Ostioles prolonged into a canal equalling at least  $\frac{1}{3}$  of the width of the metasternum; tibiae with the upper aspect simple with one wide long sulcus, except in *Stethaulax*, in which it has two sulci or grooves and the ostiolar canal is very long .....7

- 7 (6). With *two* sulci on the upper aspect of the tibia.

VII. *Stethaulax* Bergroth 1891, p. 169

With only *one* more or less pronounced sulcus on the upper aspect of the tibiae; (head shorter than pronotum) .....8

- 8 (7). Ostiolar canal *curved*; scutellum not exposing the costal margin of the hemelytra beyond the middle .....9

Ostiolar canal *straight*, nearly transverse, the margins parallel; scutellum exposing the costal margins of the hemelytra beyond the middle; (ventral segment VI about twice as long through middle as along the lateral margin).

X. *Symphylus* Dallas 1851, p. 171

- 9 (8). Ostiolar canal enlarging gradually, recurved at the end in a right angle; margins of the mesosternal sulcus carinate.

VIII. *Sphyrocoris* Mayr 1864, p. 169

Ostiolar canal not or scarcely enlarging, gradually curved or abruptly recurved toward the end; margins of the mesosternal sulcus not carinate.

IX. *Homaemus* Dallas 1851, p. 170

Genus I. *Tetyra* Fabricius 1803

KEY TO SPECIES

1. Abdomen *without* a distinct median ventral furrow or sulcus, or only slightly sulcate basally; rostrum reaching only to middle of ventral segment II (the first entirely visible ventral segment); length, 15 mm., width, 8 mm.

*antillarum* Kirkaldy 1909

(*arcuata* Fabricius 1794)

Florida; on *Solanum verbascifolium* (sec. Blatchley).

Abdomen *with* a broad, distinct median ventral furrow or sulcus; rostrum passing ventral segment II .....2

2. Pronotum *with* two large lateral calloused yellow areas, one on each side of the disc, which are partly surrounded and invaded by close set black punctures, deeper and larger than the smaller shallow punctures of the disc; ostiole small, scarcely produced into a small narrow auricle, the evaporative area small and vague in outline; rostrum reaching middle of ventral segment III; length, 11–14 mm., width, 8–9 mm. ....*robusta* Uhler 1897  
New Mexico, Utah, Arizona.

Pronotum *without* yellow calloused areas, the entire surface fairly evenly punctate with moderate sized dark punctures; ostiole evident, fairly large, with a narrow somewhat produced auricle; evaporative area large, deeply rugose longitudinally, its exterior margin truncate, nearly straight, and nearly parallel to the outer margin of the mesosternum; rostrum reaching to or passing the anterior margin of ventral segment VI; length, 12–17 mm., width 8–10 mm.

*bipunctata* Herrich Schaeffer 1839

New York to Texas and Mexico; in the pine belt; stridulates quite audibly.

#### Genus II. *Pachycoris* Burmeister 1835

*P. torridus* Scopoli 1772 (*fabricii* Tigny 1813)

Vars. *aquila* H.S. 1839, *decoratus* Perty 1830, *klugii* Burmeister 1835, *linnaei* Westwood 1837, *schaefferi* Schouteden 1904, *schousboei* Fabricius 1803.

The characters in the key will distinguish this genus and its one North American species. The varieties are color forms, a key to which will be found in Stål, Enumeratio Hemipterorum I, pp. 5 and 6. The other species of the genus are Neotropical. In general, the color of the species is black or purplish, spotted with flavous or orange or red, the spots varying in size. The head is distinctly punctulated, anterior margins slightly sinuated to base; body beneath aeneous or sordid testaceous or flavescent with a violaceous tinge; length 12.5–16 mm.

Doubtfully recorded from California.

#### Genus III. *Chelysoma* Bergroth 1891

(*Orsilochus* Stål 1867)

*C. guttata* Herrich Schaeffer 1839.

In addition to the key characters of the genus, it may be recog-

nized by the bright smooth yellow markings on the head, pronotum, and scutellum; rostrum reaching middle of ventral abdominal segment II; antennal segment II one-half of itself shorter than either IV or V, which are the longest and stoutest segments; length, 11-13 mm., width 7-8 mm.

This is the one species of this predominantly Neotropical genus found thus far in America north of Mexico. So far as records go, it is peculiar only to our Atlantic and Gulf States from North Carolina to Florida and Alabama. On *Ipomoea pes-caprae*, the goat's foot morning glory; hibernates among roots of grass clumps (see Blatchley).

Genus IV. *Camirus* Stål 1862

KEY TO SPECIES

- A. Carinate margin of head nearly straight, becoming evanescent posteriorly; anterior angles of pronotum distinctly angulated; length, 5 mm. .... *consocius* Uhler 1876  
Texas, Arizona, California.
- B. Carinate margin of the head percurrent and abruptly bent before the eye; anterior angles of the pronotum distinctly rounded; length, 4-4.5 mm., width, 3 mm. .... *porosus* Germar 1839  
Florida, Texas, California, Vancouver Island; in shrubbery in open places in pine woods in Florida (see Blatchley).

Genus V. *Acantholoma* Stål 1870

*A. denticulata* Stål 1870

Recognition characters for this, the single species in the genus, additional to those in the generic key are: antennal segment II twice the length of III; scutellum with a levigate round pale spot at each side of the base; oblong-oval in form, dull black in color, minutely pubescent with yellowish prostrate hairs; length, 5.3-5.8 mm., width, 3-3.5 mm.

New York, New Jersey, Indiana, Illinois, Kansas; found occasionally in lake beach drift.

Genus VI. *Diolcus* Mayr 1864

KEY TO SPECIES

- A. Head relatively shorter and broader, three-fifths wider than long, forming with the juga a bluntly rounded apex; pronotum punctate to edge; conspicuous greenish punctures on head and pronotum; scutellum with a round black spot laterally;



venter profusely punctate on both sides of disc; length, 8-9 mm., width, 6-7 mm. ....*chryssorrhoeus* Fabricius 1803  
North Carolina, South Carolina, Mississippi, Alabama, Florida, Texas.

- B. Head relatively longer, somewhat over one-quarter wider than long, forming with the juga a more acute angle; *not* punctate with green; pronotum *not* punctate along pale, lightly reflexed lateral margins; venter smooth, with large, scattered brown punctures; length, 8-9 mm., width, 6-6.5 mm.

*irroratus* Fabricius 1775

Florida, (West Indies); on black mangrove (*Rhizophora mangle*) on the keys and along edges of tidewater lagoons in Florida (sec. Blatchley).

Genus VII. *Stethaulax* Bergroth 1891  
(*Aulacostethus* Uhler 1871)

*St. marmoratus* Say 1831 (*simulans* Uhler 1876)

So far, this is the only known species of the genus, which is confined to America north of Mexico. Additional characters to those in the key are: rostrum reaching middle of ventral segment II; antennal segment II nearly one-half longer than III; length, 6-7 mm., width, 4.5-5.5 mm.

New Jersey, New York, Maryland, North Carolina, Georgia, Illinois, Texas, California; said to occur in cedar (sec. Blatchley).

Genus VIII. *Sphyrocoris* Mayr 1864

KEY TO SPECIES

- A. Antennal segment II *equal* to or *subequal* to III; (head broadly triangular, apex rounded, a narrow median stripe and two smaller ones running to ocelli, both levigate; anterior margin of the prosternum hardly dilated, very slightly rounded; apical angles of the abdominal segments hardly prominent); length, 8-8.5 mm., width, 5-5.5 mm.

*punctellus* Stål 1862

(Mexico.) Arizona; on wild cotton.

- B. Antennal segment II *longer* than III; (head shorter, more rounded, wider than long; humeri produced into blunt points; stigmata with white calloused spots); length, 7 mm.

*obliquus* Germar 1839

Florida, Texas, New Mexico, Arizona, California, (West Indies, Neotropical).

(N. B.—It is practically impossible to construct an adequate key for these two species, so meticulously described by color both in the primary and in the secondary descriptions.

This practice in descriptions has been shown conclusively to be a failure in the majority of the Scutelleridae which, even when brightly colored, are extremely variable in pattern in one and the same species, as for example, *Augocoris gomesii* Burmeister or *Tectocoris diophthalmus* Thunberg. The former has three named color varieties; and the latter no less than *eight*, all named, with fourteen synonyms in addition to the varietal names, *everyone described as a species on the basis of color!* There is no adequate modern structural description of either *Sph. obliquus* or *Sph. punctellus*; at the most, there are fleeting remarks by Van Duzee and Hart. These remarks presuppose actual possession of *both* species and at best are but vague indications of differences. Blatchley, in spite of an extensive color description, is no better. So, whether we are dealing with two species, or with one, or with several, will remain a question until the genus is completely and adequately revised. Mayr, however, from an examination of Germar's type, confirms the fact that in *obliquus* the third joint of the antennae is shorter than the second.

This key is given for what it may be worth; it gives the only structural characters directly comparable with each other mentioned in the two original descriptions.

Genus IX. *Homaemus* Dallas 1851

KEY TO SPECIES

1. Dilated anterior margin of the prosternum when viewed vertically from below forming a distinct but obtuse angle below the antenniferous tubercles; (posterior half of the lateral margin of each abdominal segment black) 2
- Dilated margin of prosternum rounded, not angulate, viewed from below ..... 3
- 2 (1). Length 4-5 mm.; (segments II and III of antennae subequal, V longer than IV; pronotum proportionally broader and shorter than in *proteus*; middle of venter with but few punctures; clothed with a minute pale pubescence; ostiolar canal less curved than in *proteus*; rostrum reaching hind coxae); length, 4-5 mm.

*variegatus* Van Duzee 1914

California; on *Adenostoma* and manzanita (*Arctostaphylos pungens*) (sec. Van Duzee).

Length more than 5.5 mm.; (length, 6.5-7 mm.)

*proteus* Stål 1862

Texas, New Mexico, Arizona, California; on grasses near or at roots.

- 3 (1). Ostiolar canal regularly curved at apex, *not* abruptly bent; size small; color pale; length, 4.2-6 mm., width, 3-4 mm. .... *parvulus* Germar 1839

(*grammica* Wolff 1811)

North Carolina, Florida, Indiana, Kansas, Colorado, Texas, Arizona, California; in grasses, near roots.

Ostiolar canal abruptly bent forward at apex, the bent part nearly parallel to the outer margin of the metapleura ..... 4

- 4 (3). Lateroanterior margins of the pronotum concavely arcuate; anterior prolongation of ventral segment VI broader, distinctly angulate; head generally bronze-black without pale margins; length, 7-9 mm., width, 5-6 mm.

*aeneifrons* Say 1824

Quebec, east and west to New Mexico and California; on carices and swamp grasses, and on *Solidago*.

Lateroanterior margins of the pronotum straight or feebly convexly arcuated; anterior prolongation of ventral segment VI distinctly rounded; head generally with a broad submarginal pale vitta; length, 6.5-8 mm., width, 4.5-5 mm. .... *bijugis* Uhler 1870

(*consors* Uhler 1876)

Dakotas west and south to California and Arizona; in prairies and pastures, on grasses, near the roots.

Genus X. *Symphylus* Dallas 1851

*S. caribbeanus* Kirkaldy (*deplanatus* auctt., nec H. S.)

The single species of a Neotropical genus known from America north of Mexico. Additional characters to those in the key are: disc of pronotum with a small nodule near each hind angle and a large shallow impression behind each front angle; length, 8-11 mm., width, 5-7 mm.

Florida; on wax myrtle (*Cerothamnus ceriferus*) (sec Blatchley).

Subfamily 2. Odontotarsinae Stål 1872

KEY TO GENERA

1. Ostiole distinct, continued in a quite evident narrow canal; connexivum rather broadly exposed; (mesosternum without crests or tubercles).....I. *Eurygaster* Laporte 1832, p. 172  
 Ostiole indistinct, without evident canal ..... 2
2. Head gradually narrowed before the eyes to the apex, *not* truncate anteriorly; (body silky-pubescent above and below; sides of head very obtuse, without an evident carina; sutures separating the juga from the tylus parallel or nearly parallel, to the apex).  
 II. *Fokkeria* Schouteden 1904, p. 173  
 Head in front truncate or subtruncate and broad, the angles rounded ..... 3
3. Anterolateral margins of pronotum sinuate, lateral angles notched or incised ..... 4  
 Anterolateral margins of pronotum feebly arcuate, lateral angles entire .....V. *Vanduzeeina* Schouteden 1904, p. 174
4. Surface nearly smooth, pronotal collar slightly arcuate; tibiae longitudinally sulcate above; rostrum reaching to apex of intermediate coxae; antennal segment IV longer than V; scutellum *not* carinate. III. *Phimodera* Germar 1839, p. 173  
 Surface above corrugated, pronotal collar elevated hoodlike over base of head; tibiae scarcely sulcate above, or entirely flat; rostrum reaching to apex of posterior coxae; antennal segment IV shorter than V; scutellum carinate.  
 IV. *Euptychodera* Bergroth 1908, p. 174

Genus I. *Eurygaster* Laporte 1832

KEY TO SPECIES

- A. Lateral margins of head nearly straight, *not* forming a practically continuous line with the anterolateral margins of the prothorax; humeri entirely rounded; posterolateral margins of the pronotum nearly straight, at most slightly sinuate, posterior margin straight or with a barely perceptible outward curve, a narrow, median impunctate line on the prothorax running from the base of the head to about the middle of the scutellum; antennal segment III shortest, V longest, about equal to III and IV taken together; length, 6.5–10 mm. .... *alternatus* Say 1828  
 Distributed throughout the United States, but not re-

corded from some; generally found in grasses and sedges, preferably in damp or wet ground.

- B. Lateral margins of head slightly sinuate, forming a practically straight line with the anterolateral margins of the thorax; humeri somewhat narrowly rounded with a slight but noticeable angulation; posterolateral margins of the pronotum strongly sinuate, posterior margin *straight*, a much broken and hardly distinguishable line of laevigate whitish dots on the pronotum; on the scutellum a distinct laevigate line, wider at base and becoming carinate from the posterior margin of the tumid area at the base to about the middle of the scutellum; antennal segments II, III, and IV subequal, V longest; length 10–12 mm.

*shoshone* Kirkaldy 1909  
(*carinatus* Van Duzee 1904)

Idaho, Utah, Nevada.

Genus II. *Fokkeria* Schouteden 1904

*F. producta* Van Duzee 1904

The generic characters in the key are supplemented by the following: Black, densely covered with cinereous hairs above and below; bucculae rounded; sides of pronotum very feebly sinuated (*not* arcuated); length, 5 mm.

Colorado.

It should be stated that the original description is nearly entirely based on color—an unstable factor in these small Graphosomatinae. The only structural character given being the head, which is compared with that of *Camirus conicus* Germ., a Neotropical scutellerine.

Genus III. *Phimodera* Germar 1839

KEY TO SPECIES

1. Clypeus anteriorly elevated for about half its length; marginal tubercles of the abdomen not very prominent ..... 2  
Clypeus elevated for its whole length; marginal tubercles of the abdomen quite prominent; (anterior angles of the pronotum obtuse, not broadly rounded, anterior margin more or less lightly but distinctly sinuated); length, 6.75 mm., width, 4 mm. ....*torpida* Walker 1867 (Reuter 1906)  
Saskatchewan, Colorado.
2. Anterior angles of the pronotum subacute, anterior margin *straight*; marginal tubercles quite small; length, 6.25–7

mm., width, x-4 mm. .... *binotata* Say 1824  
Michigan, Nebraska, Colorado.

Anterior angles of pronotum obtuse, rounded, anterior margin quite *strongly* sinuated between the eyes; marginal tubercles slightly prominent; length, 6.5-6.7 mm., width, 3.6-3.7 mm. .... *torrida* Reuter 1906  
Nevada.

Genus IV. *Euptychodera* Bergroth 1904

*E. corrugata* Van Duzee 1904

These are in addition to the characters in the key: Antennae black with pale incisures, segment II about as long as IV, III slightly if at all longer than I, which reaches about to the apex of the head; posterior trochanters unarmed; length, male, 5 mm., female, 6.5 mm.  
Colorado and Utah; matures about June.

Genus V. *Vanduzeeina* Schouteden 1904

KEY TO SPECIES

1. Head long, slightly oblique, sides more parallel; (vestiture very short); *more* than 6 mm. long ..... 2  
Head short, vertical, narrowed apically; *less* than 6 mm. long 3
2. Transverse median pronotal impression distinct; apex of scutellum in female with a large oblong pale spot margined with black; dorsum with pale line incomplete or absent; rostrum reaching apex of ventral segment II; length, 6-7 mm.  
*californica* Van Duzee 1925

California.

Transverse median pronotal impression nearly obsolete; apex of scutellum in female with a smaller and less distinct pale spot *not* outlined with black; dorsum with pale line distinct; rostrum reaching apex of ventral segment II; length, 7.5-8 mm. .... *borealis* Van Duzee 1925

3. Pronotum with margins sharply carinate and straight; head produced; (pronotum narrow, sides depressed; scutellum with a more or less distinct, slightly oblique, black vitta on either side of the disc; rostrum almost reaching hind margin of ventral segment II); length, 5-6 mm.  
*senescens* Usinger 1930

California.

Pronotum with the margins broadly flattened; head shorter and broader at base with the apex broadly rounded ..... 4

4. Vestiture short; connexivum alternated with black and white; pronotum broad behind, margins arcuate; (rostrum reaching posterior coxae; scutellum without an apical pale spot); length, 5-6 mm. .... *balli* Van Duzee 1904  
Colorado, Wyoming.

Vestiture long; connexivum very feebly marked with lighter color behind each incisure; margins of pronotum more nearly parallel, rectilinear or very slightly arcuated; (rostrum reaching posterior coxae); length, 6.5 mm.

*slevini* Usinger 1930

California.

## Family II. CYDNIDAE Billberg 1820

### KEY TO SUBFAMILIES

Scutellum subtriangular, not reaching the apex of the abdomen; frena long; corium exposed, broadly triangular; hind wing lobes about equal, separated by a shallow notch.

Subfamily CYDNINAE Dallas 1851, p. 175

Scutellum covering the abdomen to its apex; frena short; corium largely membranous, the exposed opaque part narrow; hind wing lobes deeply incised, the second lobe large and very prominent. Subfamily THYREOCORINAE Van Duzee 1904, p. 184

### Subfamily 1. Cydninae Dallas 1851

#### KEY TO TRIBES

Margin of the head and the lateral margin of the pronotum above *without* bristles or spines; rostrum *not* lying between two parallel ridges on the prosternum.

Tribe 2. *Shirini* Stål 1864, p. 183

Margin of the head and lateral margin of the pronotum above *with* bristly hairs or spines; rostrum lying between two parallel ridges on the prosternum. Tribe 1. *Cydnini* Stål 1864, p. 175

### Tribe 1. CYDNINI Stål 1864

#### KEY TO GENERA

1. Anterior tibiae cultrate and flattened, tarsus inserted *before* the apex of the tibia; rostrum short, not going beyond the anterior coxae, (segment II swollen); posterior tibiae short, incrassate, truncate at the apices.

I. *Scaptocoris* Perty 1830

(2 Neotropical species—*S. terginus* Schiödte and *S. castaneus* Perty.)

- Anterior tibiae neither cultrate nor flattened, fossorial; tarsus inserted at the apex; rostrum passing much beyond the anterior coxae; posterior tibiae long, more or less cylindrical ..... 2
2. *Without* ocelli; (anterior margin of the head with comb-teeth).  
IX. *Psectrocephalus* Van Duzee 1922, p. 182  
*With* ocelli ..... 3
3. Ostiole with auricle or overhanging ledge *not* extending to near body margin in a long narrow canal ..... 4  
Ostiolar canal long, narrow and distinct, reaching three-fourths of the distance from the ostiole to the body margin; (anterior margin of the head with a row of short thick comb-teeth; apex of the scutellum mucronate, *i.e.*, with a spine or process) ..... X. *Amnestus* Dallas 1851, p. 182
4. *No* deep groove on the head above, just within the reflexed margin ..... 5  
*With* a distinct groove on the head above, just within the reflexed margin, beset with bristles and short spinules ..... 8
5. Hind tibiae slender, terete or angulate in section, nearly straight, uniformly spined on both upper and lower sides ..... 6  
Hind tibiae very much flattened and curved; lower side bristly, upper side beset with bristles and short stout spinules; (ostiole with only a small external auricle).  
II. *Cyrtomenus* Amyot & Serville 1843, p. 177
6. Pronotum *without* an impressed submarginal line anteriorly ..... 7  
Pronotum *with* an impressed submarginal line anteriorly.  
VI. *Pangaeus* Stål 1862, p. 179
7. Pronotum of male *with* a deep broad impunctate cavity on middle of the apical half; ostiole prolonged as a distinct short closed canal; 5 mm. or more long.  
VIII. *Geocnethus* Horváth 1919, p. 182  
Pronotum of male *without* a deep impunctate cavity anteriorly; ostiolar canal slender, two-thirds the length of the metasternal plate; species less than 4.3 mm. long.  
VII. *Geotomus* Mulsant & Rey 1862, p. 181
8. Pronotum *distinctly* margined in front ..... 9  
Pronotum *not* distinctly margined in front; (ostiole not extended in a canal but in a flattened oblique plate).  
V. *Aethus* Dallas 1851, p. 178
9. Scutellum about as long as broad, apex acuminate; (ostiolar canal reaching almost to the outer margin of the evaporative area, its tip flat, clavately rounded).  
III. *Macroporus* Uhler 1876, p. 177



Scutellum longer than broad, the apex narrowly rounded.

IV. *Homaloporus* Uhler 1877, p. 178

*Syllobus emarginatus* Stål 1862 has been tentatively recorded from Florida. The genus (and its species) may be separated from the other North American forms by the deeply emarginate head, the juga projecting conspicuously beyond the tylus and being pointed; the sides of the head are markedly sinuate. The one species is the largest North American cydnid known to me; it is over 13 mm. long.

Genus II.\* *Cyrtomenus* Amyot & Serville 1843

KEY TO SPECIES

A. Body very convex above; antennae with short, stout, nearly moniliform segments, II much shorter than III and more slender than the others; rostrum not quite reaching intermediate coxae; prothorax wider than long, with a marked transverse dorsal impression; hemelytra with a broad hyaline or yellow membrane; general color a reddish chestnut, venter reddish; length, 8-9 mm.

*mirabilis* Perty 1834

(*castaneus* Amyot & Serville 1843)

New York, New Jersey, South Carolina, Georgia, Florida, New Mexico, Arizona, California, Illinois to Texas; on *Cyperus esculentus*.

B. Body oval, not very convex above; all segments of the antennae of nearly equal length; rostrum reaching posterior coxae; prothorax nearly square, the transverse impression not well-marked; membrane a clear golden yellow; general color a deep shining black, venter rusty black; length, 11 mm.

*teter* Spinola 1840

(*aethiops* Amyot & Serville 1843)

California, (Neotropical).

Genus III. *Macroporus* Uhler 1876

The following are additional to the key characters: Margins of the head and of the pronotum sparsely ciliate; juga with the margins broadly reflexed, with a distinct submarginal groove beset with short erect spines; antennal segment II one-half as long as III; anterior angles of the pronotum rounded, prolonged to beyond the middle of the eyes.

The one species known in the genus thus far is:

\* Genus I—*Scaptocoris* not keyed; Neotropical only.

*M. repetitus* Uhler 1876

Additional specific characters are: Submarginal groove of head with long hairs in addition to the spines; transverse impression of the pronotum vague, thickly punctate; sides of the pronotum and the posterior half thickly punctate, apical half of the disc almost smooth; scutellum with a faint median carina; length, 3.5–4 mm.

Maryland, California, New Mexico.

Genus IV. *Homaloporus* Uhler 1877

Additional characters for the genus, from Uhler's original description, are: Submargin of head grooved, set with minute teeth and slender bristles, juga not quite meeting in front of the tylus; antennal segments I and II slender, very short, III enlarged apically, IV and V subequal, thicker, long oval; segment I of rostrum shorter than the bucculae, II longest; ostiolar canal more than one-half the length of the episternum; margin of the venter remotely ciliated.

There are two species in this genus, one of which, *H. pangaeiformis* Signoret 1881 is doubtfully recorded from Texas, hence omitted. The other North American species is

*H. congruus* Uhler 1877

In this the head is almost flat on the sides, with at least three grooves on each side of the tylus, anteriorly and laterally with deep, distinct, moderately large pits, those next the eyes large and shallow; surface not apparently punctured; rostrum reaching the intermediate coxae; pronotum wider than long, the sides straight, the disc with one or two shallow lateral pits; propleura, outer area of the sternum and disc of the venter highly polished, smooth, the venter faintly rugulose laterally; length, 5 mm., width, 3 mm.

Nebraska, Colorado, Texas.

Genus V. *Aethus* Dallas 1851

KEY TO THE SPECIES

1. Scutellum *broadly* rounded, *not* narrowed at apex ..... 2  
    Scutellum *triangular*, *narrowed* at apex ..... 4
2. Ostiolar canal obsolete, sulcate, with raised margins; (rostrum reaching behind *anterior* coxae) (subgenus *Trichocoris* Uhler 1876); length, 5.5–6.5 mm. .... *conformis* Uhler 1876 California.

Ostiolar canal short, enlarged at apex into a circular auricle; rostrum reaching *intermediate* coxae (subgenus *Microporus* Uhler 1876) ..... 3

3. Membrane milk-white; head with a rounded fovea *next* each eye,

and another on each side of the tylus, near its apex; length, 4-4.5 mm., width, 2.5-2.8 mm. .... *obliquus* Uhler 1872  
New York and New Jersey west to Oregon, California, and southwest to Arizona and Texas; at roots of plants in sandy places.

Membrane pale brownish; a pit *behind* each eye, and a series of six pits across the head; length, 4.5 mm.

*testudinatus* Uhler 1876

Indiana, Colorado, New Mexico, California, (Mexico).

4. Collar of pronotum *with* an impressed, deeply arcuated submarginal line; ostiolar canal wide, very prominent, about half the length of the episternum ..... 5

Collar of pronotum *without* an impressed submarginal line; ostiolar canal narrow, *not* very prominent, less than one-half the length of the episternum ..... 6

5. Pronotum smooth, *not* punctured, transverse impression absent, (with marginal cilia); evaporative area striate-punctate; length, 6-7.5 mm., width, 3.5-4 mm. .... *communis* Uhler 1877  
Indiana, Florida, Texas, (Cuba).

Pronotum with a few obsolete punctures on the median transverse impression; evaporative area entirely smooth, neither striate nor punctate; length, 7 mm., width, 4.25 mm.

*politus* Signoret 1882

California.

6. Ostiolar canal short, narrow, subfusiform, with the ostiole *at the apex* (subgenus *Rhytidoporus* Uhler 1877); tylus extending to the apex of the head; costal margin of the corium with *one* setigerous puncture; length, 5.5-6.5 mm., width, 2-2.5 mm. .... *indentatus* Uhler 1877  
Florida, (Cuba).

Ostiolar canal *obsolete*, shorter than the coxae, narrow, ligulate (subgenus *Cryptoporus* Uhler 1877); tylus a little shorter than the juga, which are almost in contact in front of it; costal margin of the corium closely pitted and fringed with cilia; length, 5 mm. .... *compactus* Uhler 1877  
Texas.

## Genus VI. *Pangaeus* Stål 1872

### KEY TO SPECIES

1. Length *less* than 6.5 mm. .... 2  
Length 6.5 mm. or more ..... 3
2. Costal margin of hemelytra at base with 3 setigerous punctures;

the three submarginal pits of the head smaller than the middle pit, the pit next to the eye the largest; (antennal segment II slightly shorter than III); length, 5.5 mm.—6 mm. .... *uhleri* Signoret 1882  
(*rugifrons* Uhler 1877)

North Carolina, Georgia, Texas.

Costal margin of the hemelytra with only 1 or 2 setigerous punctures; pits of head obsolete; length, 5 mm.  
*piceatus* Stål 1862

Texas, New Mexico, Arizona, California.

3. Transverse impression of pronotum *interrupted* in the middle; ocelli, minute, set far back; (pronotum deep black, highly polished; outer submargin of venter remotely ciliated; antennal segment II *distinctly* longer than or subequal to III; costal margin of corium with 7 setigerous punctures); length, 7–8.5 mm. .... *discrepans* Uhler 1877  
Indiana, Tennessee, Idaho, Colorado, California, Oklahoma, Texas.

Transverse impression of pronotum *uninterrupted*; ocelli large 4

4. Antennal segment II *longer* than III ..... 5  
Antennal segment II *shorter* than III; (ocelli on a line with the base of the eyes; venter ciliated on margin) ..... 6

5. Transverse impression of the pronotum terminating in a distinct fovea before the submargin, irregularly punctate; costal margin of the corium with 3 or 4 setigerous punctures; coal black, highly polished; length, 7–8 mm.

*bilineatus* Say 1825

Quebec, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, North Carolina, Alabama, Oklahoma, Texas.

Transverse impression of the pronotum ill-defined; costal margin of the corium with 9 or 10 erect bristles; chestnut-brown to piceous; length, 9.3–10 mm., width, 4.8–5 mm.

*californicus* Blatchley 1929

California.

6. Transverse impression of pronotum *deeply* indented; (remotely punctate); color piceous black, polished; length, 7–9 mm.  
*margo* Dallas 1851

Arizona, (Neotropical).

Transverse impression of the pronotum ill-defined; costal margin length, 6.5 mm., width, 3.3 mm.

*spangbergi* Signoret 1882

Texas, Arizona.

Genus VII. *Geotomus* Mulsant & Rey 1862

## KEY TO SPECIES

1. Head closely and *distinctly punctate* ..... 3  
 Head *minutely* or *obsoletely punctate* ..... 2
2. Pronotum closely *shallowly punctate*, with a large vague smooth area on each side; length, 3.3–3.7 mm.  
*noctivagus* Van Duzee 1923  
 Arizona, (Mexico, Lower California).  
 Pronotum impunctate anteriorly, behind the middle with fine, remote, elongate punctures; sides closely punctate; length, 3.2–3.7 mm., width, 1.8–2 mm.  
*pennsylvanicus* Signoret 1883  
*(picinus* Uhler 1877)  
 Pennsylvania, North Carolina, Georgia, Illinois.
3. Length, 3.75 mm. or *more* ..... 4  
 Length, less than 3.75 mm. .... 5
4. Scutellum minutely, sparsely and almost invisibly punctate; pronotum *without* a transverse impression, disc impunctate; sides densely and finely punctate; length, 4–4.2 mm., width, 2.1–2.3 mm. .... *subpunctatus* Blatchley 1926  
 Maryland, North Carolina, Florida.  
 Scutellum anteriorly remotely coarsely punctate, posteriorly more finely so; pronotum with the transverse impression faint but evident, surface coarsely and closely punctate, obsoletely so on a small median area of the disc; length, 3.75–4.2 mm., width, 2–2.2 mm. .... *robustus* Uhler 1877
5. Length 3.5 mm. or *over* ..... 6  
 Length 3 mm.; (pronotum densely punctate) ..... 7
6. Scutellum polished, minutely punctate; anterior part of the disc of the pronotum polished, minutely rugulose, the rest coarsely punctate; length, 3.5 mm.  
*parvulus* Signoret 1883  
*(elongatus* Uhler 1876)  
 Arizona, California.  
 Scutellum and pronotum coarsely punctured; length 3.65 mm.  
*subglaber* Walker 1867  
 "North America."
7. Pronotum entirely densely punctate except for two small glabrous spots on anterior disc; length, 3–3.2 mm., width, 1.5–1.7 mm. .... *uhleri* Signoret 1883  
 Florida.

Pronotum with the posterior margin smooth; length, 3 mm., width, 1.5 mm. .... *punctatissimus* Signoret 1883  
 "Sitka."

Genus VIII. *Geocnethus* Horváth 1919

The following generic characters are abstracted from Horváth's monograph (see Bibliography):

Antennae 5-segmented, longer than the pronotum, segments II and III equal or subequal, IV distinctly longer than either; tylus and juga equal; rostrum going to intermediate or to posterior coxae; pronotum distinctly wider than the head with the eyes; posterior femora unarmed beneath, *always without* a preapical tooth.

The single species from America north of Mexico, so far known, is: *G. cavicollis* Blatchley 1924.

Among the specific characters given in the original description are: Rostrum reaching the middle coxae; pronotal disc in the female with a vague wide transverse impression; submargins of head and pronotum with a few scattered erect bristly hairs; scutellum with a submarginal row of fine punctures and a few coarser ones scattered on the apical half; membrane not reaching the apex of the abdomen in either sex; length, 5-6 mm.

North Carolina, Alabama, Florida.

Genus IX. *Psectrocephalus* Van Duzee 1922

Generic characters in addition to those in the key are: Antennal segment II longest; pronotum laterally ciliated, the disc *without* a transverse impression; costa ciliate to near apex; connexivum ciliate beyond this point.

The type species only known:

*Ps. caecus* Van Duzee 1922.

Selected specific characters are: Vertex and tylus nearly smooth, juga rugosely punctate, anterior submargin of head with a long bristle on each side of the base at the bucculae; corium deeply punctate; beneath, polished, impunctate; punctures of upper surface coarse; color black; length, 5 mm.

California.

Genus X. *Amnestus* Dallas 1851

KEY TO SPECIES

1. Color a uniform dark chestnut brown; length, 3.2-4 mm., width, 2 mm. .... *spinifrons* Say 1825  
 Massachusetts, New York, New Jersey, Pennsylvania,

Maryland, Georgia, Michigan, Indiana, Illinois, Nebraska, Kansas, Texas.

- Color in part, or wholly, pale yellowish- or reddish-brown; length, *not over* 2.7 mm. .... 2
2. Elevated anterior part of the pronotum rather evenly and coarsely punctate; (juga with 4 submarginal teeth)..... 3
- Elevated anterior part of the pronotum sparsely, finely and unevenly punctate ..... 4
3. Form elongate-oval; length, 2.2–2.5 mm., width, 1.3–1.5 mm.  
*pusillus* Uhler 1876  
New England to Colorado south to Florida and Texas.  
Form elongate-quadrangular; length, *less than* 2 mm. (1.8 mm., width, 1 mm.) ..... *pusio* Stål 1860  
Florida, (West Indies, Brazil).
4. Juga with 5 submarginal teeth each; color a nearly uniform pale yellowish-brown; length, 2.2–2.7 mm., width, 1.1–1.3 mm.  
*pallidus* Zimmer 1910  
Massachusetts west to Nebraska; on *Antennaria plantaginifolia*.  
Juga with 4 irregular submarginal teeth each; color, head, pronotum and scutellum dark reddish- to chestnut-brown, hemelytra brownish-yellow; length, 2.5–2.7 mm.  
*subferrugineus* Westwood 1837  
Florida, (West Indies).

Tribe 2. *SEHIRINI* Stål 1864

KEY TO GENERA

- Lateral margins of the body and of the pronotum black; pronotum much wider anteriorly than at the base; rostrum reaching middle of abdomen; head very large, much longer than wide, subtriangular; ostiole set far out on the episternum, near its margin ..... I. *Lobolophus* Bergroth 1891  
(*Lobonotus* Uhler 1877)
- Lateral margins of the pronotum and of the hemelytra ivory-white; pronotum narrower anteriorly than at the base; (veins of the hindwing conspicuously dark and thick); rostrum *not* reaching the abdomen; ostiolar canal broad, curved, reaching two-thirds of the distance from the ostiole to the margin of the body.  
..... II. *Schirus* Amyot & Serville 1843

Genus I. *Lobolophus* Bergroth 1891

In addition to the key characters the following may be noted for

this monotypic genus: Much widened anteriorly, head long, narrow, triangular, much longer than wide; tylus narrow, raised above the lateral lobes, juga not as long as tylus; eyes almost enclosed by the produced anterior pronotal angles; antennae slender; rostrum long and slender, segment I stout; pronotum wider anteriorly than at the base, the anterior margin deeply sinuate, the transverse impression broad and shallow; ostiole near the outer margin of the episternum; corium long and narrow.

The single species in the genus is

*L. anthracinus* Uhler 1877.

In this, the rostrum reaches ventral segment V (sec. Signoret); the pronotum is polished, with a large impunctate callosity on each side of the anterior lobe; connexivum flattened, the margin broadly compressed and very thin; length, 5 mm., width, 3 mm.

Texas, (Mexico).

#### Genus II. *Shirus* Amyot & Serville 1843

The following are in addition to the key characters for the genus: Without marginal hairs; juga equal to or slightly longer than the tylus, the margins narrowly reflexed, neither ciliate nor dentate; antennae slender, the segments gradually increasing in length from the base to the apex; rostrum reaching middle coxae; scutellum equilaterally triangular, the apex depressed, bluntly rounded; veins of the membrane few and fine; ostiolar canal curved, reaching nearly to the margin of the metasternal plate; anterior tibiae enlarged but not flattened, all tibiae with a few short spines.

There are a number of species of the genus in the Old World, but the only one known from America thus far is

*S. cinctus* Palisot de Beauvois 1805.

This has the juga not meeting in front of the tylus, finely, closely and confluent punctate; the disc of the pronotum with a broad, vague, shallow transverse impression; middle of the abdomen almost smooth; length, 4-7 mm., width, 2.5-3.5 mm.

Quebec and New England west to British Columbia and Nebraska and south to Florida, Mississippi and Texas (into Mexico); on *Monarda punctata* and other mints, sweet clover, nettles, raspberry, wild cherry, blue grass, timothy.

#### Subfamily 2. **Thyreocorinae** Van Duzee 1904

##### KEY TO GENERA

1. [Apices of juga contiguous, enclosing the tylus at its apex; eyes



globose, distinctly projecting beyond the margin of the head; tibiae sulcate above; femora without spines; European genus ..... (*Thyreocoris* Schrank)]

Apices of juga hardly contiguous, or separated; tylus percurrent; eyes outwardly longitudinally convex, their outer margins scarcely going beyond the margin of the head, or continuous with it; tibiae rounded, without a sulcus; American genera ..... 2

2. Lateral margins of the pronotum and of the chitinized parts of the hemelytra with long slender bristles or hairs; (apices of the chitinized parts of the hemelytra *obtuse*; hind tibiae with long spines on five surfaces; *at least* anterior and posterior femora without spines).

II. *Cydnoides* Malloch 1919, p. 189

Lateral margins of the pronotum and chitinized parts of the hemelytra *without* long hairs ..... 3

3. Pronotum and scutellum (viewed from the side), forming a continuous convex line, their bases on the same plane; costal margin of the corium always margined; pronotum and scutellum *never* rastrate; (eyes immersed, not at all or hardly going beyond the margin of the head; exocorium divided from the mesocorium by a longitudinal impressed line; coriaceous part of the hemelytra distinctly narrowed posteriorly, apex of the corium acuminate, rounded or truncate; median area of the mesocorium very slightly narrowed inwardly posteriorly; scutellum reaching or nearly reaching the apex of the abdomen, widened posteriorly and wider at the middle than at the base; body oval, sides arcuate, exocorium with two, sometimes only one, costae; femora with stout spines, posterior surface of tibiae with a linear ridge along its entire length).

I. *Galgupha* Amyot & Serville 1843, p. 186

Pronotum and scutellum (viewed from the side) not forming a continuous convex line with each other, the base of the pronotum posteriorly and of the scutellum anteriorly being convex-declivous; costal edge of the corium immarginate or marginate, in the latter case, both the pronotum and scutellum are rastrate ..... 4

4. Pronotum and scutellum *rastrate*, costal edge margined, exocorium bicostate and distinctly set off from the mesocorium by a very distinct longitudinal impressed line; head obtusely angulately rounded, somewhat flattened; eyes im-



the costal margin; pronotum entirely dark; vertex coarsely punctate ..... 4

Space between the mesocorial and the cubital vein at its narrowest point as wide as or wider than that between the cubital vein and the costal margin at the same point; (mesocorial vein stopping opposite the apex of the clavus; corium partly yellow; length, 3.2-4.2 mm.)

*guttiger* Stål 1862

Texas, (Mexico, Cuba).

4. Corium entirely black or brownish-black, *without* a conspicuous pale yellowish basal mark; sternites *without* pale lateral marks; ventral segment VI in the male quite sharply angulate in the middle of the anterior margin and with a dense transverse strip of brownish-black erect hairs close to the apex, in the central one-third or more, the extreme apex with a transverse groove on almost its entire extent; vertex in female moderately deeply punctured, carinate on its entire extent in front; length, 3-3.8 mm.

*diminuta* Van Duzee 1923

Arizona, California.

Corium reddish or yellowish at the base and sometimes with a small subapical pale spot on the exocorium; ventral segments with the pale lateral marks usually absent on segment II; segment VI in male without preapical brush-like hairs, without a transverse apical groove; vertex coarsely punctate ..... 5

5. Corium with a small subcostal yellow spot near the apex in addition to the larger basal mark; length, 3.5-4 mm.

*punctifer* McAtee & Malloch 1933

Texas, (Neotropical).

Corium with the basal yellow mark only; length, 4 mm.

*texana* McAtee & Malloch 1933

Texas.

6. Anterior outline of the head bluntly angulate on each side of the tylus, head tumid between these angulations, concave between the prominences and the eyes; anterior tibiae *with* an anterodorsal series of closely set black spinules in addition to the usual pale bristles, on almost its entire length; [ocelli set well behind the posterior transocular line; length, 4-4.5 mm.; (subgenus 2. *Orocoris* McAtee & Malloch 1933)].

*arizonensis* Van Duzee 1923

Anterior outline of the head *not* angulate on each side of the

- tylus nor tumid beneath; anterior tibiae *without* spinules in addition to the usual pale bristles; (corium narrowly rounded or pointed at apex, the branches of the exocorial vein nearly or quite united at their apices; mesocorium *without* veins; posterior tibiae *without* a deep longitudinal groove just exterior to the carinate line) ..... 7
7. Lateral area of the metapleuron smooth, impunctate; (subgenus 3. *Galgupha* Amyot & Serville 1843) ..... 8
- Lateral area of the metapleuron *distinctly* punctured adjacent to the ostiolar surface; [(scutellum generally entirely black, only one species with coccinelloid coloration; corium acute); (subgenus 4. *Nothocoris* McAtee & Malloch 1933)] .....13
8. Disc of pronotum and scutellum obsoletely punctate ..... 9
- Disc of pronotum and scutellum *distinctly* punctate .....11
9. Scutellum *angulate* apically; length, 4.5-5 mm.  
*denudata* Uhler 1863  
Virginia and District of Columbia to Louisiana, Florida and Texas.  
Scutellum *broadly rounded* apically; (inner margin of female genital plates almost as long as the posterior plates which are decidedly oblique and concave) .....10
10. Outline as seen from above noticeably more narrowly rounded posteriorly than anteriorly; dorsal rim of the male hypopygium with a conspicuous carinate elevation on each inner side anteriorly; length, 4.5-6 mm.  
*carinata* McAtee & Malloch 1933  
Maryland and Tennessee to Louisiana, Oklahoma and Texas.  
Outline as seen from above scarcely more rounded posteriorly than anteriorly; dorsal rim of the male hypopygium *without* carinae, broadly basin-like, at times not so; anterior femora with 4 anteroventral spines; anterior tibiae with 5 or 6 strong spines and 1 or 2 weak setulae; (length, 4.5-6 mm., width, 3.2-4 mm.).  
*atra* Amyot & Serville 1843  
Ontario and New England west to Wisconsin and North Dakota and south to Florida, Texas, Arizona and Colorado; on barley and *Plantago aristata*.
11. Branches of the exocorial vein subparallel; scutellum as viewed from the side abruptly declivous apically ..... 12
- Branches of the exocorial vein noticeably divergent; scutellum from the side usually rounded apically; (male hypopygium with a fringe of hairs; antennal segment III less than twice

the length of II; scutellum not abruptly declivous beyond the middle; length, 4.6 mm., width, 3 mm.)

*ovalis* Hussey 1925

Massachusetts, District of Columbia and Virginia, south to Georgia, Florida and Texas, (Mexico and Guatemala).

12. Hind margins of the male hypopygium as seen from below *shallowly* concave for most of its width, dorsal rim narrow and abruptly declivous anteriorly, with unusually long hairs forming a conspicuous fringe; length, 4-5 mm.; width, 3-3.2 mm. .... *aterrima* Malloch 1919  
Canada and Maine to New York, New Jersey, Maryland, Illinois, Indiana, to Wisconsin and Oklahoma.

Hind margin of the male hypopygium *abruptly* concave at the middle, the dorsal rim flat and broad anteriorly, *without* long hairs; length, 4.5-5.5 mm.

*hesperia* McAtee & Malloch 1933

California.

13. Female: genital plates *not* longer on the inner margins than ventral segment V at the middle, sometimes distinctly shorter; (prosternal sulcus nearly or quite reaching the anterior margin of the anterior acetabula, almost parallel-sided, deep, the lateral ridges carried well up to past the posterior end of the sulcus; anterior margin of ventral segment VI angulate at middle; male: vertex of head with large deep punctures, contiguous on anterior half or more, giving it there a reticulate appearance; length, 4-4.5 mm.)

*nitiduloides* Wolff 1802

Ontario and New England west to Colorado and south to North Carolina, Texas, (Guatemala); on *Plantago purshii*.

Female genital plate distinctly longer on the inner margins than ventral segment V at middle ..... 14

14. Scutellum dull, crowded punctate, more or less rugose and rastrate peripherally; mesocorium punctate posteriorly; length, 4-5 mm. .... *bakeri* McAtee & Malloch 1933  
Colorado.

Scutellum polished, only moderately punctate; mesocorium impunctate posteriorly; length, 3.5 mm.

*cas* McAtee & Malloch 1933

Texas.

## Genus II. *Cydnoides* Malloch 1919

### KEY TO SUBGENERA AND SPECIES

1. Hind tibiae *without* a carinate line on the posterior surface;

- exposed corium about as wide at the apex as at the base (subgenus 2. *Sayocoris* McAtee & Malloch 1933) ..... 2
- Hind tibiae *with* a definite carinate line on the posterior surface; exposed corium not nearly as wide at apex as at base; (prosternal sulcus shallow, much widened in front; corium rounded at apex) (subgenus 1. *Cydnoides* Malloch 1919) 4
2. Pronotum pale yellow on the lateral margins, the anterior discal part varying from yellowish-brown to piceous, posterior margin and scutellum testaceous; (head convex above, *all* chitinized parts of the hemelytra white); length, 3.5-4 mm.  
*albipennis* Say 1831  
*(sayi* Van Duzee 1904)  
 Kansas, Colorado; on *Glycyrrhiza lepidota*.
- Pronotum dark on the lateral margins, the disc and the scutellum testaceous to piceous ..... 3
3. Form *more* narrowed anteriorly; head produced about one and one-half times the length of the eye beyond the anterior transocular line; hind margins of the genital plates almost straight and transverse; general color above piceous; length, 3 mm. .... *peregrinus* McAtee & Malloch 1933  
 Lower California, Mexico.
- Form *less* narrowed anteriorly; head produced about the length of the eye beyond the anterior transocular line; hind margins of the genital plates more or less concave and oblique; color above piceous anteriorly, castaneous or paler posteriorly; (chitinized part of the hemelytra ivory-yellow, with a small blackish spot before the apex); length, 3.5 mm.  
*obtusus* Uhler 1894  
 California. Arizona; under *Euphorbia polycarpa*.
4. Corium entirely fuscous to black, *no part whitish*; hind tibiae *with at least* 5 posterodorsal bristles; length, 4-5.2 mm., width, 3-3.5 mm.; (2 subspecies, *ciliatus* Uhler, and *orientis* McAtee & Malloch 1933).....*ciliatus* Uhler 1863 (subsp. *orientis* McA. & M.) Minnesota, Kansas, Nebraska, Missouri, Colorado, Florida, Texas; (subsp. *ciliatus* Uhl.) Oregon, Nevada, Utah, New Mexico, California; burrows in sand; also found under *Euphorbia* spp. and on *Cassia marilandica*.
- Corium partly white or cream-colored; hind tibiae with *not more than 4* anterodorsal bristles ..... 5
5. Corium immaculate cream colored, except on its inner margin near middle, where there is a fuscous mark; clavus fuscous

on inner margin *only*; scutellum in profile *evenly* rounded subapically; length, 4 mm.

*confusus* McAtee & Malloch 1933

New Mexico, Arizona, Texas, (Colima, Mexico, in the Tierra Caliente).

Corium cream colored basally, fuscous apically, the intermediate area sometimes with dark punctures; clavus entirely fuscous; scutellum in profile rather angularly declivitous subapically; length, 3.25–4.25 mm. .... *renormatus* Uhler 1895  
Illinois, Colorado, New Mexico, Arizona, Texas.

(N.B.—*Cydnoides arizonensis* Van Duzee is transferred by McAtee & Malloch, *op. cit.*, to *Galgupha* A. & S., subgenus *Orocoris* McA. & M.)

### Genus III. *Amyssonotum* Horváth 1919

To the divisional characters in the generic key may be added, from Horváth's original characterization of the genus: Body very broad oval; ocelli separated from each other more than three times as far as from the eye; rostrum extending to posterior coxae; corium noticeably narrowed posteriorly, the apex obtuse; exocorium costate, punctate; tibiae terete, *without* a sulcus; pronotum, except the apex, and the scutellum from each side toward the middle, densely very finely rastrate.

The one species and type of the genus is

*A. rastratum* Stål 1860

The original description sets forth the following characters: Head twice as long as broad, very punctate, base nearly smooth; pronotum with the anterolateral margins rounded, behind the middle obviously emarginate, anteriorly densely punctate, disc and posteriorly very densely longitudinally rastrate, basally nearly smooth; beneath densely punctate, ventral disc smooth; length, 3.6 mm., width, 2.5 mm.

Texas, (Neotropical).

### Genus IV. *Corimelaena* White 1839

(*Allocoris* McAtee & Malloch 1933)

#### KEY TO SUBGENERA AND SPECIES

1. Spiracles of ventral segments III to VI *below* the lateral carina (subgenus *Corimelaena* White—*Allocoris* McA. & M.) ..... 2
- Spiracles of some of segments III to VI *in* or *above* the lateral carina ..... 15

2. Apex of corium *acute* .....11  
 Apex of corium *rounded or obtusely pointed* ..... 3
3. Corium entirely dark distinctly punctured to the end of the edge of the costa; margins of vertex slightly but distinctly reflexed; median transverse impression of pronotum very faint; anterior tibiae with 5 posterodorsal spines in addition to the apical spine; (length, 4-4.8 mm.)  
*nigra* Dallas 1851  
 (*anthracina* Uhler 1876)  
 Hudson Bay and British Columbia to Oregon, California, Nevada, New Mexico, Arizona, Michigan, New York (?).  
 Corium more or less pale and almost or quite impunctate along the costa; margins of the vertex *usually not reflexed* ..... 4
4. Pale margin of corium widened basally, extending *over* the cubital vein and almost filling the cell between the cubital vein and the claval suture, sometimes with a broad median interruption; *less than 4 mm. long* ..... 9  
 Pale margin of the corium of almost uniform width, *not extending over the cubital vein at any point*; species averaging 4 mm. in length ..... 5
- 5.\* Last tergite in *females* nearly always more or less pale margined; genital plates with large deep punctures ..... 6  
 Last tergite of *males not pale margined* ..... 7
6. Subgenital plates half as long as genital plate; last tergite not pale margined; length, 4 mm.  
*feminea* McAtee & Malloch 1933  
 Texas.  
 Subgenital plates *not more than one-third* as long as the genital plates, last tergite more or less pale margined; (costa black on the inner part of the ventral exposure) ..... 8
7. Genital plates nearly as long on the inner as on the posterior margin; penultimate ventral segments before the genital plates *with a sharp lateral carina*; disc of dorsum distinctly punctured; length, 3.5-4.2 mm., width, 2.7-3 mm.  
*lateralis* Fabricius 1803  
 (*gillettii* Van Duzee 1904)  
 Massachusetts west to Nebraska and south to Florida and Texas, (Mexico).  
 Genital plates *distinctly* shorter on the inner than on the posterior margin; disc of the dorsum only obsoletely punctured; (pale lateral edges of ventral segments V and VI thickened, somewhat tumid, embracing the spiracles); penulti-

\* This couplet exactly as in McAtee and Malloch.



mate ventral segment before the genital plates *without* a sharp lateral carina; length, 4 mm.

*polita* Malloch 1919

Texas.

8. Dorsal rim of hypopygium obviously broadest at the lateral angles; (costal stripe narrowed, posteriorly somewhat obsolete, not extending to the cubitus, and not as wide as the mesocorium, costa black on the inner part of the ventral exposure; ventral segments polished medially, but not broadly; length, 3.5-4.2 mm., width, 2.7-3 mm.)

*lateralis* Fabricius 1803

Dorsal rim of the hypopygium as broad as, or broader anteriorly than at the lateral angles; (pronotum and scutellum almost evenly punctate; anterior rim of the hypopygium nearly flat; ventral exposed surface *not* deeply sulcate, flange low; length, 3.5-4 mm.) .....*contrastata* McAtee & Malloch 1933  
Arizona, (Mexico).

9. Pale marking of the corium broadly interrupted by black near the middle; (posterior tibiae with two or three posterodorsal bristles; disc of the pronotum and the scutellum glossy, almost impunctate; hind margin of hypopygium distinctly convex medially; the corial mark usually yellowish, not sharply margined internally and scarcely reaching the mesocorial vein basad of the central black interruption; length, 3-3.5 mm.) .....*interrupta* Malloch 1919  
Texas, (Mexico and Central America).

Pale markings of corium not interrupted ..... 10

10. Hind tibiae *without* posterodorsal bristles; sides of the head in front of the eyes slightly emarginate; length, 3-3.5 mm.

*alpina* McAtee & Malloch 1933

New York (Adirondack Mts.).

Hind tibiae with 1 to 3 short posterodorsal bristles; sides of the head in front of the eyes distinctly emarginate, especially in the male; (male hypopygium with two longitudinal convergent carinae or their vestiges, across the anterior rim, bounding an area shaped like the keystone of an arch upside-down; anterior margin of the pronotum as distinctly punctured as the posterior part of the head); length, 2.7-3.2 mm., width, 2-2.2 mm. ....*pulicaria* Germar 1839  
Quebec and New England west to British Columbia and Colorado, and south to Mississippi, Florida and Texas; on *Ceanothus americanus*, *Veronica peregrina*, cultivated berries, etc.

11. Pale markings of the corium widened near the base, extending over the cubital vein and almost filling the cell between the cubital vein and the claval suture .....12  
 Pale markings of the corium *not* extending over the cubital vein at any point .....13
12. Male with the entire upper surface with uniform large deep punctures with narrow ridges between giving a honey-combed effect; hind margin of the hypopygium deeply concave emarginate; female with the entire upper surface with uniform deep punctures; length, less than 2.5 mm.  
*minuta* Uhler 1863  
 Texas, (West Indies).  
 Male with the disc of the pronotum and the scutellum with sparse punctures, or almost impunctate; emargination of the hind margin of the hypopygium transverse at the bottom and with the yellow margin much narrower than the exposed black part below it; tibiae pale: female with the disc of the pronotum and of the scutellum sparsely and shallowly punctured; ventral segment VI distinctly longer than the preceding segments taken together; tibiae dark; length, 2.8–3.1 mm. ....*barberi* McAtee & Malloch 1933  
 Texas, (Mexico, Central America).
13. Inner margin of the pale costal stripe straight; margin of male hypopygium *not* broadly yellow; species not over 3 mm. long .....14  
 Inner margin of the pale costal stripe slightly angulated near the middle; margin of the male hypopygium broadly yellow; (body very robust); length, 3–4 mm. ....*agrella* McAtee 1919  
 Maryland, Virginia, Kentucky.
14. Male hypopygium broadly exposed, its hind margin convex medially, concave sublaterally; sides of vertex only slightly sinuate; (dorsal ring of male hypopygium shallowly basined, smooth); head *not* almost angularly emarginate before the eyes, slightly concave; length, 2.5 mm.  
*harti* Malloch 1919  
 Maryland, Virginia, Georgia, Illinois.  
 Male hypopygium almost entirely concealed from below by ventral segment VI, its hind margin slightly concave; sides of vertex distinctly, almost triangularly emarginate before the eyes; length, 2–2.7 mm., width, 1.3–1.7 mm.  
*marginella* Dallas 1851  
*(nanella* McAtee 1919)

- New York, New Jersey, Maryland, Virginia, Indiana, Florida; on *Arisimina parvifolia*.
15. Spiracles of segments V and VI *in* the carina, of segments III and IV *below* the carina (subgenus 2—*Termapora* McAtee & Malloch 1933); (pale border of the corium entire, tibiae as pale as the tarsi; venter with a narrow impunctate discal area; length, 2.5–3 mm.) .....*minutissima* Malloch 1919  
Mississippi, Texas, (Mexico).
- Spiracles of segments III and IV *in* the carina (subgenus 3—*Parapora* McAtee & Malloch 1933) .....16
16. Corium *with a dark mark* on the costa beyond the middle; length, 3 mm. ....*californica* Van Duzee 1929  
California.
- Corium *entirely yellow* .....17
17. Male: dorsal rim of the hypopygium essentially flat, neither decidedly sloping nor excavated interiorly; (female: genital plates decidedly shorter on the inner than on the posterior margins; posterior tibiae without evident posterodorsal bristles; posterior margin of the scutellum and the tibiae pale; greatest width of the opaque area behind the ostiole barely exceeding the width of the ostiole and not half as wide as the glossy part of the metapleuron behind it; length, 2–3.25 mm.) .....*cognata* Van Duzee 1907  
Arizona.
- Male: dorsal rim of the hypopygium decidedly sloping or excavated interiorly; (sides of pronotum rounded; lateral margins of venter except segment VI distinctly carinated, inconspicuously yellow; posterior margins of the hypopygium concolorous; vertex behind the eyes punctae) .....18
18. Male: anterior rim of the hypopygium sloping inwardly, a rounded carina following its inner side; (female: genital plates decidedly shorter on the inner than on the posterior margins; hind tibiae with *two* or more posterodorsal bristles, which are about as long as the diameter of the tibia; posterior margin of the scutellum concolorous; tibiae concolorous; greatest width of the opaque area behind the ostiole much greater than that of the ostiole, and about equal to that of the glossy part of the metapleuron behind it; length, 3.5–4 mm.)
- extensa* Uhler 1863  
(*montana* Van Duzee 1909)
- South Dakota and Iowa to Washington and California, Utah, Nevada, Arizona; on wild tobacco (*Nicotiana* sp.).

- Male: Anterior rim of the hypopygium depressed or bevelled off anteriorly, forming a nearly straight carina along its inner side ..... 19
19. Carina of the hypopygium with a more or less pronounced setulose elevation on each side posteriorly; length, 3.5–4 mm.  
*virilis* McAtee & Malloch 1933  
 Idaho, Utah, California, Arizona.
- Carina of the hypopygium without lateral setulose elevations; (female: genital plates nearly as long on the inner as on the posterior margins); length, 2.75–3.5 mm.  
*incognita* McAtee & Malloch 1933  
 British Columbia and Colorado south to California and Texas, (Mexico).

Family III. PENTATOMIDAE Leach 1815

KEY TO SUBFAMILIES

1. Scutellum U-shaped, very large, nearly or quite reaching apex of abdomen; *no indication of frena*; opaque part of the corium narrow, triangular, the apical margin very oblique.  
 1. GRAPHOSOMATINAE Jakovlev 1884, p. 197  
 Scutellum subtriangular, or *somewhat* U-shaped, rarely approaching apex of abdomen; *frena at least*  $\frac{1}{4}$  as long as scutellum; opaque part of the corium broad and subtriangular ..... 2
2. Spiracle of ventral segment II (*i.e.*, the first segment visible under the posterior edge of the metasternum), exposed, not hidden by the metapleura, a short but evident distance from their posterior margin; (bucculae subparallel or slightly converging posteriorly; segment I of rostrum contained in the groove or partly free and projecting at an angle).  
 3. TESSARATOMINAE Stål 1864, p. 243  
 Spiracle of ventral segment II concealed by the metapleura, *rarely* exposed *just at* the posterior margin of the metasternum ..... 3
3. Bucculae subparallel, *not* united posteriorly; segment I of rostrum *not* free, lying within the groove between them, at least posteriorly ..... 4  
 Bucculae convergent and united behind; segment I of rostrum stout, free, directed away from the head, only its base lying between the bucculae ..... 5. ASOPINAE Spinola 1851, p. 245
4. Sternum longitudinally carinate between the coxae for its entire length; venter subcarinate for its entire length, with a long acute spine or process projecting anteriorly from ventral

segment II between the hind coxae; (prosternum anteriorly produced into a plate, the inner margin of the plate reflexed); tarsi 2-segmented.

4. ACANTHOSOMATINAE Stål 1864, p. 244

Sternum and venter without a carina or ridge; tarsi *always* 3-segmented; prosternum not produced; (exceptionally, the sternum and venter may be carinate or subcarinate, or the sternum may be produced, but the tarsi are *always* 3-segmented) ..... 2. PENTATOMINAE Stål 1864, p. 199

Subfamily 1. **Graphosomatinae** Jakovlev 1884

Tribe *PODOPINI* Dallas 1851

KEY TO GENERA

1. Cheeks flattened, thin, a little longer than tylus; antennal tubercles prominent beyond sides of head, armed on the outer side with a curved spine; (angles of pronotum armed with a short acute tooth; no metasternal carina).

II. *Podops* Laporte 1832, p. 197

Cheeks convex, tumid, much longer than and contiguous before tylus; antennal tubercles scarcely prominent beyond sides of head, unarmed ..... 2

2. Anterior angles of pronotum armed with a prominent denticulate rounded or quadrangular lobe; without a metasternal carina ..... I. *Oncozygia* Stål 1872, p. 197

Anterior angles of pronotum *without* lobes; provided with a distinct metasternal carina...III. *Weda* Schouteden 1905, p. 198

Genus I. *Oncozygia* Stål 1872

A monotypic genus, whose one species is

*O. clavicornis* Stål 1872

In addition to the key characters are the following: antennae short, segment II reaching apex of head, I and IV subequal; rostrum reaching middle coxae; length, 3.5-5 mm.

Nothing seems to be known about it other than its occurrence in Virginia, Florida, Texas and Vancouver Island! This distribution is too scattered to be real.

Genus II. *Podops* Laporte

KEY TO SPECIES

1. Tooth or projection near humeral angle of pronotum very prominent, subcylindrical, surpassing the humerus by a distance

- equal to length of eye, its apex and anterior margin curved; margin of pronotum in front of humeral tooth deeply sinuate or concave ..... 2
- Tooth near humeral angle of pronotum much less prominent, but only slightly surpassing the humerus, subtriangular, its apex obtuse or subacute; margin of pronotum in front of tooth feebly sinuate or straight ..... 3
2. Lobe or tooth at the anterior angle of pronotum very large, surpassing eye by one third or more of its length, its apex obtuse; rostrum reaching or slightly surpassing posterior coxae, rostral segments II and III subequal, each one-half longer than IV; femora wholly piceous-black; length, 7-9 mm. .... *dubius* Palisot de Beauvois 1805  
New York?, New Jersey?, Virginia, Georgia, Florida, Texas, (West Indies); in sedges, in axils of leaves (sec. Blatchley).  
Tooth at anterior angle of pronotum much smaller, not surpassing eye, its apex subacute; rostrum scarcely reaching intermediate coxae; rostral segment II nearly as long as III and IV taken together; femora paler annulated; length 5-5.5 mm. .... *peninsularis* Blatchley 1924  
Florida; under boards and among grass roots at the edges of ponds (sec. Blatchley).
3. Disc of abdomen sparsely irregularly punctate; margin of pronotum between apical and humeral projections distinctly but not deeply sinuate; outer apical angles of male genital plate produced and visible from above beyond the apex of the scutellum; length, 6-6.5 mm. .... *cinctipes* Say 1828  
Quebec and New England States west to Minnesota and Nebraska and south to New Jersey and District of Columbia; in sandy places (Hart); at grass roots in New Jersey.  
Entire abdomen deeply uniformly punctate throughout; margin of pronotum between the projections straight; outer apical angles of male genital plate short, obtuse, not visible from above; length, 5-5.5 mm. .... *parvulus* Van Duzee 1904  
Quebec, Massachusetts, New York, New Jersey, Nebraska, Kansas, Illinois, Colorado.

Genus III. *Weda* Schouteden 1905

This is another monotypical genus, apparently known only from the type specimen which is in Europe. In addition to the key characters, the following will help to recognize the genus; absence of lobes on pronotum and presence of a distinct metasternal carina, which set it off from *Oncozygia* Stål.

*W. horvathi* Schouteden 1905

the only species in the genus may be known by the juga being slightly longer than the tylus and contiguous before it; eyes pedunculated; antennal segment I not reaching apex of head, distinctly longer than III, a little longer than II and subequal to IV, V longest and equal to III and IV taken together; rostrum not passing anterior coxae; length, 5.6 mm., width, 3 mm.

Colorado.

Subfamily 2. **Pentatominae** Stål 1864

## KEY TO TRIBES

1. Juga laterally toothed near apex; (venter with a shallow longitudinal sulcus medianly; head very long; anterolateral margins of pronotum usually with coarse teeth).
  4. *Halyini* Stål 1872, p. 201
- Juga *not* toothed laterally near the apex ..... 2
2. Segment I of rostrum not evident between the bucculae anteriorly, apparently emerging behind the middle of the head, reaching the anterior coxae.
  1. *Discocephalini* Fieber 1861, p. 200
 Segment I of rostrum resting about parallel to under surface of head, its basal end evidently in front of the middle of the head ..... 3
3. Body very flat, regularly ovate, broadest behind middle, margins all explanate; head flat above with a thin dilated margin, about as wide as the scutellum; scutellum broad, scarcely narrowed apically; sides of tergum rather broadly exposed.
  2. *Sciocorini* Amyot & Serville 1843, p. 200
 Body not extremely flat, usually broadest at humeri, margins *not* uniformly explanate; head *not* very widely dilated, convex above if as wide as scutellum, but generally narrower; sides of tergum narrowly or not at all exposed ..... 4
4. Metasternum with a median smooth elevated area, strongly notched behind to receive the ventral spine, and prolonged anteriorly as a bifid process; (juga usually meeting broadly in front of tylus) ..... 6. *Edessini* Kirkaldy 1909, p. 242
- Metasternum with no more than a simple median carina ..... 5
5. Venter with first three segments on each side of middle with a curved stridulatory band, finely and densely cross-striated; body elongate, about four times as long as its greatest width.
  3. *Mecidiini* Distant 1902, p. 201
 Venter *without* a finely striated band on each side of the middle

of the venter near the base; body not over three times as long as its greatest width; (juga without lateral teeth).

5. *Pentatomini* Stål 1872, p. 207

Tribe 1. *DISCOCEPHALINI* Fieber 1861

KEY TO GENERA

A. Head *narrower* than the anterior margin of pronotum; side of head with a spinose prolongation in front of eyes.

I. *Dryptocephala* Laporte 1832, p. 200

B. Head *as broad as* the anterior margin of pronotum; side of head without spinose prolongation in front of eyes.

II. *Platycarenum* Fieber 1861, p. 200

Genus I. *Dryptocephala* Laporte 1832

This genus is Neotropical, and apparently unknown from the United States until Hart (*Pentatomidae* of Illinois) noted nymphs seemingly of this genus from Brownsville, Texas, on the Gulf of Mexico, near the mouth of the Rio Grande.

Genus II. *Platycarenum* Fieber 1861

KEY TO SPECIES

A. Lateral margins of thorax and exterior margin of corium *entirely punctate*; apex of scutellum *without* a very minute levigate spot; a small levigate, long, suboblique corial spot; length, 8 mm., width, 4 mm. (female) ..... *clypeatus* Stål 1862 Texas, Arizona, (Mexico); in earth at roots of plants.

B. Lateral margin of thorax and base of outer margin of corium *impunctate*; apex of scutellum with a small levigate spot; small levigate spot of corium subrotundate; male and female, length, 9 mm., width, 5 mm.

*marginellus* Dallas 1851

Mexico.

Tribe 2. *SCIOCORINI* Amyot & Serville 1843

Genus *Sciocoris* Fallén 1829

To the key characters, these may be added for the genus: juga meeting in front of tylus; ocelli very small; scutellum reaching the middle of the dorsum, with its apex rounded; connexivum very wide, almost wholly exposed.

This is an Old World genus represented in America north of Mexico by one Palaearctic species, which ranges across central Europe into China and Siberia; this is



*S. microphthalmus* Flor 1860

Specific characters are: thickly fusco-punctate, punctures forming small blotches here and there; antennae slender, segment II slightly longer than III, segments IV and V subequal; length, 5 mm.

Ontario, New Hampshire, Maine, New York, Michigan, Minnesota, North Dakota—a clearly cold climate insect, found apparently in North America in mountainous parts, *i.e.*, White Mountains, Green Mountains, Adirondack Mountains—all of which have a distinctly boreal air. It is found here in weeds and grasses along edges of woodland streams. In Europe, the various species are found at the roots of plants in sandy or stony places.

Tribe 3. *MECIDINI* Distant 1902

Genus *Mecidea* Dallas 1851

This tribe has been erected for one genus, and its single species. The genus may be further distinguished by having on the venter on each side near the spiracles a densely transversely strigose vitta, which crosses the three basal ventral segments. No further differential characters for the species

*M. longula* Stål 1856

would seem to be needed; length, 11–13 mm., width, 3–3.5 mm.

Iowa, Colorado, New Mexico, Texas, Arizona; supposed to occur in sand areas; taken in Arizona on grasses at the borders of canyon streams, and on *Senecio*.

Tribe 4. *HALYINI* Stål 1872

Genus *Brochymena* Amyot & Serville 1843

KEY TO SPECIES

1. Humeral projections of pronotum subquadrate, prominently toothed; basal quarter of scutellum distinctly elevated; ostiole merely an inconspicuous pit without a canal or auricle of any kind, or the auricle is extremely small, no dull evaporative area evident ..... 2
- Humeral projections subtriangular with small teeth, rounded or otherwise, but *never* subquadrate with prominent teeth; basal quarter of scutellum hardly elevated; ostiole with an oblique crateriform base and a distinct, usually very prominent laterally extending auricle, this sometimes with a partial spiral twist, a dull subtriangular evaporative area about the ostiole and canal ..... 9

- 2 ( 1). Juga longer than tylus by *at least* the width of one jugum at that point ..... 3  
 Juga subequal to tylus, if longer *never* by one half of one jugum at that point ..... 5
- 3 ( 2). Anterior tibia stout and short, dilated from about the middle to apex; (humeral teeth long and very acute; length, 13.5–14 mm., width, 8 mm.) ..... *barberi* Ruckes 1939  
 Arizona.  
 Anterior tibiae not or but feebly dilated ..... 4
- 4 ( 3). Base of scutellum distinctly gibbous; only antennal incisures pale; humeral teeth long and acute; length, ?  
*aculeata* Distant 1889  
 Mexico (Sonora).  
 Base of scutellum raised but never exceedingly tumid or gibbous; *basal half* of each antennal segment pale; humeral teeth blunt; length, 12–19 mm., width, 8–10 mm. .... *poeyi* Guérin 1857  
 Florida, (West Indies).
- 5 ( 2). Anteoctular tubercle attenuated into a strong tooth or spine; Length, 11 mm. .... *apiculata* Van Duzee 1923  
 Mexico (Sonora).  
 Anteoctular tubercle either small and inconspicuous, or entirely obsolete ..... 6
- 6 ( 5). Anterior tibia short and stout, shorter than anterior femora, dilated from about the middle to the apex; (juga not or but slightly longer than tylus) ..... 8  
 Anterior tibia long and slender, longer than anterior femora, if at all dilated, the dilation is restricted to the very apex ..... 7
- 7 ( 6). Juga sometimes slightly longer than the tylus; horizontal sulcus between the humeral teeth and the dorsal aspect of the humerus usually very pronounced; tibial sulcus shallow, its edges indistinct; anterior and posterior angles of the ventral abdominal segments with a black triangular or elongate spot; length, 12–17 mm., width, 8–10 mm. .... *arborea* Say 1825  
 Ontario and New England to Kansas, Florida, Texas and Mexico.  
 Juga subequal to tylus, rarely *very* slightly longer; *no* horizontal sulcus between the humeral teeth and the dorsal aspect of the humerus; tibial sulcus distinct, its edges raised and quite evident; anterior and posterior angles

of the abdominal segments *without* black triangular or elongate spots, or, if spots are present, obsolescent; length, 14–18 mm., width, 8.5–10 mm.

*florida* Ruckes 1939

Florida.

- 8 ( 6). Lateral edges of juga in front of subapical tooth with the tylus, forming a continuous are around apex of head, which is *not* truncated or triangular in outline; length, 12–15 mm. .... *haecula* Stål 1862  
Texas, Arizona, Mexico.

Lateral edges of juga in front of subapical teeth straight and converging, so that the apex of head is triangular or narrowly truncated in outline; length, 13.5–14 mm., width, 8 mm.

*barberi*, var. *diluta* Ruckes 1939

Texas.

- 9 ( 1). Metasternal evaporative area somewhat impressed in its surrounding plate; antennal segment III distinctly longer than II ..... 10

Metasternal evaporative area *not* impressed in its surrounding plate; antennal segment III variable ..... 12

- 10 ( 9). Lateral margins of pronotum pale, calloused, with somewhat small conical or blunt teeth; humeri unarmed and somewhat smooth; (two pale callosities on disc of pronotum and two larger ones near basal angles of scutellum); visible margin of connexivum lower than costal edge of hemelytra; length, 18–22 mm., width, 9.5–11 mm. .... *myops* Stål 1872  
North Carolina, Mississippi, Alabama, Louisiana, Texas, New Mexico, (Mexico).

Lateral margins of the pronotum *not* pale calloused, concolorous with the disc and provided with small irregular conical teeth; humeri unarmed or retrorse-serrate, prominently elevated above rest of pronotum; visible border of connexivum distinctly elevated above the costal margin of hemelytra, so that these appear sunken into the dorsum ..... 11

- 11 (10). Apex of head triangular in front of teeth; narrow edge of connexivum alternated, *not* a pale continuous smooth line; discal point of hemelytra pale; length, 8–18 mm., width, 7–11 mm.

*carolinensis* Westwood 1837  
(*annulata* Fabr. 1775)

Atlantic Coast States to Florida, Alabama.

- Apex of head subtruncate in front of teeth; (teeth blunt but their sinuses still evident); entire edge of connexivum and the abdominal incisures pale dull yellow, discal point of hemelytra obsolete or inconspicuous; length, 21 mm. .... *marginella* Stål 1872  
Florida, Texas.
- 12 ( 9). Jugal distinctly longer than the tylus, exceeding it by *at least* the width of one jugum at that point ..... 13  
Jugal subequal in length to the tylus, *never* exceeding it by the width of one jugum at that point ..... 15
- 13 (12). With an irregular band of deep large black pits extending obliquely across each basal corner of scutellum just inside each basal angle; color *not* light brownish-yellow; markings on membrane dark fuscous, very distinct ..... 14  
Without an irregular band of deep black pits across basal angles of scutellum; scutellum with *no* large prominent pits at all, except the two triangular excavations at the basal angles; ground color pale yellowish-brown; markings on membrane frequently faint and obsolete; length, 13 mm. .... *pilatei* Van Duzee 1934
- 14 (13). Membrane of hemelytra clear hyaline; color usually brownish to fuscous; male genital cup *without* a transverse sulcus; length, 8–18 mm., width, 6–11 mm.  
*quadripustulata* Fabricius 1775  
Quebec and New England to Oregon, California, Utah, Colorado, Arizona and Texas; noted as preying on tussock and brown-tail moths.  
Membrane milky hyaline; color more grayish with a distinct whitish bloom; male genital cup *with* a *deep* transverse sulcus; length, 12–15 mm.  
*sulcata* Van Duzee 1918  
California.
- 15 (12). Propleuron and lateral one-third of pronotum quite tumid so their continued surface appears to be subspherical; [marginal pronotal teeth small, stout, separated and few in number (usually about 3); length, 12–15 mm.].  
*tenebrosa* Walker 1867  
Texas, Colorado, Utah, Nevada, Arizona, California, Oregon, Mexico.  
Propleuron and lateral one-third of pronotum not so swollen

- and the margin between these two surfaces acute and thick ..... 16
- 16 (15). Segment III of antennae *subequal to or longer than* segment II ..... 17
- Segment III of antennae *shorter than* II ..... 21
- 17 (16). Antehumeral sinus evident; humeri prominent, acute or rectangular; tibia *always* with a median annulus which bears a darker central blotch ..... 18
- Antehumeral sinus weak or obsolescent; (pronotal teeth flattish; blunt and retrorse); tibia stout and reddish-fuscous without an evident pale median annulus and a dark blotch; [apex of head before the teeth rounded arcuate (subtruncate in some males); outline of abdomen almost orbicular and wider than diameter across the humeri; length, 17.5–18.25 mm., width, 9–9.5 mm.]  
*dilata* Ruckes 1938
- Arizona.
- 18 (17). With longitudinal white or ivory pale stripes across posterior pronotum and basal corners of scutellum; (body form elliptical; length, 16–16.25 mm., width, 8–8.5 mm.). ..... *lineata* Ruckes 1938
- Arizona, New Mexico.
- Pronotum and scutellum not marked as above ..... 19
- 19 (18). Diameter of head just in front of eyes one-quarter greater than distance from that line to apex of head; head truncated in front of teeth and not much produced; color usually reddish-brown; hemelytra with numerous scattered stellate pale spots; length, 15–17 mm.  
*punctata* Van Duzee 1909
- Indiana, Virginia, Georgia.
- Diameter of head just in front of eyes equal to or slightly less than distance from that line to apex of head; head less truncated in front of teeth, tending to be produced into an obtuse triangle; color not reddish-brown, usually much darker ..... 20
- 20 (19). Color mostly black or very dark; antennal segments I and II dark fuscous to black, segment II two-thirds of III; lateral margin and teeth of pronotum rufous; juga tending to overlap the tylus or their tips to converge; length, 12–14 mm. .... *hoppingi* Van Duzee 1921
- Colorado, Utah.
- Color lighter; antennal segments I and II rufous, segment

II subequal to III but *not* one-third shorter; lateral margin of pronotum and teeth pale but not distinctly reddish; juga more or less parallel and hardly converging; length, 13-16 mm., width, 7-8 mm.

*affinis* Van Duzee 1904

Iowa, Washington, California.

- 21 (16). Apex of head decidedly and acutely triangular; sinus between jugum and tooth obtuse; well-mottled species, contrastingly colored light and dark; length, 17-19 mm., width, 8.5-12 mm. .... *cariosa* Stål 1872  
Tennessee, Arkansas, Mississippi, Florida, Louisiana, Texas.

Apex of head subtruncated; sinus between jugum and tooth obsolete; color not so contrastingly mottled; length, 13-15 mm., width, 7-9 mm. .... *pallida* Blatchley 1926  
Florida.

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## A SYNOPSIS OF THE HEMIPTERA-HETEROPTERA OF AMERICA NORTH OF MEXICO

By J. R. DE LA TORRE-BUENO

(Continued from no. 3, p. 206)

Family III—PENTATOMIDAE (*continued*)

Tribe 5—PENTATOMINI Stål 1872

### KEY TO GENERA

1. Jugs straight, acute (sometimes obtuse), surpassing tylus  
*but not converging* before it; humeral angles of pro-  
notum acute or acutely spinose..... 2  
Jugs obtuse, equalling tylus or converging and nearly or  
quite meeting in front of it; mesosternum *without* a  
prominent carina prolonged anteriorly..... 4
- 2 (1). Ventral segment II anteriorly produced at middle into a  
stout spine projecting between the posterior coxae;  
mesosternum with a very prominent median carina  
prolonged anteriorly.  
XXIX. *Arvelius* Spinola 1837, p. 240  
Ventral segment II not produced into a spine; mesosternum  
with a *low* median carina..... 3
- 3 (2). Femora unarmed..... XX. *Chlorocoris* Spinola 1837, p. 233  
Femora acute at middle of apex above, ending in a minute  
spine..... XXI. *Loxa* Amyot & Serville 1843, p. 234
- 4 (1). Metasternum with a large, smooth, flattened plate, bifid or  
notched posteriorly; (rostrum long, extending on to  
venter; humeral angles prominent; anterolateral mar-

gins of pronotum with several long teeth; distinctly pilose dorsally).

- XXX. *Neopharnus* Van Duzee 1910, p. 240  
 Metasternum *without* a smooth plate; (juga rarely contiguous) ..... 5
- 5 (4). Ventral segment II produced anteriorly toward or between hind coxae at middle in a stout spine or well-defined tubercle ..... 6  
 Ventral segment II sometimes convexly prominent at middle, but not produced forward in a stout spine or tubercle ..... 12
- 6 (5). Juga not exceeding tylus ..... 7  
 Juga surpassing tylus and nearly or quite meeting in front of it ..... 11
- 7 (6). Ventral spine *passing* middle coxae, [spiracles large, black or concolorous (*tinctus* Dist., W. I.)].  
 XXVIII. *Piezodorus* Fieber 1861, p. 239  
 Ventral spine *not reaching* middle coxae ..... 8
- 8 (7). Antennal segment I surpassing apex of head.  
 XXIII. *Vulsirea* Spinola 1837, p. 235  
 Antennal segment I *not* surpassing apex of head ..... 9
- 9 (8). Antennal segment II *more* than half as long as V ..... 10  
 Antennal segment II *less* than half as long as V; (ventral spine sometimes reduced to a broad tubercle).  
 XXVII. *Banasa* Stål 1860, p. 237
- 10 (9). Ostiolar prolongation acuminate, reaching over halfway to the body margin.  
 XXVI. *Acrosternum* Fieber 1861, p. 236  
 Ostiolar prolongation subtruncate, reaching *less* than one-third the distance to the body margin.  
 XXV. *Nezara* Amyot & Serville 1843, p. 236
- 11 (6). Ostiolar sulcus drawn out laterally and tapering into a narrow ridge at apex.  
 { XXXI. *Dendrocoris* Bergroth 1891, p. 242  
 { XXXII. *Odmalea* Bergroth 1915, p. 242  
 Ostiolar sulcus *short, truncated*.  
 XXXIII. *Brepholoxa* Van Duzee 1904, p. 242
- 12 (5). Ostiole *without* a distinct anterior auricle, the margin of the orifice V-shaped at inner end, exteriorly drawn out into a tapering canal often evanescent apically into a narrow acuminate ridge rising from the posterior side of the canal ..... 13

- Ostiolo with the rounded, rarely elongate, orifice on the outer side of a low elevation, which extends around its anterior side and outwardly, usually as a short raised auricle with a more or less free obtusely rounded apex ..... 18
- 13 (12). Frena exceeding midscutellum; evaporative area *well developed* ..... 14  
Frena not reaching midscutellum; evaporative area *very small and ill-defined*.
- II. *Trichopepla* Stål 1867, p. 212
- 14 (13). Ostiolar prolongation short, reaching about *one-third* the distance from the ostiolo to the lateral margin of the metasternum; juga not surpassing tylus (*Pentatoma auct.*) ..... 16  
Ostiolar prolongation reaching *half-way* or more to the lateral margin of the metasternum ..... 15
- 15 (14). Juga not surpassing tylus.
- XIX. *Thyanta* Stål 1862, p. 230  
Juga surpassing tylus and meeting in front of it.
- I. *Peribalus* Mulsant & Rey 1866, p. 211
- 16 (14). Anterolateral margins of pronotum distinctly reflexed ..... 17  
Anterolateral margins of the pronotum acute or carinate, *not reflexed* ..... IIA. *Liodermion* Kirkaldy 1904, p. 213  
(*Lioderma* Uhler 1871)
- 17 (16). Rostral segment III *shorter* than II and about equal to IV ..... IV. *Chlorochroa* Stål 1872, p. 213  
Rostral segment III about equal to II and longer than IV.
- III. *Rhytidolomia* Stål 1872, p. 213
- 18 (12). Head *at least* over four-fifths to seven-eighths as wide as scutellum; (prothorax with a large plate-like production of the anterior margin on each side ventrally, which curves ridgelike mesad of coxa but does not extend posteriorly beyond the latter) ..... 19  
Head *less than* seven-eighths as wide as scutellum ..... 20
- 19 (18). Pronotum *with a median ridge only*; (lateral extension of prothorax on venter not going beyond anterior margin of eye) ..... XIV. *Neottiglossa* Kirby 1837, p. 226  
Pronotum *three-ridged*, sides straighter; (lateral margins of prothorax on venter extending much beyond anterior margin of eye) ..... XIII. *Aelia* Fabricius 1803, p. 225
- 20 (18). Ostiolo with inner end nearly in line with the outer sides of the adjacent coxae, without an evident raised auricle or canal or the usual large opaque evaporative area.
- XXII. *Murgantia* Stål 1862, p. 234

- Ostiole about as far to the side of the outer sides of the coxae as the coxal diameter, terminating in a canal or an evident raised auricle and with a well-defined large opaque evaporative area present, rarely one or the other not developed..... 21
- 21 (20). Bucculae short, extending as far as anterior margin of eyes; anterior and lateral margins of pronotum strongly impressed and reflexed; (canal from ostiole distinct but short, not reaching middle of metasternum, terminating abruptly; large red-and-black species).
- XXIV. *Runibia* Stål 1861, p. 235
- Bucculae extending quite or nearly to base of head; anterior and lateral margins of pronotum *not* strongly impressed or reflexed; (ostiole auriculate exteriorly, without a distinct canal)..... 22
- 22 (21). Posterior tibiae *smoothly rounded* above, at least on basal half ..... 23
- Posterior tibiae flattened or feebly or strongly *sulcate* above, at least on basal half ..... 26
- 23 (22). Bucculae strongly arcuate, *much* exceeded posteriorly by rostral segment I..... 24
- Bucculae nearly straight-edged, *not* exceeded posteriorly by rostral segment I..... 25
- 24 (23). Width of scutellum at the apices of the frena *fully* twice the length of the frena.
- XV. *Cosmoepepla* Stål 1867, p. 227
- Width of scutellum at apices of frena at most little more than the length of the frena.
- VI. *Mormidea* Amyot & Serville 1843, p. 217
- 25 (23). Tylus *rounded* at apex, *not* surpassing juga; eyes and pronotum contiguous.
- VII. *Solubea* Bergroth 1891, p. 218
- Tylus *acute* at apex, strongly surpassing juga; eyes distant from pronotum about as far as their diameter.
- X. *Proxys* Spinola 1837, p. 224
- 26 (22). Posterolateral margins of the pronotum emarginate near the humeri..... XVIII. *Prionosoma* Uhler 1863, p. 229
- Posterolateral margins of the pronotum *not* emarginate ... 27
- 27 (26). Bucculae sloping off at posterior end, *without* an evident posterior lobe ..... 28
- Bucculae elevated at posterior end *into a distinct* lobe, ending abruptly behind..... 31

- 28 (27). Margins of pronotum *arcuate* and explanate; veins of membrane anastomosing.  
 XVII. *Meneclis* Stål 1867, p. 228  
 Margins of pronotum *sinuate*; veins *not* anastomosing.....29
- 29 (28). Frena reaching well beyond mid-scutellum..... 30  
 Frena *not* reaching beyond mid-scutellum; pronotal margin entire.....XVI. *Eysarcoris* Halm 1834, p. 228
- 30 (29). Anterolateral margin of pronotum *sinuate*, *serrate* or *crenulate* anteriorly, if smooth (*integer* Stål), straight and slightly reflexed.  
 VIII. *Euschistus* Dallas 1851, p. 219  
 Anterolateral margins of pronotum *not serrate*, *entire*.  
 IX. *Padacius* Stål 1862, p. 223
- 31 (27). Tylus *not* more prominent above than juga, which converge over it at apex.  
 V. *Carpocoris* Kolenati 1846, p. 217  
 Tylus throughout more prominent than juga, which are *parallel* ..... 32
- 32 (31). Apical part of the scutellum narrower than hemelytra.  
 XII. *Hymenarcys* Amyot & Serville 1843, p. 224  
 Apical part of scutellum broader than hemelytra.  
 XI. *Coenus* Dallas 1851, p. 224

Genus I. *Peribalus* Mulsant & Rey 1866

KEY TO SPECIES

1. Scutellum broad and concolorous to, sometimes pallescent at, the apex, without a white tip; (connexivum alternated with black; head deeply and closely black punctate, juga longer than tylus; length, 7.75-8.5 mm.).  
*tristis* Van Duzee 1904  
 Vancouver Island, California, Washington.  
 Scutellum with a *white* tip..... 2
2. Connexivum *alternated*; scutellum moderately broad; length, 8-9.5 mm. .... *abbreviatus* (Uhler) 1872  
 Nebraska, Kansas, Colorado, Utah, Montana, Arizona, California, British America; on *Prosopis juliflora*.  
 Connexivum *black* with a pale margin..... 3
3. Scutellum broad; body strongly convex, broadest behind middle; length, — mm. .... *piceus* Dallas 1851  
 Iowa, Colorado, Montana, Ontario.  
 Scutellum not broad; body not broadest behind the middle..... 4

4. With short stiff gray hairs; length, 9 mm.

*hirtus* Van Duzee 1927

California.

Without such hairs; (scutellum narrow at tip; form more depressed and narrowed posteriorly); length, 7.5–9 mm., width, 4.5–5 mm. .... *limbolarius* Stål 1872

Common throughout North America into Mexico; on *Solidago*.

*Pentatoma dubia* Dallas, from "N. Am.," not included; it does not appear to have been recognized since described—a doubtful species.

Genus II. *Trichopepla* Stål 1867

KEY TO SPECIES

1. Anterolateral margins of pronotum *carinate*, sometimes quite roundedly reflexed or expanded..... 2  
    Anterolateral margins of pronotum *calloused*, *not* carinate, continuing the slope of the disc..... 6
2. Head longer than its width across the eyes, apex narrower and more produced, sides approaching before the antecular sinus; rostrum *at least* attaining *apex* of hind coxae..... 3  
    Head *not* longer than its width across the eyes, rounded at apex with the sides parallel for a space before the antecular sinus; rostrum *not* surpassing the *base* of the hind coxae 4
3. Head distinctly longer than its width across eyes; apex narrow, parabolic, but little arcuated; antennal segment II obviously longer than III; membrane infuscated; posterior disc of pronotum coarsely irregularly punctured; male genital segment trisinuately excavated; calloused lines on the base of the scutellum more or less broken and obscured; length, 6–8 mm. .... *semivittata* Say 1832  
    Ontario to Colorado and Texas.  
    Head scarcely longer than width across eyes, apex broadly rounded; antennal segments II and III subequal; membrane whitish-hyaline; posterior disc of pronotum closely finely punctured; male genital segment deeply roundedly excavated; three calloused lines on base of scutellum very distinct and regular; length, 7–8.5 mm.  
    *vandykei* Van Duzee 1918  
    California.
4. Connexivum plainly or indistinctly alternated with black at the incisures ..... 5

Connexivum black, its margin broadly pale; length, 8 mm., width, 5 mm. .... *atricornis* Stål 1872  
Illinois to Wisconsin, California, British Columbia  
(Alaska ?).

5. Cheeks more rounded at apex; whole surface finely punctured; width of pronotum *two and one-third* times its greatest length, sides more oblique and slightly arcuated; male genital segment deeply excavated, its lateral margins truncated; (rostrum attaining base of hind coxae; osteolar canal long, flat and obtuse at apex); length, 6 mm.

*pleyto* Van Duzee 1921

California.

Cheeks wider at apex; whole surface coarsely punctured; width of pronotum *twice* its greatest length, sides less oblique; male genital segment shallowly excavated, sinuate; length, 6.5–8 mm. .... *californica* Van Duzee 1918  
California, Idaho, Washington, British Columbia; (Mexico).

6. Antennal segments II, III and IV *subequal*, III only slightly shorter than the other two; length, 6 mm., width, 4.5 mm. (maximum for both sexes)..... *klotsi* Ruckes 1937  
Wyoming.

Antennal segment II *distinctly* longer than III; length *more than* 7 mm. .... 7

7. Apex of rostrum *reaching* intermediate coxae; margins of connexivum broadly *pale*; (juga slightly exceeding tylus); length, 9–10 mm. (males and females).

*grossa* Van Duzee 1918

Idaho, California.

Apex of rostrum *just passing* intermediate coxae; connexivum *alternated with black*; length, 8½–9 mm. (males).

*aurora* Van Duzee 1918

California, Montana.

Genus III. *Rhytidolomia* Stål 1872

IIIA. *Liodermion* Kirkaldy 1904

IV. *Chlorochroa* Stål 1872

(These three genera or subgenera, are treated together, as they are certainly closely related.)

#### KEY TO GENERA AND SPECIES

1. Anterolateral margins of pronotum carinated but *not* distinctly reflexed (*Liodermion* Kirkaldy, n.n. for *Lioderma* Uhler) ..... 2

- Anterolateral margins of pronotum acutely carinated, sharply reflexed, either broadly or narrowly ..... 5
2. Antennal segment II longer than III, IV and V subequal; (rostrum *reaching* ventral segment III, rostral segment II very long, reaching middle coxae; form oval, triangularly produced in front; green or olive-green in color, margins, including head and apex of scutellum pale; length, 8-9 mm., width, ? ? ? ) ..... *viridicata* Walker 1867  
Montana, Nebraska, Colorado, (Mexico).
- Antennal segment II *not* longer than III, or subequal to it ... 3
3. Antennal segment II *shorter* than III, IV one-third longer than II, (V not quite one-third longer than IV; rostrum nearly reaching posterior margin of ventral segment II, its segment II slightly longer than III, which in turn is slightly longer than IV; ostiole with a very short anteriorly curved canal; length, 9.5 mm.); color sordid testaceous  
*schotti* Barber 1927

Alabama.

- Antennal segments II and III subequal; color olive green or brown ..... 4
4. Costal area of hemelytra broadly pale, bordered within by a black line on corium; length, 9.5-12 mm., width, 6-6.5 mm.  
*saucia* Say 1831  
New England and New York to Florida; in salt marshes, on grasses and sedges.

Costal area of hemelytra *not* bordered by a black line on corium, concolorous; (antennal segment I shortest, II and III subequal [16: 15], IV slightly longer than the two preceding segments, V longest, more than twice as long as I [proportion of the segments, 10: 16: 15: 18: 22]; rostrum reaching middle of ventral segment II, segments I and III equal, II one-half longer than either, IV two-fifths of II, [proportion of segments, 20: 30: 20: 12]); length, 12 mm.

*rita* Van Duzee 1934

Arizona.

5. Rostral segments II and III *equal or subequal*, (IV shorter than III); form more elongated and produced anteriorly (*Rhytidolomia* Stål) ..... 6  
Rostral segment II *shorter* than III; form proportionally broader and less produced anteriorly (*Chlorochroa* Stål)  
9
6. Color pale stramineous, hemelytra deep piceous or black; (an-



tennal segments IV and V subequal; rostrum reaching almost to base of ventral segment III; evaporative surface large, pale, dull; tylus subequal to juga; ocelli about as far as their diameter from the posterior margin of the head; anterior tibiae with a strong spine at the inner aspect of the apex; length, 13 mm., width, 8 mm.)

*osborni* Van Duzee 1904

Colorado, Arizona, Texas.

Color green or olive ..... 7

7. Color uniform dark olive brown or somewhat greenish, margins of pronotum and hemelytra paler; (juga sinuate beyond eyes, slightly exceeding tylus; rostral segment IV three-quarters of III; distance between ocelli six times their distance from the inner margins of the eyes, ocelli on or below a line drawn between the anterior angles of the pronotum; anterior angles of pronotum *almost* dentate; segment II of antennae one-quarter longer than III; length, 16-19 mm., width, 7-8 mm.) ..... *senilis* Say 1831  
New England south to Virginia; in salt marshes.

Color green or olive brown; entire margins behind the head and a median line on the scutellum (sometimes almost obsolete), pale; form proportionally broader, more oval ... 8

8. Antennae black, segments I and II, and base of III, green; apex of genital segment of male deeply concavely excavated; outer angles *subacute*; length, 11 mm.

*faceta* Say 1824

"Dakota," Nebraska, Colorado, Utah, California, Arizona.

Antennae black, segment *I only* green; (costal edge of hemelytra beyond middle blackish); apex of genital segment of male feebly concave with a rounded median tooth; outer angles *obtuse*; length, 13-16 mm., width, 7.5-10 mm.

*belfragii* Stål 1872

Canada, Iowa, Illinois, Nebraska.

9. Form elongate-oblong; outer margins, apex of scutellum, three large dots at its base and numerous smooth calloused points on the scutellum, pronotum and hemelytra whitish, the narrow margins sometimes tinged with red; length, 11 mm., width, 6.5 mm. .... *sayi* Stål 1872  
Montana, Idaho, Kansas, Nevada, Colorado, Arizona, California.

Form broader; three smooth dots at base of scutellum, if present, inconspicuous ..... 10

10. (Form broad oval; color deep clear green); entire margins behind the head, and the tip of the scutellum, reddish-yellow or even crimson; male genital segment strongly produced on the ventral surface; (antennal segment II one-half as long as III; rostrum reaching middle of ventral segment II; length, 13-14 mm., width, 6.5-7 mm.)

*persimilis* Horváth 1908  
(? *uhleri* Stål)

Margins of entire body and tip of scutellum usually inconspicuously pale; if strongly contrasted or red, then the male genital segment is *not* produced on the ventral surface .....11

11. Form oblong; outer margins and apex of scutellum conspicuously pale or even crimson; pronotum, scutellum and hemelytra distinctly marked with smooth pale dots; ventral punctures dark; length, 12.5-15 mm., width, 7.3-8 mm.

*ligata* Say 1831

Colorado, Utah, New Mexico, Arizona, California, Vancouver Id.; on cotton, alfalfa, grapes, corn, chile peppers, tomato, peaches, milo, maize, sorghum, peas, figs, *Prosopis* beans, *Yucca*, *Ribes*, *Solanum elaeagnifolium*.

Form more ovate; pale outer margins inconspicuous; ventral punctures concolorous .....12

12. Antennal segment II twice as long as III, which is much the shortest; rostrum reaching posterior coxae, segment I a little shorter than the head, II longer, reaching middle coxae, III and IV subequal; pale outer margins and apex of scutellum inconspicuous; male genital segment produced on the ventral surface; form ovate; length, 9-12 mm., width 5.5-6.5 mm. .... *congrua* Uhler 1876

Idaho, Montana, Utah, Colorado.

Antennal segment II much longer than III; rostrum extending to posterior coxal margins, segment II much longer than III, which is subequal to IV; pale outer margins and points on hemelytra moderately conspicuous, the latter sometimes a little paler than the surrounding surface; length, 11-15 mm., width, 6.5-8.5 mm. .... *uhleri* Stål 1872

(? *persimilis* Horváth)

Quebec and Ontario to New Jersey, Nebraska, Montana, Idaho to California and Mexico, Alaska, Texas; on nasturtium, willow, juniper, *Grindelia squarrosa*, *Opuntia*, *Juni-*

*perus sabina*, *Chrysopsis*, *Kuhnia*, *Ambrosia psyllostachya*,  
*Lespedeza capitata*, grasses.

Genus V. *Carpocoris* Kolenati 1846

KEY TO SPECIES

- A. Head a little longer than its width across eyes; cheeks narrower; sides of pronotum a little sinuated; scutellum with a deep groove behind the pronotal margin; membrane surpassing abdomen for nearly one-half its length beyond tip of corium; rostrum attaining apex of hind coxae, segment I scarcely surpassing apex of bucculae; antennal segment II little if at all longer than III; length, 9–10 mm.

*sulcatus* Van Duzee 1918

California.

- B. Head a little shorter than width across eyes; sides of pronotum arcuated; no deep groove in scutellum; membrane *not* or *but slightly* surpassing abdomen; rostrum reaching to or but slightly surpassing middle coxae, I slightly surpassing apex of bucculae; antennal segment II about one-half longer than III; length, 9–10 mm. .... *remotus* Horváth 1907

Colorado, Utah, Arizona, North Dakota, Montana, California, Northwest Territory (Canada).

Genus VI. *Mormidea* Amyot & Serville 1843

KEY TO SPECIES

1. Head *quite* deflexed anteriorly, black, bucculae concolorous; pronotum before the middle *with* a narrow abbreviate calloused fascia; anterior angles without a small outwardly directed tooth; lateral margins of venter subcalloused; apical margins of the segments scarcely prominent, except segment VI in males; (subgenus *Melanochila* Stål 1872); length, 5.5–6.5 mm. .... *lugens* Fabricius 1775  
Quebec to Texas, east of the Rocky Mountains.

Head *scarcely* or *slightly* deflexed anteriorly, bucculae pale; sometimes black punctate; pronotum *without* a continuous transverse ruga before the middle, anterior angles with a small, or minute, or blunt outwardly pointing tooth; apical angles of the ventral segments most often more or less *distinctly* prominent (subgenus *Mormidea* s.s.) .....

2. Scutellum marked on each side of the base with a large calloused

spot, or with a calloused line or vitta between the anterolateral margins, which is frequently flavescens; (membrane embrowned; sternum black, pleura heavily and the venter trivittate with fuscous; calloused intramarginal line of scutellum subequal to frenum, or extended as far as frenum); length, 5.5–6 mm., width, 3.25–3.5 mm.

*pictiventris* Stål 1862

Florida, Texas.

- Scutellum marked on the basal angles with a minute calloused spot, frequently pale, or without such spot ..... 3
3. Pale testaceous punctured with black; white and calloused—the narrow apex of the scutellum and three basal points, two points on disc of pronotum anteriorly, the slender outer margins of the pronotum and the base of the hemelytra; a median ventral vitta; connexivum not maculated; antennae more or less pale-marked; length, 5.5–6 mm., width, 3.3–3.5 mm. .... *cubrosa* Dallas 1851  
(*sordidula* Stål 1872)

New Mexico, Texas.

White markings as above much reduced; connexivum maculated; venter without a vitta; antennae entirely black or narrowly pale at joints; length, 7 mm., width, 4 mm.

*tetra* Walker 1868

(*griscescens* Stål 1872)

Texas, Arizona, (Mexico).

*Mormidea punctifer* Walker 1867, recorded as from California is omitted from this key; Van Duzee says (1904) "Unrecognized by recent students."

Genus VII. *Solubea* Bergroth 1891

KEY TO SPECIES

- A. Humeri armed with long anteriorly directed spines; anterior tibiae longitudinally sulcate; spiracles black; anterior margin of male hypopygium (ventral view) broadly concave; length, 10–12 mm., width, 4.5–5 mm.  
*pugnax* Fabricius 1775  
Connecticut and New York, to Florida, Texas and Arizona, (Mexico and West Indies to Brazil); on grains (injurious to rice), corn, wheat, *Panicum*, *Setaria*, said to attack cotton worm.
- B. Humeri with short spines; anterior tibiae longitudinally sulcate;

spiracles *not* black; posterior margin of male hypopygium (ventral view) very strongly lobate in center; not over 8-9 mm.; length, 7-9.5 mm., width, 5-5.5 mm. .... *insularis* Stål  
(*Mormidea guerini* Blatchley 1926, nec

Amyot & Serville 1843)

Florida, (Cuba).

Genus VIII. *Euschistus* Dallas 1851

KEY TO SPECIES

1. Anterolateral margins of pronotum straight, neither crenate nor dentate, entire (subgenus *Paraschistus* Kirkaldy 1909); (anterolateral margins of pronotum very narrowly and slightly reflexed; basal and apical angles of the ventral segments black; connexivum black with a median flavescent fascia; tylus surpassing juga; antennal segment II slightly shorter than III; humeri scarcely prominent, obtusely rounded-angular; femora scantily black punctate; length, 10 mm., width, 6 mm.).

*integer* Stål 1872

Arizona, (Mexico).

Anterolateral margins of pronotum crenate or dentate; frequently sinuate (subgenus *Euschistus* Dallas) ..... 2

- 2 (1). Margin of abdomen calloused, pale ..... 3

Margin of abdomen neither calloused nor entirely pale ..... 4

- 3 (2). Connexivum wholly pale, *without* a black inner line, conspicuously broad; angles of ventral abdominal segments darker, but *without* conspicuous black points; (juga longer than tylus, making head distinctly incised anteriorly; antennal segments II, III, IV and V subequal, V and distal part of IV black, I attaining at least to apex of tylus; membrane immaculate; length, 14.5-15 mm., width, 8-9.5 mm.) (females only).

*latimarginatus* Zimmer 1910

Nebraska, Colorado.

Connexivum narrowly black inside the pale borders; (pronotum quite convex behind; apical ventral segments with two smooth points; apex of male genital segment with a large, quite deep sinus); length, 9-10 mm.

*comptus* Walker 1868

Texas, (Neotropical).

- 4 (2). Membrane obscure fuscous, basal margin sometimes palles-

- cent; antennal segments I, II and III conspersed with black; (juga exceeding tylus); length, 10–12 mm., width, 6–6.5 mm. .... *biformis* Stål 1862  
 Arizona, (Mexico).
- Membrane griseous or somewhat infusate; antennae wholly, or at least segments I, II and III pale, impunctate or very obsoletely fuscous punctate; (apex of tylus obtuse; impressions at basal angles of scutellum generally less distinct; thorax before middle of disc *without* two punctiform callous spots; anterior femora unarmed; anterior angles of prosternum frequently with a very minute black spot) ..... 5
- 5 (4). Juga with a few *sparse* punctures along the lateral margins and between the ocelli; (disc of pronotum and of hemelytra largely impunctate; antennae pale; tylus as long as juga, slightly acuminate, juga narrowed anteriorly; antennal segment II a little shorter than III; anterolateral margins of pronotum slightly sinuate with a few small crenulations anteriorly; humeri produced in a short tooth, not very acute; length 10 mm., width, 7 mm.) ..... *subimpunctatus* Malloch 1919  
 Illinois.
- Juga above *densely* punctured ..... 6
- 6 (5). Membrane normally *distinctly* dotted with fuscous; tergum in fully developed examples black ..... 7
- Membrane *without* dots; tergum rarely fuscous or black, generally croceous or rufescent ..... 17
- 7 (6). Margin of venter with a minute black dot or point in or at each incisure ..... 8
- Margin of venter immaculate, angles of segments concolorous ..... 16
- 8 (7). Body strongly convex, especially below; [anterolateral margins of the pronotum serrate nearly to the humeri, which form short, acute but abrupt spines, *distinctly inclined anteriorly*; (scutellum rather broad at apex; membrane with oblong convex black dashes between the veins (sometimes absent); length, 10.5–11.5 mm., width, 6–6.5 mm.)] ..... *crassus* Dallas 1851  
 North Carolina, Georgia, Florida; on weeds and grasses.
- Body less convex, sometimes obviously depressed ..... 9
- 9 (8). Juga distinctly produced beyond the rounded apex of the tylus, subacute; apex of head strongly incised; hemelytra as wide or nearly as wide as the abdomen, nearly

- or quite covering the connexivum; length, 12–15 mm., width, 7–8.5 mm. .... *euschistoides* Vollenhoven 1868  
Quebec to Vancouver Island, Montana, Colorado, and south through New York to Florida and Texas.
- Juga very little, if at all, longer than the tylus; hemelytra narrower than the abdomen, leaving the maculate connexivum exposed ..... 10
- 10 (9). Form *not* distinctly depressed, the sides of the pronotum sometimes a little expanded and reflexed before the humeri, in which case the venter is marked with a row, sometimes incomplete, of black spots ..... 11  
Form *distinctly* depressed, especially within the lateral margins of the pronotum; venter *without* black spots ..... 14
- 11 (10). Venter *without* distinct black spots on the median line; length, 12–14 mm. .... 12  
Venter *with* a median row of black spots, which sometimes are almost obsolete; length, *less* than 12 mm. .... 13
- 12 (11). Humeri prominent, acute or rounded, *never* spinose; upper surface rather closely irregularly punctured; (juga equalling or slightly surpassing tylus; antennae wholly pale; connexivum broadly exposed); length, 12.5–15 mm., width, 7–9 mm. .... *servus* Say 1831  
Massachusetts and Ohio to Kansas, and south to Texas and New Mexico.
- Humeri *acutely* spinose; upper surface paler; punctures more distinct and regularly disposed; length, 12 mm., width, 7 mm. .... *impictiventris* Stål 1872  
Vancouver Island, Colorado, Utah, New Mexico, Texas; on *Medicago sativa*, pest on cotton, other cultivated plants.
- 13 (11). Humeri prominent, rounded; antennal segment V and apical one-half of IV black; length, 10–12 mm., width, 6.5–7.5 mm. .... *tristigmus* Say 1831  
Northern Canada to southern Mexico; on potato, raspberry and many other field crops and plants.
- Humeri produced, acute or spinose; antennae entirely pale or rufous; size as above ..... *tristigmus* Say 1831  
var. *pyrrhocerus* Herrich Schaeffer 1842
- 14 (10). Over 10 mm. long; (punctures on upper surface forming round scattering black dots, more noticeable on the hemelytra); male genital segment broadly concave arcuated ..... 15  
Less than 10 mm. long; (head above with a dark margin;

- anterolateral margins of pronotum almost straight, pale, defined within by black punctures; no median ventral spots); genital segment of male with a rather deep V-shaped or rounded median notch and a much smaller notch on each side; length, 8–9.5 mm., width, 5.5–6.2 mm. .... *politus* Uhler 1897  
New Hampshire, Massachusetts to Maryland, Ohio, Tennessee; on scrub oak on Long Island, New York.
- 15 (14). Legs dotted with black; apical half of antennal segment V blackish (dusky—Uhl.), barely longer than IV, II much shorter than III, which is subequal to IV; length, 11–12 mm., width, 6–6.5 mm. .... *conspersus* Uhler 1897  
Vancouver Island, Washington, California.
- Legs punctured with fuscous, femora with not more than about 4 black points beneath; antennal segments IV and V dusky, II and III subequal; length, 11–13 mm., width, 7–8 mm. (rostrum reaching to posterior coxae).  
*inflatus* Van Duzee 1903  
Colorado, New Mexico, Utah, Arizona.
- 16 (7). Pronotum *with* a raised calloused somewhat irregular line between the humeri; (hemelytra *without* round dark spots; humeri acute or ending in a sharp spine); incisures *without* a small black spot; genital segment of male *without* a black spot at its base; color reddish-brown; length, 10.5–12.5 mm., width, 7.5–8 mm.  
*ictericus* Linné 1763  
Northern United States and Canada to Florida, Texas and Oklahoma; on grasses in damp or wet ground.
- Pronotum *without* a continuous calloused somewhat irregular line between the humeri; without marginal spots or dots on venter; male genital segment *with* a blackish basal spot; length, 11.5–14 mm., width, 8–9 mm.  
*variolarius* Palisot de Beauvois 1805  
All over United States; omnivorous, economic.
- 17 (6). Antennae concolorous or subinfusate toward apex; humeri distinct, always prominent, frequently acutely produced; (antennae long; segment I of rostrum reaching to or slightly exceeding apex of bucculae).....18  
Antennal segments I, II and III black punctate, IV and V black, their bases pale; humeri obtusely rounded, scarcely prominent; length, 9–10 mm.  
*spureculus* Stål 1862  
Arizona, (Mexico).



18 (17). Over 10 mm. long (11–12 mm.); (punctures finer and closer on the head and anterior part of pronotum, leaving an obvious but somewhat irregular pale vitta between the prominent subacute humeri, these punctures segregated so as to form scattering round black dots on the hemelytra; posterior angles of female ventral segment VII acuminate and produced; length, 10.5–12 mm., width, 7–8 mm.).

*obscurus* Palisot de Beauvois 1805  
(*bifibulus* of American authors)

Georgia, Florida, Mississippi, Texas.

Length 10 mm., or *less* .....19

19 (18). Form broad ovate; (pronotum *without* a pale transverse fascia; humeri prominent, acute); upper surface with scattering pale points on scutellum and hemelytra; male genital segment rounded at apex, feebly emarginated at middle; (apical angles of female ventral segment VII not attenuated or produced); length, 9–9.5 mm., width, 5–5.5 mm. .... *renator* Fabricius 1794  
Florida, Texas, Arizona, California, (West Indies, Mexico).

Form oblong; upper surface regularly and closely punctured; male genital segment broad at apex and feebly trisinnuated; length, 8–9 mm.

*zopilotensis* Distant 1890

Texas, (Mexico).

#### Genus IX. *Padaeus* Stål 1862

This is Stål's characterization of the genus: Body oval, quite convex below. Head triangular, median lobe slightly longer than the lateral lobes, bucculae percurrent, posteriorly abruptly abbreviated. Basal segment of rostrum (I) slightly shorter than the bucculae, II shorter than III and IV taken together. Apex of scutellum quite narrow. Mesosternum carinate. Abdomen slightly wider than the hemelytra. Legs unarmed.

Recorded north of Mexico is the one species.

*P. viduus* Vollenhoven 1868.

This species is black, with abundant white guttulae; legs cereous (wax-colored), black-spotted; abdominal segments with a median white guttula in each; length, 12 mm.

Arizona, (Neotropical).

Genus X. *Proxys* Spinola 1837

KEY TO SPECIES

- A. Feet pale, black consperse, femora and tibiae entirely concolorous; length, ? ? ? ? mm.  
*albopunctulatus* Palisot de Beauvois 1805  
 Southern States (Uhler); swampy forest where mangroves grow.
- B. Entire femora, or at least apices, and apices and bases of tibiae black, the latter immaculate conspersed with a scant few black spots; length 11–13 mm., width, 6.5–7 mm.  
*punctulatus* Palisot de Beauvois 1805  
 Southern Indiana and Illinois, to Georgia, Florida, Oklahoma, Texas and Arizona (Mexico); on cotton.

Genus XI. *Coenus* Dallas 1851

To the distinctive characters in the key may be added: Tylus as long as juga; rostrum reaching hind coxae; ostiole with a very short auricle; tarsi sulcate above; scutellum broad, slightly surpassing corium. The one species in the genus is

*C. delius* Say 1831

This is oval in shape, somewhat flattened above and strongly convex below; dull yellowish above, thickly and evenly marked with fuscous punctures; antennal segment I shortest, V longest, II three-fourths length of III; pronotum with the apex deeply emarginate; veins of membrane anastomosing; length 8.5–10.5 mm., width, 4.5–6 mm.

Quebec, and New England west to British Columbia and Montana, south and west to Oklahoma and Texas (?).

On timothy and clover, moth mullein, blue grass; generally found in weeds and small growth.

Genus XII. *Hymenarcys* Amyot & Serville 1843

KEY TO SPECIES

- 1. Sides of head *parallel* before middle; (thorax obtusely impressed near anterolateral margins, thoracic margins straight or nearly straight, somewhat obtuse; antennal segments I and II subequal) ..... 2
- Head *narrowed* in front ..... 3

2. Apex of head rounded, *entire*, tylus subprominent; apex of scutellum moderately broad; veins of membrane simple, scarcely anastomosing, parallel; length, 6.5–9 mm., width 3.5–4.5 mm. .... *aequalis* Say 1831  
New England west to Colorado, Montana, Saskatchewan, New York, New Jersey, Maryland, Ohio, Kansas, south and west to Oklahoma and Texas.
- Apex of head slightly *emarginate*; apex of scutellum broader; veins of membrane reticulate; length, 8–10 mm., width, 4.5–6 mm. .... *reticulata* Stål 1872  
Arizona, (Mexico).
3. Anterolateral margins of pronotum slightly *rotundate*, subexplanate; length, 8.5–11.5 mm., width, 5.5–7 mm. .... *nervosa* Say 1832  
Quebec and New England to Nebraska and Dakota, south to Maryland and North Carolina and southwest to Oklahoma and Texas; on cotton.
- Anterolateral margins of prothorax nearly *straight*, strongly reflexed; (antennal segment II longer than I; juga longer than tylus); length, 11–12 mm. .... *crassa* Uhler 1897  
Arizona.

### Genus XIII. *Aelia* Fabricius 1803

This is a brief description of the genus derived from original characterizations and from material in hand: Head basally wide, much produced anteriorly, as long as or longer than pronotum medially, juga surpassing tylus and more or less meeting in front of it, leaving apex of head incised or not; rostrum exceeding the intermediate coxae, segment I not as long as head, II longer, III and IV short, more or less subequal; prothorax trapezoidal, humeri somewhat prominent but rounded; prosternum anteriorly produced in a thin rounded lamina, sometimes covering base of antennae; corium nearly equal to membrane, membrane with a few feeble longitudinal veins; abdomen quite flat above, quite convex below. There is one North American species thus far known:

*Aelia americana* Dallas 1851.

Some of its distinguishing characters, derived from specimens, are: Head as long as pronotum, juga contiguous in front of tylus, a median punctate callous vitta from apex of tylus, where it is narrow, to base of head; bucculae angulate; antennal segment I very short, one-half as long as the distance from its base to the apex of the

head, II and III subequal to I, IV slightly longer, V longest; rostrum slightly exceeding intermediate coxae, segment I passing the base of the head, II a little longer than III and IV taken together; thorax more than twice as wide as long, anterior angles obtusely prominent, anterolateral margins calloused, with a few evanescent punctures, yellow, humeri rounded and slightly indented posteriorly, posterolateral margins rounded, basal margin slightly sinuate, anterior margin straight, a yellow calloused impunctate median vitta extending from the anterior margin and percurrent on the scutellum, narrowing and vanishing a short distance from its apex and bounded by a black deeply punctate vitta on each side on the scutellum; scutellum slightly longer than wide at its base; corium brown, deeply black-punctate, black-margined at costal margin, which is wide, yellow, somewhat calloused and feebly punctured with concolorous punctures, membrane hyaline, veins light brown; ostiole small, black, without a canal; stigmata black; the whole insect punctured above and below; length, 8.5 mm., width, 4.5 mm. at humeri.  
Dakota, Montana, Manitoba, Nebraska, Colorado, Arizona.

Genus XIV. *Neottiglossa* Kirby 1837

KEY TO SPECIES

1. Sides of head less tumescent within the margins; ostioles continued outward in an obsolete ruga (*Neottiglossa* s.s.) ..... 2  
Sides of head more tumescent within the margins; ostioles continued outward in a distinct ruga. (*Texas* Kirkaldy 1904), (*Melanostoma* Stål 1872) ..... 3
2. Antennal segment III three-quarters the length of II; head not black, rather finely, not densely and deeply, punctate, vertex with a narrow median pale line, extending backward on the pronotum; (upper surface of head almost flat transversely, not tumidly elevated within the margins); length, 4.5–5.5 mm., width, 3–3.5 mm. .... *undata* Say 1831  
Northeastern United States and Canada, west to Vancouver Island, New Jersey, Illinois, Iowa, Nebraska, Colorado; on grasses, red clover, mullein (*Verbascum*), wild grape.  
Antennal segment III five-sixth the length of II; head entirely black, feebly bronzed, deeply and densely punctate; vertex without a pale line; length, 5–6.25 mm.  
*trilineata* Kirby 1837  
Nova Scotia, Michigan, Dakota, British Columbia, Nebraska, California.

3. Deflected anterior part of the head a little impressed on each side of the tylus, not forming an excavated basin; tylus quite distinctly elevated to the apex; length, 4-5 mm., width, 2.5-3 mm. .... *sulcifrons* Stål 1872  
New Jersey, North Carolina, Georgia, Iowa, Indiana, Nebraska, Kansas, New Mexico, Texas; on blue grass and timothy.

Deflected anterior part of the head strongly impressed, forming an excavated basin in which the tylus is not at all elevated; length, 4-5 mm., width, 2.5-3 mm. .... *cavifrons* Stål 1872  
Indiana, Illinois, Utah, Texas, Arizona, California; on blue-grass, *Lespedeza*, *Pycnanthemum*.

Genus XV. *Cosmopepla* Stål 1867

KEY TO SPECIES

1. Scutellum very obtusely rounded at apex; frenum very short, not quite one-third length of scutellum; broadly oval ..... 2  
Scutellum less obtusely rounded at apex; frenum reaching almost one-half the length of the scutellum; body proportionally longer; (above slightly brassy and thickly punctured) ..... 3
2. Scutellum black with a red spot on each side near apex; transverse fascia and longitudinal central spot of pronotum narrow, linear; abdomen above narrowly edged with red; length, 5-6 mm. .... *bimaculata* Thomas 1865  
(*carnifex* Fabricius 1798, *lintneriana* Kirkaldy 1909)  
Eastern United States and Canada to Texas, Colorado, Mississippi, and Washington; on *Scrophularia nodosa*, *Ranunculus*, *Rubus*, *Mentha*, *Verbascum thapsus*, *Stachys*, *Brassica nigra*, *Daucus carota*, potato, thistle, currant, pokeberry, bouncing bet, goldenrod, ragweed, etc.
- Scutellum entirely concolorous, transverse fascia of pronotum irregular, widened in the middle, slightly elevated; abdomen beneath broadly edged with ochraceous, this margin inwardly sinuated opposite each stigma; length, 5.5-6 mm., width, 3.5-4 mm. .... *uhleri* Montandon 1893  
Nevada, California.
3. Transverse yellowish fascia of pronotum irregular, slightly elevated; scutellum punctured to apex, apically narrowly edged with yellow; yellow margin deeply sinuated on each segment; (stigmata black; length, 4-7.5 mm., width, 3-5 mm.) .... *conspicillaris* Dallas 1851  
Vancouver Island to Mexico and Lower California.

- Transverse yellow fascia of pronotum shining, regular; apex of scutellum more broadly edged with yellowish ochraceous ..... 4
4. Scutellum punctured near apex on the yellowish-ochraceous part; transverse fascia of pronotum extended backward to near its base, two dark spots in the middle of the fascia; abdomen beneath with the lateral margins broadly pale ochraceous; a segmental series of small rounded dark spots covering the stigmata; length, 7 mm. .... *binotata* Distant 1889 Arizona.

Apex of scutellum shining, impunctate on the yellowish-ochraceous part; transverse fascia of pronotum *not* extended backward, impunctate, slightly elevated; abdomen beneath with pale ochraceous lateral margin of equal width, including stigmata; length, 6.25 mm., width, 3.6 mm.

*decorata* Hahn 1834

Texas, Arizona; (Neotropical).

Genus XVI. *Eysarcoris* Hahn 1834

To the generic key characters may be added: Scutellum somewhat broadened behind frena, sometimes large or moderate; ostioles marginate or subauriculate; juga rounded. The one North American species so far known is

*E. intergressus* Uhler 1893 (*melanocephalus* Uhler 1876)

This is dull fulvous clouded with darker; juga wide, slightly longer than tylus and indented near its apex; rostrum slender, reaching behind posterior coxae; antennal segment I stout, not quite reaching apex of head, II and III longer, subequal, IV a little longer; pronotum with a small fovea near each side of middle disc and an indented spot nearer the outer margin, margins slender, reflexed; pleural and epipleural segments black, polished, punctate; membrane milky-whitish, veins pale piceous; length, 5.5-6 mm., width, 3.5-4 mm. Has somewhat the aspect of *Cosmoepepla conspicillaris* (Uhler).

Kansas, California.

Genus XVII. *Meneclis* Stål 1867

A monotypical genus; characters in addition to those in the key are: Head deeply inserted in thorax; antennae slender; rostrum reaching base of ventral segment III; ostiole without a canal but with a prominent curved auricle. Its single species is

*M. insertus* Say 1831.

Added specific characters are: Broadly oval, depressed; antennal segment I shorter than head, II to IV subequal, V longest; rostral

segment II as long as III and IV taken together; veins of membrane anastomosing; connexivum broadly exposed; length, 12-14 mm., width, 6.5-8 mm.

New England and Ontario west to Nebraska and Kansas, southwest to Arizona and California, North Carolina, New Jersey, Arkansas.

This is an arboreal species.

Genus XVIII. *Prionosoma* Uhler 1867

The references to this genus are solely to the original description in Proc. Ent. Soc. Philad., for 1863, pp. 363-365. Since this is a relatively inaccessible paper here is a recasting, in standard terms, of the original description: Head long, narrow, juga prominent, exceeding tylus but not contiguous before it, lateral margins sinuate in front of the antennae, tylus forming a prominent median ridge; antennal segment I just reaching apex of head, constricted basally, much stouter than the remaining segments, segments II and IV subequal, all segments with numerous stiff hairs; eyes hemispherical, prominent; ocelli widely separated, set near the eyes and base of head; bucculae extending onto prosternum, narrow, enlarging toward base of head, subtruncated; rostrum very slender in middle, segment II as long as III and IV taken together, III much broader than the other segments, depressed, a little longer than IV, IV  $\frac{2}{3}$  the length of III and not quite so stout; thorax *eight*-sided, broader than long, anterior lobe very abruptly narrowed laterally and emarginated, humeri projecting, with a subacute process outwardly, posterior margin truncate; scutellum broad, a little longer than corium, not abruptly sinuated laterally, bluntly rounded at apex; corium almost equally broad throughout, interior apical margin obliquely rounded, middle of apex emarginated, membrane with seven longitudinal sinuate veins; abdominal segments laterally with projecting thorn-like blunt processes; venter obtusely convex; sternum sulcate to receive rostrum; anterior tibiae prismatic, with a spine on inner aspect. The single species thus far known is

*P. podopioides* Uhler 1863.

These are the structural characters and color picture in the original description:

Pale testaceous with fuscous markings, covered with heavy pile; head with a few deep coarse punctures and several irregular longitudinal ridges; antennae with long stiff white hairs; rostrum reaching middle coxae; thorax anteriorly deeply emarginate, with a blunt small tooth at anterior angles, humeral projections a little curved

posteriorly, smooth, bearing a tooth-like process apically, behind this emarginated, sides regularly rounded from the emargination to the basal margin, which is subtruncated, smooth; scutellum irregularly erodedly closely punctured, surface uneven, with a Y-shaped elevation, the stem of which runs toward the apex, a short levigate line at basal middle and a few levigate areas, yellow; corium with a levigate callous lenticular yellowish spot beyond middle; membrane pale brown, veins white-margined; posterior angles of the connexivum and the processes yellow, otherwise blackish; beneath very hairy, closely fusco-punctate, punctures grouped in patches near legs and arranged in two indistinct longitudinal vittae on each side of venter, median line yellow, stigmata dark brown; length, 9 mm., width 5 mm. California (original description), Arizona; in yucca. *W. H. Cresson*

Genus XIX. *Thyanta* Stål 1862

KEY TO SPECIES

1. Antennal segment III one-quarter longer than II, III to V subequal; (ventral segments without black spots at the incisures or on the sides; humeral angles obtuse; connexivum very narrowly or not at all exposed); length, 7-8 mm., width, 4-5 mm. .... *pseudocasta* Blatchley 1926 Florida.  
 Antennal segment III *not* or but slightly longer than II ..... 2
2. Humeri produced into long acute spines anteriorly directed; lateral margins of the pronotum concavely arcuate from the anterior margin to the apex of the spine; anterior disc of the pronotum with two small black spots; incisures with *two* minute black spots; male hypopygium with the central lobe cleft in the center; length, 9-13 mm., width, 6-7 mm. .... *perditor* Fabricius 1794 Florida.  
 Humeri rounded or angulated, sometimes produced into the form of small acute spine; male hypopygium without a central lobe ..... 3
3. Antennal segment II *but little or not longer* than III; species at least 8 mm. long ..... 4  
 Antennal segment II *much longer* than III; much smaller species, rarely 7 mm. long ..... 6
4. Ocelli exceptionally large, the distance between their lateral margin and the inner margin of the eye not greater than the width of the ocellus; antennal segment II shorter than



III; punctation coarse, not very dense, intervening surface rugosely uneven; edge of abdomen with black points; humeri usually angulated; hairs on tibiae of both sexes moderately long, not noticeably irregular; (male hypopygium with a large rounded protuberance just below the inner margin of the opening; without a conspicuous concave area on each side of apex); length 8-9 mm., width, 5-5.5 mm. .... *casta* Stål 1862  
Florida, New Mexico, Arizona, California, Mexico, Texas, (Neotropical).

Ocelli small, the distance between their lateral margins and the inner margins of the eyes distinctly greater than the width of an ocellus; punctation close and regular, intervening surface even or with a few raised points; humeri rounded or acute but not spined; edge of abdomen sometimes pale but without distinct black points; (male hypopygium flattened for a considerable distance below the upper margin of the opening, with a conspicuous concave area on each side at the apex) ..... 5

5. Lateral margins of pronotum glossy black, vertically rugose; (male hypopygium with a slight but distinct elevation in the center of the upper margin); length, 9-10 mm., width, 5.5-6 mm. .... *calceata* Say 1831  
New England to Illinois and Florida.

Lateral margins of pronotum rarely black, *not* vertically rugose; (male hypopygium transverse in center, or almost so); length, 9-12 mm., width, 5-6.5 mm.

..... *custator* Fabricius 1803  
Quebec and New England to British Columbia, Indiana, Colorado, Arizona, Texas, Mexico; on oats, corn, sorghum, cotton squares and bolls, sugar beets, asparagus, grasses, red clover, etc.

6. Ostiolar canal *not* longer than the distance from its apex to the lateral margin of the mesosternum; (connexivum immaculate or with nearly obsolete spots; black points on venter absent; posterior margin of male hypopygium with a small notch in the center); length, 5-7 mm., width, 4-4.5 mm. .... *rugulosa* Say 1831  
Montana and Nebraska to Utah, Colorado, Oregon, California, Arizona, Texas; on *Bumelia angustifolia* Nutt. and wild gooseberry.

Ostiolar canal *much* longer than the distance from its apex to the lateral margin of the mesosternum ..... 7

7. Head *much longer* than its greatest width; dorsum green with conspicuous yellowish-white longitudinal stripes on head, scutellum and hemelytra; pronotum with a broad conspicuous median transverse depression; length 6 mm. (male), 7 mm. female ..... *elegans* Malloch 1919 Texas.

Head *as broad as long*, or the dorsum without yellowish-white stripes and the pronotum having no well-defined median transverse depression ..... 8

8. Abdominal venter in both sexes with a transverse row of black dots or spots near the posterior margin of each segment; anterolateral margins of pronotum subcarinate only in the posterior half or less; (head with the sides straight for a considerable distance; mesosternum with a black spot or patch on each side of the central ridge; lower margin of hypopygial opening in male with a deep or shallow central V-shaped notch); length, 6-7 mm., width, 3.5-4 mm.

*punctiventris* Van Duzee 1904

North Dakota, Nebraska, Colorado, Utah, California, Texas.

Abdominal venter *without* a transverse row of black dots or spots; anterolateral margins of pronotum sharply carinate in whole or in part; (male hypopygium *without* a notch)..... 9

9. Mesosternum with a large black patch on each side of central ridge; pronotum sharply carinated on anterolateral margins from posterior to near anterior margin; head short, narrowed before eyes to the rounded apex, the sides not at all parallel; (surface closely and evenly punctate); length, 5.5 mm., width, 3 mm. .... *brevis* Van Duzee 1904 Colorado, Utah, Idaho, California, Arizona, Texas; on *Atriplex*.

Mesosternum *without* a large black patch on each side of the central ridge; pronotum with lateral margins sharply carinate only on posterior half or less; sides of the head distinctly parallel before the antennae, apex broad, rounded; length, 5.5-7 mm., width, 4 mm. .... *antiguensis* Westwood 1837 Florida, Texas, Arizona, California, (Neotropical).

Note: From this key are omitted:

*T. pallidovirens* Stål 1859, which is not clearly delimited; there are no other records of this than the original by Stål and one or two tentative records by Van Duzee; all other records appear to be repetitions of Stål's California record; has been made a variety of *custator*, and resurrected; an obscure species.

*T. acerra* McAtee 1919, which was described as a variety of *calceata* and variously attributed to that species or to *custator*; Blatchley regards it as a good species; it falls within the limits of size of *custator*, i.e., length, 9–11 mm., width, 5–6 mm.; the original description is entirely by color.

Genus XX. *Chlorocoris* Spinola 1837

KEY TO SPECIES

1. Ventral sulcus of abdomen *entirely* absent; (head short and conical; humeri spinose); length, 15 mm., width, 8 mm.

*subrugosus* Stål 1872

Arizona, (Mexico).

Ventral sulcus more or less evident ..... 2

2. Head long, triangular, with juga more acute; humeral angles drawn into very acute spines; (rostrum *reaching* base of abdominal segment III); length, 20 mm.

*atrispinus* Stål 1862

New Mexico, (Neotropical).

Head shorter, subconical with the apices of the juga more or less evidently rounded; lateral margins of pronotum straight, humeral angle a *right* angle ..... 3

3. With *distinct* median, slightly calloused, longitudinal pale line running through the entire length of the pronotum and scutellum; lateral margins of pronotum serrated *almost throughout*; ventral abdominal sulcus shallow, faintly outlined to base of abdominal segment VI; length, 15–17 mm.

*hebetatus* Distant 1889

Arizona, (Mexico).

Apical half of scutellum with a *prominently* elevated, pale smooth ridge; lateral margins of pronotum distinctly serrated *only half-way*; ventral sulcus much deeper and more evident to base of abdominal segment VI ..... 4

4. Lobes of head not of equal length, tylus shorter than juga, giving the head an incised aspect; antennal segment II subequal to III, not or only slightly longer; length, 19–20 mm., width, 9.5 mm. .... *flaviviridis* Barber 1914  
Arizona.

Lobes of head of equal length; antennal segment II *longer* than III; length, 19 mm. .... *rufopictus* Walker 1867  
Mexico.

Genus XXI. *Loxa* Amyot & Serville 1843

## KEY TO SPECIES

- A. Rostrum not reaching base of abdominal segment II; juga very acute, laterally slightly curved at apex, nearly touching in front of the tylus, which is very narrow at apex; humeri produced into long, acute, *anteriorly* directed spines; apices of femora produced into a distinct spine above; posterior angles of abdominal segments acutely, almost spinously produced, posterior angle of segment VI produced into a long acute spine; length, 19.6–22 mm., width, 12.2–15 mm. (at humeri, including spines).

*flavicollis* Drury 1773

Florida, (West Indies and Mexico, south to Brazil and Bolivia).

- B. Rostrum passing apex of abdominal segment III; juga not greatly produced beyond tylus, *not* curved or converging in front of it; humeri produced into short, *outwardly* directed spines; apices of femora angulate above, *not* spined; posterior angles of abdominal segments minutely spined, posterior angle of segment VI with a *short* spine; length, 22 mm., width, 12–13 mm. ... *florida* Van Duzee 1909  
Florida.

Genus XXII. *Murgantia* Stål 1862

1. Antennae short, stout, black, shorter than the length of the pronotum and scutellum taken together, segment I shortest, III slightly longer than II, IV and V subequal; anterior angles of pronotum rounded, anterior margin deeply excavate to receive head, anterolateral margins calloused on anterior half, raised, not explanate, posterior margin straight; (rostrum not reaching posterior coxae); legs black, an apical yellow spot on femora; body black below; length, 9–12.5 mm., width, 5.5–6.5 mm.

*histrionica* Hahn 1834

New England, west to Colorado, south to Florida and west to Texas and California; on Cruciferae, especially cultivated cabbage, on *Cleome pentaphylla* in Cuba.

- Antennae long and slender, longer than scutellum and pronotum, segment I shortest, V longest, III and IV subequal; (antennal tubercles apically slightly produced); anterior angles of pronotum angulate with a more or less acute

tubercle, anterior margin straight, anterolateral margins widely reflexly carinate; legs pale, more or less black-spotted and lined; body pale or flavescent below ..... 2

2. Rostrum reaching apex of ventral segment III; humeri slightly angulately rotundate; (median pale line of scutellum reaching apex); membrane fuliginous with hyaline margins; length, 7.5–8.5 mm., width, 4.5–5 mm.

*violascens* Westwood 1837

Florida.

Rostrum reaching apex of ventral segment IV; humeri smoothly rounded; entire membrane hyaline, except close to the corial margin; length, 8.25–10 mm., width, 4.9–5.75 mm.

*varicolor* Westwood 1837  
(*munda* Stål 1861)

Colorado, (Mexico).

Note: *M. angularis* Walker, questioned by Van Duzee, omitted.

#### Genus XXIII. *Vulsirea* Spinola 1837

Other generic characters not stated in key are: Head small; rostrum reaching between hind coxae; mesosternum with a distinct carina; ventral surface smooth, feebly convex. This is a Neotropical genus, of which only one species has thus far been recorded north of Mexico, namely,

*V. violacea* Fabricius 1803

Further structural characters are: broadly oval, widest behind middle; antennal segments III to V more or less subequal; posterior connexival angles prominent, *not* acute; length, 12–18 mm., width, 7–10.5 mm.

Florida, (Neotropical).

#### Genus XXIV. *Runibia* Stål 1861

The following generic characterization is derived from the key in which Stål sets up the genus (Stett. Ent. Zeit., XXII: 139): Margins of the stigmata of the metasternum elevated, exteriorly united and more or less longly carinate-produced and abbreviated nearly at the middle of the side of the metastethium, apex often elevated, not noticeably evanescent; antennal segment I (basal) exceeding head. Basal segment of the rostrum (I) much longer than the bucculae. Base of venter unarmed.

The one species in the genus recorded north of Mexico is

*R. proxima* Dallas 1851

In this, the body is croceous, together with the head, or rufescent; above spotted with black, sometimes with a vitta in place of spots; connexivum black-spotted; length, ??? mm.

Texas.

Genus XXV. *Nezara* Amyot & Serville 1843

Genus XXVI. *Acrosternum* Fieber 1861

KEY TO GENERA AND SPECIES

1. Ostiolar canal short and truncate at apex, not or scarcely reaching the middle of the metapleura; ventral spine short and obtuse; [abdomen with a low median carina; rostrum reaching or surpassing middle of hind coxae (Genus *Nezara* A. & S.); length, 14-17 mm., width, 7-8.5 mm.].

*viridula* Linné 1758

New York (adventitious?), Virginia, Louisiana, Florida; (Europe, Asia, Africa, Australia); on *Celtis*, *Morus*, rice, sugar cane, cotton, potato, soy beans, oranges, sweet potato, and many other plants; a serious plant and fruit pest in Florida.

Ostiolar canal long and curved, becoming gradually evanescent; nearly reaching the posterolateral angles of the mesopleura; ventral spine distinct (Genus *Acrosternum* Fieber 1861) ..... 2

2. Short oval, broad in general aspect; anterolateral margins of the pronotum strongly arcuated; head wider across the eyes than long; juga surpassing tylus; margins of abdomen concolorous with black points at the incisures; (abdomen without a median ridge; rostrum scarcely reaching middle coxae); length, 13.5-15 mm., width, 9-10 mm.

*pennsylvanicum* DeGeer 1773

Quebec to Florida, Iowa; on *Ceanothus*.

Elongate oval; anterolateral margins of pronotum almost straight; head not or but little wider than long; tylus equalling juga; margins of abdomen fulvous with black points at the incisures ..... 3

3. Spine of ventral segment II hardly attaining middle of posterior coxae; (abdomen with a smooth median ridge); apex of male genital segment nearly transverse, distinctly trisinuate, the outer apical angles acute; (rostrum reaching hind coxae); length, 13-19 mm., width, 7.5-10 mm.

*hilaris* Say 1832

Eastern States to Florida, Indiana to Pacific States, Arizona, Texas; on golden rod, linden, hazel, wild cherry, wild grape, basswood, cotton (economic), tomatoes, egg-plant, turnips, mustard, peas, oranges, beans, corn, peaches, okra, mesquite pods.

Spine of ventral segment II reaching or passing the anterior margin of the posterior coxae; apex of male genital segment quite deeply and subacutely emarginate, very obscurely sinuated, the outer apical angles obtuse; (tip of scutellum more broadly rounded); length, 14–15 mm., width, 8–8.5 mm. .... *marginatum* Palisot de Beauvois 1805  
Florida, Texas, California, Arizona.

Genus XXVII. *Banasa* Stål 1860

KEY TO SPECIES

1. Apical angles of the last abdominal segment slightly acuminate at the apex, the remaining angles somewhat acutely subprominent; (scutellum *without* a large levigate pale spot in the basal angles; lateral angles of the prothorax hardly or but slightly prominent) (subgenus *Banasa* s.s.) ..... 2
- Apical angles of last abdominal segment somewhat obtuse, the apex hardly acuminate, the remaining abdominal segments hardly or very obsoletely prominent (subgenus *Atomosira* Uhler 1871) ..... 7
2. Incisures of abdomen *without* black points ..... 3
- Incisures *with* small or large black points ..... 4
3. Antennal segment II scarcely shorter than III; (abdominal disc longitudinally smooth); length, 8–9 mm., width, 5–5.5 mm. .... *subrufescens* Walker 1867  
New Mexico, (Neotropical).
- Antennal segment II *much* shorter than III (not more than one-half as long as III); (rostrum reaching posterior coxae; lateral margins of the pronotum reflexed, impunctate; tibiae grooved; juga obliquely strigose); length, 8.5–12 mm., width, 5–6 mm. .... *lenticularis* Uhler 1894  
Florida, (West Indies); on *Xalisma ferruginea*.
4. Black points of the incisures small, or minute and hardly visible, *but present*, when larger, sometimes with a suffused dark point or spot on the anterior margin of the following segment ..... 5
- Black points of connexivum conspicuous; (antennal segment II

three-quarters length of III; head apically narrow; abdomen almost smooth; length, 11.5–12 mm., width, 6 mm.)

*calva* Say 1832

(*catinus* Dallas 1851)

New England and New York, west to British Columbia and Montana and Oregon, and south to Colorado, North Carolina and Georgia; on holly and *Citrus aurantium*.

5. Ventral spine extending to middle coxae; short oval; head apically narrowed, with a narrow black margin; juga and tylus obsoletely rugosely punctate, tylus narrowly black-margined; (color largely yellow); length, 9.5–11.5 mm., width, 6(?)–6.25 mm. .... *imbuta* Walker 1867  
Texas, (Mexico).

Ventral blunt tubercle only, barely attaining posterior coxae; long oval in form; head apically broad, *not* black-margined; juga and tylus densely coarsely punctate, tylus *not* black-margined ..... 6

6. Juga rugosely punctate; rostrum reaching base of ventral segment II; antennal segments I and II subequal, each about one-half as long as III; color in general green; length, 8–11 mm., width, 4.8–6 mm. .... *dimidiata* Say 1831  
Quebec and New England west to the Pacific and south to Northern Florida, Oklahoma, Texas; on birch and other trees, hazel, chokeberry.

Juga coarsely punctate, *not* rugose; rostrum *almost* reaching posterior margin of posterior coxae; antennal segment II three-quarters as long as III; color mostly pale, much suffused with red; length, 10–12 mm., width, 5.5–6 mm.

*subcarnea* Van Duzee 1935

Arizona, California.

7. Scutellum with a *small* somewhat smooth pale spot on the basal angles, or with none; membrane fuscous-spotted ..... 8  
Scutellum with a *large* levigate subcallous spot at the basal angles; membrane vitreous, unspotted; (antennal segment II distinctly *not* shorter than III; rostrum reaching base of ventral segment III; color clear green; length, 9–11 mm., width, 5.5–6.5 mm.) ..... *euchlora* Stål 1872  
Maryland, South Carolina, Georgia, Florida, Iowa, Oklahoma, Texas, Indiana, North Carolina, Alabama, Utah, New Mexico, Arizona, Illinois, Colorado; on cedar.
8. Very unevenly remotely large black punctate above; antennal segment II one-third III (sec. Stål), (scarcely more than



one-half III, sec. Blatchley); incisures *without* a black spot; rostrum reaching base of ventral segment III; color ferruginous; length, 10.5–11.5 mm., width, 5.5–6 mm.

*packardii* Stål 1872

New Jersey to Florida; on *Juniperus virginiana*.

Quite densely, very finely and quite regularly black punctate above; (apex of tylus subimpressed); antennal segment II three-quarters of III; incisures *with* a black spot; rostrum reaching middle of ventral segment III; color pale sub-olivaceous flavescent; length, 10–11.5 mm., width, 6–7.5 mm.

..... *sordida* Uhler 1871

Massachusetts, Maryland, District of Columbia, Virginia, Colorado, New Mexico, Arizona, California, Washington, Vancouver Island.

Genus XXVIII. *Piezodorus* Fieber 1861

KEY TO SPECIES

(One Cuban species added, which might be found in Florida)

- 1. Ventral spine projecting anteriorly to the middle of mesosternum, which is *sulcate* longitudinally, *not* carinate; spiracles not black-rimmed; length, 8–10 mm.

*tinctus* Distant 1889

(Panama and Antilles.)

Ventral spine *not* projecting to the middle of the mesosternum, reaching intermediate coxae; mesosternum *carinate*; spiracles black rimmed .....

- 2. Rostrum markedly overlapping the apex of the ventral spine; pronotum *without* a transverse levigate subcalloused pale band between the humeri, unicolorous, evenly punctate everywhere; color dark green; a stouter appearing species; length, 11.5–12.5 mm., width, 6–6.5 mm.

*lituratus* Fabricius 1794

Florida, (all over Europe into Asia and Africa, Madeira Id.).

Apex of rostrum contiguous to apex of ventral spine or *slightly* overlapping it; pronotum between the humeri with a levigate subcalloused pale, sometimes reddish, band with a very few scattered punctures, generally light anteriorly to the band, darker posteriorly; a light yellow-green, almost stramineous in color; a narrower species; length, 9.5–11.5 mm., width, 5–6 mm. ....

*guildinii* Westwood 1837

Georgia, Florida, New Mexico, (Neotropical).

Genus XXIX. *Arvelius* Spinola 1837

Further characters for distinguishing the genus are: Juga narrow, much longer than tylus, acutely pointed; rostrum slender, at least reaching base of ventral segment IV; humeri spinose; veins of membrane simple; mesosternum with a prominent median carina; abdomen carinate; ostiole prominent, with the auricle more than one-half the length of the tube. Of the two species catalogued, one only is known north of Mexico, which is

*A. albopunctatus* DeGeer 1773

These are characters additional to the generic given above and in the key: Dull greenish-yellow, with a few large widely scattered metallic blue or green punctures; mesosternal carina prominent, extending anteriorly between the anterior coxae and posteriorly between the posterior coxae, where it is notched apically to receive the apex of the prominent ventral spine; abdomen with an obtuse median ventral carina, ventral segments with hind angles acute, segment VI produced spinously; length, 14–16 mm., width, 9–10 mm.

Florida, Texas, Arizona, California, (Mexico into South America).

Genus XXX. *Neopharnus* Van Duzee 1910

In this genus, there are the following characters additional to those in the key: Juga broad, deeply sinuate before the eyes; rostrum reaching apex of ventral segment III; anterolateral margins of pronotum eroded, with several filamentous teeth; humeri produced into an outwardly projecting rounded lobe; tibiae sulcate; ostiolar canal reaching middle of metasternal plate.

The only species so far known is

*N. fimbriatus* Van Duzee 1910

Specifically characterized as follows (in part): Broadly oval, punctate and hairy; legs annulate with fuscous; four or five teeth on anterolateral margins of pronotum, the teeth at the anterior angles reaching to the anterior margin of the eyes, humeri nodular; abdomen with a broad flat longitudinal carina in a wide shallow depression; ostiolar canal straight; length, 12 mm., width, 8 mm.

Florida.

Genus XXXI. *Dendrocoris* Bergroth 1891Genus XXXII. *Odmalea* Bergroth 1915

## KEY TO SPECIES

1. Head inclined in front, with juga *not* in contact (*Odmalea* Berg-

- roth); (humeri strongly prominent and very acute; length, male, 5-6 mm., female, 6-7 mm., width, male, 4-4.5 mm., female, 5-5.5 mm.) ..... *schaefferi* Barber  
Texas.
- Head rounded in front, with juga more or less in contact (*Dendrocoris* Bergroth) ..... 2
2. Humeri rounded, not at all prominent, barely projecting beyond lateral margins of hemelytra; (anterolateral margins of the prothorax somewhat convexly arcuate; length, 5-8 mm.)  
*pini* Montandon 1893  
Texas, California, Colorado, Arizona.
- Humeri more or less rounded or obtuse, projecting well beyond the costal margins of the hemelytra ..... 3
3. Anterolateral margins of prothorax *concavely* arcuated ..... 4  
Anterolateral margins of prothorax nearly straight ..... 5
4. Anterior half of pronotum infuscated; connexivum without a small black spot at incisures; length, 4-4.5 mm.  
*contaminatus* Uhler 1897  
Texas, Arizona, California.
- Anterior half of pronotum concolorous; connexivum with a black spot or band at incisures; length, 6.5-8.5 mm., width, 4.5-5.25 mm. .... *humeralis* Uhler 1877  
Vermont, Massachusetts, New York, New Jersey, Pennsylvania, Maryland, West Virginia, Ohio, Iowa, Kansas, Colorado, New Mexico, California, Georgia; predacious; found in oak, hickory and hazel.
5. Veins of membrane reticulated; anterolateral margins of pronotum impressed and impunctate; length, 6 mm. (male), 7.5 mm. (female), width, 4 mm. .... *reticulatus* Barber 1911  
Arizona.
- Veins of membrane *not* reticulated; surface of pronotum punctured to the margins, which are not impressed ..... 6
6. Stigmata, extreme apical angle of abdominal segments above and below, and a large spot on each incisure of the connexivum, next the costal margin, black; length, 6.5-8.5 mm., width, 4.5-6 mm. .... *fruticicola* Bergroth 1891  
North Carolina, Florida; on scrub oaks.
- Stigmata concolorous; extreme apical angle of abdominal segments below and a band at base and apex of each abdominal of the connexivum, black or fuscous; length, 7.5 mm. (male), 8.5 mm. (female) .... *arizonensis* Barber 1911  
Arizona.

Genus XXXIII. *Brepholoxa* Van Duzee 1904

A few additional characters to those in the key are as follows: Jugs exceeding tylus anteriorly; antennae slender; bucculae with a prominent tooth at their apical one-third; rostrum passing middle coxae; humeri acute; spine on ventral segment II; ostiole with an auricle; tibiae not sulcate.

Only the type species of the genus is known,

*B. heidemanni* Van Duzee 1904

A few of the specific characters are: Elongate oval, subdepressed; above and below a uniform pale dull yellow; head, pronotum and scutellum finely punctate with numerous narrow transverse rugae between the rows of punctures; antennal segment II one-half longer than III, which is subequal to IV, V slightly shorter; rostral segments II and III subequal, IV shorter; anterolateral margins of pronotum finely crenulate; connexivum broadly exposed; ventral spine reaching hind coxae; length, 11-12 mm., width, 6-7 mm.

Florida; from black mangrove and shrubbery along edges of brackish bayous.

Tribe 6. *EDESSINI* Kirkaldy 1909

Genus I. *Edessa* Fabricius 1803

KEY TO SPECIES

- A. Antennal segments II and III, and IV and V respectively, subequal; ostiolar canal extending beyond middle of metapleura, apically attenuated; metasternal plate wide anteriorly, arms long and broad, the sinus between them wide, obtuse, somewhat shallow; male hypopygium seen from below quite narrowly and deeply excavated, margins of sinus not sinuate; eighth tergite in female distinctly angulated posteriorly; green in general color; length, 13-15 mm., width, 7-8.5 mm. .... *bifida* Say 1832  
Florida and Southern States to Texas and occasionally north to Maryland.
- B. Antennal segments II and III equal, V a little longer than IV, (II twice as long as I); ostiolar canal *not* attaining middle of metapleura, truncate at apex; metasternal plate narrow, anterior arms rather short, roundedly acute, not extended to middle of mesosternum, sinus between arms narrow, deep; male hypopygium seen from below broadly but not deeply excavated, margins of sinus slightly sinuate; eighth

tergite in female *not* distinctly angulated posteriorly; color testaceous, fusco-punctate, hemelytra stramineous yellow with a ferruginous streak; length, 13 mm., width 7 mm. .... *florida* Barber 1935 Florida.

Subfamily 3. **Tessaratominae** Stål 1864

Genus *Piezosternum* Amyot & Serville 1843

The following selected characters are given to aid in the recognition of the genus: Body large, obovate; head small, triangular, juga longer than the tylus and contiguous before it, antenniferous tubercles entirely visible from above, unarmed; bucculae quite high, of equal height throughout; antennae 5-segmented, not very long, terete, segment I exceeding apex of head, II longer than III; rostrum passing anterior coxae, segment I slightly exceeding bucculae posteriorly; anterolateral margins of the pronotum very narrowly reflexed, base posteriorly produced; scutellum triangular, as broad as long, apex acute, frena extending beyond middle of scutellum; apical margin of the corium sinuate, the exterior apical angle acute; prosternum simple; metasternum quite elevated, posteriorly truncate, anteriorly quite produced, anterior production noticeably compressed-angulate, extending to anterior coxae; apical angles of the abdominal segments produced in prominent teeth; ventral segment II subelevated at middle and touching the truncated posterior part of the metasternum; tibiae slightly sulcate above.

This genus is divided by Kirkaldy into two subgenera, the typical subgenus with two recorded species, is Neotropical; the subgenus *Piezosternias* Kirkaldy, with three species, is Ethiopian, one species of these being Madagascan: The single species recorded north of Mexico is

*P. subulatum* Thunberg 1783

A few additional characters to recognize the species are: Anterolateral margins of pronotum sinuate, humeri produced; scutellum apically produced into a slender spine; length, 20–22.5 mm., width, 12.5 mm.

I have met with a reference to this species as found in Texas, but cannot relocate it. However, since this big species ranges from Brazil north into Mexico and the Antilles (Cuba, etc.), it will doubtless sooner or later be found once more in Texas, or even in Louisiana and Florida.

This subfamily is represented in America by one other genus, *Pantochlora* Stål, its one species, *vivida* Stål, being known from Mexico to Nicaragua; and this may extend even into the Gulf Strip. The other American species of *Piezosternum*, *thunbergi* Stål, appears to be known only from Rio de Janeiro, Brazil.

Subfamily 4. **Acanthosomatinae** Stål 1864

KEY TO GENERA

- A. Posterolateral margins of the pronotum depressed and amplified; posterior angles of the pronotum angularly projecting posteriorly; ostioles rather short, shorter than twice the distance from their apices to the anterior angles of the metasternum..... I. *Meadorus* Mulsant & Rey 1866, p. 244
- B. Posterolateral margins of the pronotum neither depressed nor amplified; posterior angles of the pronotum obtuse, *not* projecting posteriorly; ostioles about three times as long as the distance between their apices and the anterior angles of the metasternum.... II. *Elasmostethus* Fieber 1861, p. 244

Genus I. *Meadorus* Mulsant & Rey 1866

(*Elasmucha* Stål 1864)

(*Acanthosoma* Van Duzee 1904)

Generic characters additional to those in the key are: Posterolateral margins of the pronotum depressed, emarginate; tylus slightly longer than the juga; rostrum slender, passing posterior coxae; anterior angles of the pronotum dentate; ostiolar canal short, broad, curved.

The one species so far discovered with us is

*M. lateralis* Say 1831

To the generic may be added these selected characters: Oblong oval; greenish-yellow with coarse reddish-brown punctures; segments II and III of the rostrum subequal, IV shorter than either; length, 7-9 mm., width, 4.5-5 mm.

Quebec and New England west to the Pacific Coast, New York; an abundant species on white birches and on beeches in New York and Massachusetts.

Genus II. *Elasmostethus* Fieber 1861

KEY TO SPECIES

1. Antennae piceous or shining black with the incisures pale; (pro-

notal punctures fine, concolorous anteriorly, a dark narrow series posteriorly) ; length, 9–10 mm., width, 5–5.5 mm.

*atricornis* Van Duzee 1904

Quebec, New York, Maryland, Indiana, Montana ; on *Aralia racemosa*.

Antennae pale except for the more or less darker apical segment ..... 2

2. Pronotal punctures coarse, almost like foveoles, widely separated ; venter without a lateral row of black spots, one to each segment, from ventral segment II to VI ; length, 7–11 mm., width, 4.9–6 mm. .... *cruciatus* Say 1831

(and var. *cooleyi* Van Duzee 1904)

Quebec, New England and New York to Montana, Oregon and Vancouver Island, and south to North Carolina, Nevada, New Mexico, Utah, Texas and California.

Pronotal punctures small, punctiform fairly close together ; ventral segments II to VI each with a lateral black spot on each side ; length, 10.6 mm., width, 4.9 mm.

*interstinctus* Linné 1758

Northwest Canada, Alaska, (Europe, on birch ; across northern Asia into Japan).

#### Subfamily 5. **Asopinae** Spinola 1851

##### KEY TO GENERA

1. Scutellum reaching nearly to the apex of the abdomen, surpassing the corium and very broad, at least twice as wide at the middle as the free part of the corium ; apex broadly rounded (Tribe *Discocerini* Schouteden 1907).

I. *Stiretrus* Laporte 1832, p. 247

Scutellum shorter than abdomen, never surpassing the corium and in general shorter than that, rarely as wide beyond the frena as the free part of the corium, the part beyond the frena in general narrower, tip of scutellum rounded, truncate-rounded or angulate (Tribe *Asopini* Schouteden 1907) ..... 2

2. Eyes *not* contiguous to the anterior margin of the pronotum ; head nearly as long as pronotum ; (all femora unarmed ; juga much longer than tylus ; humeri emarginate, not very prominent ; base of scutellum not prominent).

II. *Heterosceloides* Schouteden 1907, p. 248

Eyes contiguous to the anterior margin of pronotum ; head

- rarely as long as pronotum; (juga never dilated nor strongly elevated) ..... 3
3. Only anterior femora with an anteapical spine or tubercle below; (venter at base with a prominent tubercle or a more or less long spine; body more convex below than above; frena attaining at least middle of scutellum; antennal segment I *not* attaining apex of head; ventral spine neither bifid nor incised at apex) ..... 4  
 Anterior femora *unarmed* ..... 8
4. Ventral spine broad, *depressed*, roundedly truncate at apex, reaching only to the metasternum; (humeri sharply and prominently spined; male without pubescent patches on venter) ..... III. *Alcaeorrhynchus* Bergroth 1891, p. 248  
 Ventral spine either round or *laterally* compressed ..... 5
5. Frena *not* going beyond middle of scutellum ..... 6  
 Frena going beyond middle of scutellum; (ventral spine not going beyond intermediate coxae; juga equalling tylus in length, not converging; anterior tibiae not dilated, sometimes compressed; anterior femora with only a tubercle).  
 VI. *Andrallus* Bergroth 1905, p. 250
6. Ventral spine reaching at least to the intermediate coxae; apex of scutellum quite broad; (frena about  $\frac{1}{2}$  length of scutellum) ..... IV. *Oplomus* Spinola 1837, p. 249  
 Ventral spine *not* produced anteriorly beyond the posterior coxae; scutellum apically narrowed ..... 7
7. Anterolateral margins of the pronotum with a distinct carina; tibiae with a very distinct groove or sulcus below.  
 V. *Perillus* Stål 1862, p. 249  
 Anterolateral margins of pronotum not carinate; tibiae without a distinct sulcus.....VII. *Perilloides* Schouteden 1907, p. 249
8. Segment II of rostrum as long as or longer than III and IV taken together, III equal to IV or nearly twice as long; (venter *without* an acuminate tubercle or spine at base) ..... 9  
 Segment II of rostrum shorter than III and IV taken together. 10
9. Segment III of rostrum distinctly longer than IV, II more than twice III; bucculae quite elevated; juga not meeting in front of tylus; (antennal segment II only slightly longer than III; anterolateral margins of pronotum obtuse, humeri produced into a stout spine, which is apically truncate-emarginate; apex of scutellum with sides subparallel); osti-



- ole with a distinct curved canal; (anterior tibiae more or less dilated; colors metallic blue or green with red to brown markings) .....VIII. *Euthyrhynchus* Dallas 1851, p. 251
- Segment III of rostrum not longer than IV; bucculae strongly elevated, in side view overhanging behind; juga meeting in front of the tylus; ostiolar canal subobsolete.
- VII. *Rhacognathus* Fieber 1861, p. 251
10. Segment IV of rostrum very distinctly longer than III; venter with a basal spine which is not produced beyond the posterior coxae; (bucculae quite strongly elevated; anterolateral margins of pronotum straight, obtuse, not carinate; tibiae rounded above beyond middle; above black with a red or yellow pattern) .....IX. *Mineus* Stål 1867, p. 252
- Segment IV of rostrum equal to or shorter than III; venter with or without a basal spine ..... 11
11. Venter *with* a long, distinct, laterally compressed spine at base; reaching *at least* to the intermediate coxae; (mesosternum with a longitudinal median carina; metasternum *not* carinate; posterior angles of pronotum without a spine; juga either equal in length to tylus, or slightly longer and converging before it; humeri acuminate and rounded).
- X. *Apateticus* Dallas 1851, p. 253
- XA. *Podisus* Herrich Schaeffer 1853, p. 253
- Venter *without* a basal spine or prominent tubercle ..... 12
12. Anterolateral margins of pronotum denticulate, humeri outwardly produced, prominent, sharply spined; (frena  $\frac{2}{3}$  the length of the scutellum).
- IV. *Andrallus* Bergroth 1905, p. 250
- Anterolateral margins of pronotum entire, smooth; humeri *not* prominent; (segment II of rostrum one-half longer than III; juga not meeting in front of tylus; ostiole with a distinct curved canal; ventral segment II not more elevated than I; metallic dark blue or bronzy above).
- XI. *Zicrona* Amyot & Serville 1843, p. 258

Tribe 1. *DISCOCERINI* Schouteden 1907

Genus I. *Stiretrus* Laporte 1832

These are a few generic characters added to those in the key: Rostrum surpassing middle coxae; humeri obtusely angulate; ostiolar canal broad; ventral segment II with a spine; anterior tibiae dilated; scutellum broad, U-shaped.

*St. anchorago* Fabricius 1781

Our one North American species is further characterized thus: Broad oval; blue-black above, patterned more or less with yellow, orange or red; antennal segments II, IV and V subequal, III one-third shorter than any one of them; ostiolar canal curved; length, 8–11.5 mm., width, 5–7 mm. Four varieties are listed, differing in color.

New England west to Iowa, Pennsylvania(?), Indiana, Georgia, Florida, Texas, and Kansas; highly predaceous, attacking among others larvae of *Galeruca*, *Doryphora*, *Papilio*.

Tribe 2. *ASOPINI* Schouteden 1907Genus II. *Heterosceloides* Schouteden 1907

This is an abstract of the original generic characterization of Schouteden: Juga as long as tylus; eyes prominent, with a small tubercle behind, not touching pronotum; rostrum reaching to intermediate coxae, segment I shorter than bucculae; antennae simple, segment I not attaining apex of head; humeri prominent and sharply incised, anterior margin of the pronotum narrower than head with eyes; ostiole distinct, short, straight; metasternum with two acute oblique carinae; venter with a small spine reaching only to posterior coxae. Our one species north of Mexico is

*H. lepida* Stål 1862

In this the anterior tibiae are strongly widened apically, and bear a small spine; a short, light-colored longitudinal carina on the posterior lobe of the pronotum; base of scutellum reddish; length, 6 mm.

Texas.

Genus III. *Alcaeorrhynchus* Bergroth 1891

## KEY TO SPECIES

A. Clypeus nearly as wide anteriorly as at its greatest width (nearly three-quarters as wide); juga not calloused at the anterior margin; femora not infusate apically, if slightly so, not biannulate; abdominal spine flat, narrowed at tip, rounded; humeral spines *not* or very slightly, anteriorly directed; length, 18–24 mm., width 12–14 mm. (female).

*phymatophora* Palisot de Beauvois 1805

Florida, (Neotropical).

B. Clypeus much narrower than at its greatest width (about one-half as wide); anterior margin of juga calloused; femora

infusate apically, generally biannulate; abdominal spine flat, broad at tip, nearly truncate; humeral spines noticeably directed anteriorly; length, 18-24 mm., width, 12-14 mm. .... *grandis* Dallas 1851  
Florida, Texas, (Neotropical).

Genus IV. *Oplomus* Spinola 1837

KEY TO SPECIES

1. Head with the apex distinctly narrowed; prosternum dilated on each side into a rounded lamina (subgenus *Polypocilus* Stål 1870); (a levigate longitudinal line on pronotum, extending to anterior one-quarter of the scutellum; length, 14.5-15 mm.) ..... *dichrous* Herrich Schaeffer 1839  
Arizona, (Mexico).

Apex of head truncate; posternum not dilated; [posterior femora with two small teeth or tubercles apically (subgenus *Oplomus* s.s. Spinola)] ..... 2

2. Membrane entirely dark, aeneous or blackish; (lateral angles of thorax very slightly prominent, apex rounded); with a levigate line (may or may not be carinate) on pronotum and on apical one-half of scutellum; connexivum concolorous; length, 11.5-13 mm. .... *tripustulatus* Fabricius 1803  
Florida. (Neotropical).

Membrane in greater part subhyaline, pale toward the apex; a distinct levigate carina on the pronotum and on the apical one-half of the scutellum; connexivum white-spotted; length 10.5 mm. .... *mundus* Stål 1862  
Texas, Mexico.

Genus V. *Perillus* Stål 1862  
(and *Perilloides* Schouteden 1907)

KEY TO SPECIES

1. Somewhat depressed; pronotum scarcely elevated above level of scutellum; tibiae sulcate above; length, 10 mm. .... *confluens* Herrich Schaeffer 1839  
Texas, Colorado, New Mexico, Arizona.

More convex; pronotum quite strongly convex above base of scutellum; tibiae not sulcate above ..... 2

2. Anterior femora with a blunt <sup>inconspicuous</sup> tubercle in place of a spine; length, 5-7.5 mm., width, 4.5-5 mm. .... *exaptus* Say 1825  
Widespread throughout United States.

Anterior femora with a stout spine <sup>OR TUBERCLE</sup> ..... 3

3. Surface finely and closely punctured; anterior margins of ventral segment VI broadly rounded; (antennae black with metallic green reflections; length, 8.5 mm., width, 4.7 mm.)

*splendidus* Uhler 1861

Texas, Colorado, California, (Mexico).

Surface coarsely punctured; anterior margin of ventral segment VI quite distinctly produced in a more or less obvious angle .....4

4. Antennae black, only basal joint and incisures pale; abdominal segments *with* a row of black spots; length, 8.5–11.5 mm., width, 5.5–7 mm. .... *bioculatus* Fabricius 1775

Ontario to Arizona and California, etc.; preys on larvae of *Doryphora*.

Antennae black, first two joints and basal half of III rufous; abdomen *without* black spots; length, 9–11 mm., width, 5–6 mm. .... *circumcinctus* Stål 1862

New York, Illinois, Ontario and New England to Manitoba, Nebraska and Dakota.

Genus VI. *Andrallus* Bergroth 1905

(= *Audinetia* Ellenrieder 1862)

The following characters additional to those in the key will help to recognize this species: Head shorter than pronotum, nearly flat, apex roundedly truncate, jugs scarcely or not longer than tylus; antenniferous tubercles visible from above; bucculae very high, evanescent posteriorly; rostrum reaching posterior coxae, segment I reaching base of head, II shorter than III and IV taken together; antennal segment I not reaching apex of head, II slightly longer than III; anterolateral margins of pronotum anteriorly dentate, humeri produced laterally in a bidentate point, posterior angles not dentate, but obtusely prominent; hemelytra surpassing greatly the apex of the abdomen; membrane with simple or bifurcate veins; ostiolar canal sharply defined, quite short, subtransverse; intermediate femora spined, or with a tubercle; anterior tibiae not dilated, all tibiae with a pronounced longitudinal sulcus above; apical segments of venter not prominent; lateral stridulatory area on the ventral disc larger than usual, on segments III to VI.

The one species in the genus is

*A. spinidens* Fabricius 1787

(= *Apateticus ludovicianus* Stoner 1917)

This may be readily distinguished by the generic characters; length, 13–16.5 mm., width, 7–8.75 mm.

Louisiana, Texas; this is a widely distributed species, known from Africa, Madagascar, British India, Malaysia, New Caledonia, Fiji, Tahiti and Mexico!

Genus VII. *Rhacognathus* Fieber 1861

Further generic characters than those given in the key are: Head not or scarcely longer than wide including eyes, shorter than the pronotum; juga not or hardly longer than tylus, not contiguous, or longer than tylus and contiguous or nearly so; bucculae elevated; antennae simple, segment I not reaching apex of head, III subequal to II; rostrum thick, not surpassing intermediate coxae, segment I reaching base of head, II reaching mesosternum, longer than the following segments taken together, III and IV short, subequal; humeri scarcely prominent, posterior angles of pronotum denticulate; ostioles effaced, short, close to the anterior margin of metasternum; all femora unarmed, tibiae with an evident sulcus, anterior scarcely flattened; no silky areas on venter of male.

There is one species in America, namely

*Rh. americanus* Stål 1870

This is broad oval; fuscous or dull clay yellow (luteous); connexivum spotted; head longer than broad, apex rounded, juga contiguous before tylus; rostral segment II slightly shorter than III and IV taken together, these being subequal; antennal segments II and III subequal, IV one-third longer than either, V longest; anterolateral margins of pronotum finely crenulate; ventral segment II and anterior femora unarmed; tibiae flat above; length, 9–11 mm., width, 5.5–6.5 mm.

Massachusetts, Illinois, Indiana, Michigan, Minnesota, Manitoba.

Genus VIII. *Euthyrhynchus* Dallas 1851

In addition to the key characters are the following: Head shorter than pronotum; juga and tylus of equal length; bucculae little elevated, evanescent posteriorly; rostrum passing posterior coxae, thick, I slightly surpassing base of head, II longer than III and IV taken together and attaining metasternum, III longer than IV; antennal segment I not reaching apex of head, II a little longer than III; anterior angles of pronotum prominent, humeri prolonged into a quite narrow process truncately emarginate at apex, posterior angles of pronotum simple; hemelytra not or but slightly longer than abdomen; ostiolar canal not very long, quite narrow, distinct, transverse and curved; mesosternum with a very distinct carina which

enlarges anteriorly and posteriorly; metasternum not sulcate; intermediate femora unarmed, anterior tibiae more or less distinctly dilated, intermediate and posterior tibiae with a very distinct sulcus above; no silky areas in male.

There is one species:

*E. floridanus* Linné 1767

which may be known by these characters: Elongate oval; above bluish-black, more or less marked with red; apex of head subtruncate, juga equalling tylus, margins feebly sinuate in front of eyes; antennal segments II to V subequal; anterolateral margins of pronotum crenulate, humeri ending in an oblong spine apically *nearly* truncate, *slightly* bifid; ventral segment II and anterior femora unarmed; length, 12–17 mm., width, 6.5–8 mm.

Florida; on *Garberia fruticosa* Nutt. and on shrubbery along hammocks in Florida (Blatchley); supposedly predacious.

Genus IX. *Mineus* Stål 1867

This monotypical genus is further characterized as follows: Head shorter than pronotum, about as wide as long; juga and tylus equal; bucculae elevated, meeting posteriorly; rostrum reaching posterior coxae, not very thick, segment I reaching prosternum, II shorter than III and IV taken together, subequal to IV, which is twice as long as III; antennal segment I reaching apex of head, II notably longer than III; anterior angles of the pronotum salient, humeri not prominent, posterior angles not denticulate; ostiolar sulcus close to mesosternum, moderately long, distinct; femora unarmed, anterior tibiae not dilated, all tibiae without a sulcus, except vaguely apically; a silky area on each side of disc of abdomen in male. The one species:

*M. strigipes* H.S. 1853

May be known by these structures: Elongate suboval; blue-black, shining, narrow edges of the head and basal half of the hemelytra yellow, otherwise edged with orange at margins; antennal segment II and V subequal, III and IV shorter, subequal; rostral segments II and IV subequal, III shorter; ostiolar canal long, curved, very narrow; ventral spine short, slender, reaching hind coxae; length, 9–10 mm., width, 4.5–5 mm.

Massachusetts to Illinois and south, New York, New Jersey, District of Columbia, Maryland, North Carolina, Florida; on *Ceanothus* (Jersey tea); supposedly predacious.

Genus X. *Apateticus* Dallas 1851XA. *Podisus* Herrick Schaeffer 1853

## KEY TO GENERA, SUBGENERA AND SPECIES

1. Male venter with an opaque rugulose area on each side of the median line of the disc, extending from ventral segments IV to VI; apical angles of ventral segment VI not prominent; (frena going beyond middle of scutellum); juga in general a little longer than the tylus, with their inner angles distinctly acute and converging toward each other; venter without a median row of black spots; tibiae sulcate; over 14 mm. long ..... 2
- Male venter without rugose areas; apical angles of ventral segment VI acuminate; juga not longer than tylus, with rare exceptions; venter with a median row of black spots; (female genital segment with *two* basal plates ventrally); tibiae sulcate or not; length less than 14 mm. .... 7
2. Humeri not, or hardly, prominent and not acute; anterolateral margins of pronotum straight at base and thence convexly curved anteriorly, posterior angle spined; female genital segment with two basal plates ventrally; (Genus *Apateticus* Dallas 1851) ..... 3
- Humeri acuminate, more or less prominent; anterolateral margins of pronotum nearly straight or concavely sinuated, posterior angles of pronotum without or with a very small tooth or spine; female genital segment with three basal plates ventrally: (Subgenus *Poecilus* Stål 1870) ..... 4
3. Anterolateral margins of pronotum outwardly curved in a smooth curve, calloused, pale, edge crenulate, humeri *rounded*; basal one-third or more of the costal margin of the hemelytra calloused, smooth, impunctate; basal angles of scutellum *without* calli; all tibiae entirely black or dark; (strigose vitta in male with long silky hairs); length, 13–13.5 mm., width, 7 mm. .... *marginiventris* Stål 1870  
(*gillettei* Uhler 1895)

Nebraska, Colorado, Arizona, (Mexico).

Anterior one-half of the anterolateral margins of the pronotum outwardly curved, coarsely dentate, posterior one-half slightly sinuate, with a narrow calloused edge, humeri angulately rounded; costal margin of the hemelytra neither calloused nor pale, anteriorly slightly explanate; basal angles of scutellum with long narrow calli, smooth except

for one or two deep punctures; all tibiae black with a broad pale annulus; length, 13-17 mm., width, 7-9 mm.

*lineolatus* Herrich Schaeffer 1839  
(*halys* auctt.)

Florida, Texas, (Mexico, Neotropical).

4. Antennal segments III and V *equal or subequal*; median genital plate of female *quadrangular* ..... 5  
 Antennal segment III *shorter* than V; median genital plate of female *triangular*; (posterior angles of abdominal segments not acute, of last segment rounded) ..... 6
5. Lower (ventral) appendage of male short, rather broad, flattened, narrowed apically but blunt, not attenuated, more or less cultrate; upper appendage palpus-like, small, nearly straight, about one-half the length of lower; juga markedly surpassing tylus; humeri acute, slightly more or less than half of a right angle; (posterior angles of pronotum *not* spined or dentate; posterior angles of the abdominal segments acute, last segment bluntly *angulate*; length, 17-20 mm., width, 8.5-11 mm.) ..... *cynicus* Say 1831  
 Quebec to Texas and Arizona.

Lower appendage of male vertical for one-half its length, then abruptly bent outwardly at apex and produced into a nearly terete black member; upper appendage of male long, straight (as long as rostral segment III); juga somewhat surpassing tylus but not meeting before it; humeri subacute; (rostrum reaching base of *hind* coxae); length, 15-18 mm. .... *anatarius* Van Duzee 1934  
 Arizona.

6. Humeri acute, more or less *one-half* of a right angle, not calloused at tip; posterior angles of pronotum acute, spine, *if present*, minute; posterior angles of abdominal segments not prominent, rounded; male genital lower appendage narrow, flattened, markedly attenuated apically to an acute point, more or less cultrate; upper appendage much longer than lower; length, 13-17 mm., width, ? ? ? ?

*bracteatus* Fitch 1856

Quebec, Massachusetts, Connecticut, New York, Nebraska, Idaho, Vancouver Island.

Humeri blunt, *slightly* more or less than a right angle, tips calloused; posterior angles of pronotum with a *small* sharp tooth; (rostrum reaching behind the middle coxae); male genital lower appendage narrow, flattened, markedly at-



- tenuated apically to an acute point, more or less cultrate; posterior angles of abdominal segments not acute; length, 13-18 mm., width, 8-10 mm. .... *crocatus* Uhler 1897  
 Oregon, Washington, Minnesota, Utah, Arizona, California, Michigan, Illinois, New York, Nantucket Island, Mass.; Manitoba, Vancouver Island, Colorado.
7. Scutellum without, or with *very small*, callous spots at base; frena distinctly surpassing its middle; tibiae *with* a dorsal canal or sulcus; ostiole long, curved; (genus *Podisus* Herrich-Schaeffer 1853 .... *Eupodisus* Schouteden 1916) ..... 8  
 Scutellum with one basal transverse callosity, or with lateral and median calloused spots, the latter sometimes not well marked; frena not surpassing middle of scutellum; tibiae *without* a dorsal sulcus; ostiolar canal short, not curved; (head broadly rounded in front, tylus slightly exceeding juga; lateral angles of pronotum acute, with large sharp spines, posterior angles of the pronotum with a small tooth) (subgenus *Tylospilus* Stål 1870); length, 7.5-10 mm., width, 4.75-6 mm. .... *acutissimus* Stål 1870  
 New Mexico, Arizona, Texas, (Mexico); taken on *Holcus halepensis*.
8. Humeri acutely spined, the long dark spines strongly directed *forward*; anterolateral margins and two distinct spots on pronotum, and the apex of the scutellum distinctly calloused and white; (membrane entirely fuliginous, *not* vitate; ventral spine reaching anterior margins of hind coxae; antennal segment I one-half length of head before the eyes, II longest, III two-thirds the length of IV and about equal to V; rostrum reaching to hind coxae; length, 8.5-11.5 mm., width, 4.5-6.5 mm.) ... *mucronatus* Uhler 1897  
 Florida, (Neotropical); from cabbage palmetto and other trees.  
 Humeri obtuse or acute, if spined, the spines directed *outward*; anterolateral margins of pronotum and apex of scutellum *not* conspicuously calloused ..... 9
9. Humeri blunt, almost rounded; membrane *without* a *dusky vitta*; (form oblong, broader posteriorly than usual in the genus) ..... 10  
 Humeri produced, acute or spined; membrane *with* a *longitudinal dusky vitta*, which is sometimes obsolete or only faintly indicated in some individuals, exceptionally ..... 11
10. Venter normally with two rows of black points on each side;

membrane concolorous, without a distinct dusky vitta; ventral spine reaching posterior coxae; (antennal segment II three times as long as I; head black-margined; a pale, more or less calloused line from the anterior margin of the pronotum to the apex of the scutellum); length, 9–11 mm., width, 5–6 mm. .... *placidus* Uhler 1870  
 Quebec, Ontario, Massachusetts, New York, New Jersey, Michigan, Iowa, Nebraska, Illinois, Colorado; preys on tent caterpillar and other lepidopterous larvae and on larvae of *Galerucella luteola*.

Venter *without* lateral black spots or points (although there are *brown* lateral spots, sometimes faint); membrane with a smoky elongate spot on the *basal angles*; basal spine of venter long, extending *between* the hind coxae; (humeri rounded, *not* spined; teeth of anterolateral margins of pronotum large, coarse and irregular); length, 12.5–14.1 mm., width, 6.75–7 mm. .... *fretus* Olsen 1916  
 Massachusetts, New York, New Jersey, North Carolina, Indiana, Michigan; on trees.

11. Humeri distinctly but not deeply emarginate posteriorly, a little before the apex of the black humeral spine; apex of scutellum not noticeably pale .....12  
 Humeri produced, acute or spinose, entire, *not* emarginated posteriorly; apex of scutellum noticeably pale .....13
12. Head rounded anteriorly; juga *not* exceeding tylus; anterolateral margins of the pronotum finely crenulate or dentate; posthumeral tooth small, acute, humeri slightly anteriorly inclined; no smooth median longitudinal line on pronotum and scutellum; length, 11.5–12 mm., width, 6.4–7 mm.  
*sagitta* Fabricius 1794

Texas, (Mexico).

Head slightly incised anteriorly, juga *slightly* exceeding tylus; anterolateral margins of pronotum in front coarsely crenulate or dentate; posthumeral tooth blunt, almost like a tubercle, humeri somewhat posteriorly inclined; a smooth median longitudinal line from the middle of the pronotum to the disc of the scutellum, not continued to its apex; length, 12.5 mm., width, 7.2 mm. .... *fuscescens* Dallas 1851  
 Texas, (Mexico).

13. Humeri produced, but not spined or acute, apex rounded or blunt; legs immaculate ..... 14  
 Humeri very acute or spinose; femora marked with dark points or a subapical annulus ..... 15

14. Ventral spine short, *not* reaching hind coxae; rostrum reaching to or between posterior coxae; antennal segment II about four to five times the length of I, and one-quarter longer than III; black mark on last ventral segment more or less round, sometimes long, or obsolete; length, 7–11.5 mm., width 4.5–6.25 mm. .... *modestus* Dallas 1851  
Ontario to New York and Georgia, Ohio, Illinois, Dakota, Nebraska, Montana, Iowa, Colorado, British Columbia, (West Indies?); preys on tent caterpillar.

Ventral spine long, going between posterior coxae; rostrum *not* reaching posterior coxae; antennal segment II about four times as long as I and *twice* as long as III; black mark of last ventral segment elongate, sometimes obsolescent; length, 9.5–12 mm., width, 5.9–7 mm. .... *pallens* Stål 1859  
California.

15. Ventral spine very short, not reaching posterior coxae; antennal segment II four times as long as I and one-third longer than III; pale anterolateral margins of pronotum denticulate; color dark, quite strongly tinged with rufous, especially on the legs and antennae; femora darker toward the apex, and sometimes with an obscure darker subapical annulus; median row of ventral black spots growing *larger* posteriorly; (a dark spot or mark on the disc of the hemelytra and one on base of scutellum); length, 9–12 mm., width, 5–6.5 mm. .... *serieventris* Uhler 1871  
Quebec to New Jersey, south to North Carolina and west to Minnesota, Montana, Colorado, Vancouver Island; preys on noctuid larvae.

Ventral spine long, extending between posterior coxae; (rostrum reaching middle of posterior coxae); antennal segment II one-half or more longer than III, IV and V shorter, subequal; anterolateral margins of pronotum denticulate, narrowly margined with yellow, a calloused impunctate median line from anterior margin of pronotum to apex of the scutellum; color more gray or brown; legs with *two* black *points* near apex of femora; median row of ventral dark spots small, with the posterior one much the larger; length, 10–14 mm., width, 6–8 mm.

*maculiventris* Say 1831

Nearly all United States to Arizona and California, Quebec, Ontario, Manitoba, Vancouver Island; preys on many coleopterous and lepidopterous larvae.

Genus XI. *Zicrona* Amyot & Serville 1843

Additional generic characters to key are: Head shorter than pronotum, scarcely as long as wide, juga and tylus equal; rostrum thick, reaching posterior coxae, segment I reaching the prosternum, II slightly shorter than III and IV taken together, III subequal to IV; antennal segment I *not* reaching apex of head, II longer than III; pronotum twice as wide as long, humeri and posterior angles not prominent; prosternum not dilated anteriorly; ostiolar canal distally effaced, but little curved; mesosternum with a distinct carina; intermediate femora unarmed, anterior tibiae not dilated, tibiae not sulcate; no silky areas in male, but ventral segments III-V depressed medially. One species in the genus:

*Zicrona caerulea* Linné 1758 (*cuprea* Dallas 1851)

This is oblong-oval; dark purplish blue or metallic green; rostral segment II one-half longer than III; anterolateral margins of pronotum obtuse, humeri not prominent; ostiolar canal lying close to anterior margin of metasternal plate; length, 7-9 mm., width, 3.5-4 mm.

Hudson's Bay, Maine, New Hampshire, Michigan west to British Columbia, California and Arizona; in high altitudes or latitudes; supposed to be predaceous. This insect is found from Europe east to Siberia.

Family IV. **ARADIDAE** Spinola 1837

Genus *Aradus* Fabricius 1803

KEY TO SPECIES

1. Rostrum *not* reaching base of head; lateral margins of pronotum *not* explanate, (pronotum more or less trapezoidal in shape) (subgenus *Quilnus* Stål 1873) 2  
 Rostrum extending *beyond* base of head; lateral margins of pronotum more or less explanate (subgenus *Aradus* s.s.) ..... 4
- 2 (1). Antennae thicker than front femora; postocular tubercles obsolete ..... 3  
 Antennae more slender than front femora; postocular tubercles distinct; length, 6.75-7.8 mm.  
*heidemanni* Bergroth 1906  
 British Columbia and Rocky Mountain region.
- 3 (2). Length of antennal segment II about two-thirds of the width of the head between the eyes, III enlarged toward the apex; sides of the scutellum feebly ele-

vated; length of female less than 7 mm.; length, 5-6.5 mm. .... *niger* Stål 1873  
Eastern United States, Colorado, Mexico; on *Pinus palustris*.

Length of antennal segment II *more* than three-quarters of the width of the head between the eyes, III cylindrical; sides of scutellum moderately but distinctly elevated; length of female more than 7 mm.; length, 7.6 mm. .... *nigrinus* Parshley 1921  
Arizona.

4 (1). Median carinae of pronotum slightly developed, obsolete anteriorly; (antennae scarcely longer than the head, very robust, segment III *not* twice as long as I); length, 3-5 mm. .... *cinnamomeus* Panzer 1794  
United States east of the Rockies, California; on *Pinus, Picea, Alnus, Betula, Juniperus*.

Median carinae very distinct, extending to anterior margin of pronotum ..... 5

5 (4). Rostrum *not* extending beyond apical one-fifth of the prosternum; (sides of the pronotum strongly angulate, concave-arcuate anteriorly; length, 3.75-4.5 mm.)  
*insoletus* Van Duzee 1916  
Pacific Coast.

Rostrum extending *at least* to front coxae ..... 6

6 (5). Antennal segment II about as long as III, both slender and cylindrical; length more than 8 mm. .... 7  
Antennal segment II *generally* distinctly longer than III, often one or both *not* cylindrical ..... 8

7 (6). Lateral margins of abdomen almost entire; pronotum widest slightly behind middle; length, 8.2-10 mm.  
*aequalis* Say 1832  
Eastern and southern North America.

Lateral margins of abdomen strongly crenate; pronotum widest *well before* middle; length, 8-11 mm.  
*crenatus* Say 1832  
Eastern North America, Mexico; Palearctic; on *Platanus, Pyrus, Quercus, Fagus, Betula, Abies*, maple, hickory, *Liriodendron*.

8 (6). Antennal segment III three-quarters the length of II, yellow in apical half, both cylindrical, II one-half thicker than III; length, 11-11.3 mm.  
*ampliatus* Uhler 1876  
California, Utah.

- Antennae not as in the preceding above; size usually smaller ..... 9
- 9 (8). Antennal segment III only slightly, if at all, thicker than II ..... 10
- Antennal segment III enlarged, about one-half thicker than II; length, 7.5-9 mm. .... *quadrilineatus* Say 1825  
Eastern North America, west across Canada; on *Quercus*.
- 10 (9). Antennae very robust, at the widest part most distinctly thicker than anterior femora ..... 11
- Antennae more slender, often cylindrical, not or *but slightly* thicker than front femora ..... 23
- 11 (10). Pronotum *with* three polished black areas behind the middle; head and pronotum dark, contrasting with the pale hemelytra and abdomen; length, 5-6.3 mm.  
*ornatus* Say 1832  
Pennsylvania, District of Columbia, Maryland, Virginia, Ohio, Indiana.
- Pronotum *without* polished areas; color generally otherwise ..... 12
- 12 (11). Antennal segment III largely yellow; body black; pronotum two-thirds as long as head; (abdomen almost circular; length 5.8 mm.) ..... *curticollis* Bergroth 1913  
North Carolina, Georgia.
- Antennal segment III concolorous, or pale *toward apex only*; body brownish; pronotum longer ..... 13
- 13 (12). Scutellum pentagonal, sides moderately elevated; color generally almost uniform brown; (female genital lobes as viewed from above either very short and transverse, or long and widely separated) ..... 14
- Scutellum *triangular*, sides *generally* strongly elevated; colors often variegated ..... 15
- 14 (13). Head *longer* than pronotum; sides of scutellum elevated to apex; length, 5.2-7 mm. .... *behrensi* Bergroth 1886  
Pacific Coast.
- Head *as long* as pronotum; sides of scutellum scarcely elevated beyond middle; length, 5.5-7 mm.  
*robustus* Uhler 1871  
North America east of Rockies; on *Quercus*.
- 15 (13). Width of antennal segment III about equal to one-half the distance between the eyes; length, 4.4-4.6 mm.  
*coarctatus* Heidemann 1907  
California.

- Width of antennal segment III much less; length over 5.1 mm. .... 16
- 16 (15). Sides of pronotum serrate or dentate ..... 17  
Sides of pronotum entire or finely granulated ..... 18
- 17 (16). Antennal segment III *more than* twice longer than broad, II unicolorous or with very slight paleness at apex; length, 5.5–6.7 mm. .... *fuscomaculatus* Stål 1859  
Pacific Coast; on *Picea sitchensis*, live oak.  
Antennal segment III *less than* twice longer than broad; length, 5.5–6 mm. .... *pannosus* Van Duzee 1920  
California.
- 18 (16). Antennal segment II distinctly *shorter* than the distance between the eyes; (only brachypterous known); length 6 mm. .... *intectus* Parshley 1921  
Wyoming, Colorado, Yukon Territory, Canada; Manitoba.  
Antennal segment II *at least* as long as the distance between the eyes; (only macropterous known) ..... 19
- 19 (18). Pronotum widest in basal third ..... 20  
Pronotum widest *at or near* middle; (rostrum not reaching mesosternum; genital lobes long, rounded posteriorly) ..... 21
- 20 (19). Pronotum *slightly* shorter than the head; rostrum scarcely reaching middle of mesosternum; length, 5.7–6.5 mm. .... *apicalis* Van Duzee 1920  
California; on *Pinus jeffreyi*.  
Pronotum three-quarters the length of the head; rostrum not quite reaching the hind margin of the prosternum; length, 7 mm. (female) ..... *vandykei* Van Duzee 1927  
Oregon.
- 21 (19). Sides of scutellum slightly raised ..... 22  
Sides of scutellum strongly raised, higher than the basal elevation; (pronotum widest at middle) median carinae sinuate; length, 5.8–6.3 mm. .... *implanus* Parshley 1921  
Northeastern North America.
- 22 (21). Basal elevation of the scutellum higher than its sides; pronotum widest *behind* middle; median carinae of pronotum nearly parallel; length, 6–6.7 mm. .... *duzeeci* Bergroth 1892  
Northeastern North America to Indiana; on *Pinus*.

- No basal elevation in scutellum, sides higher than the disc; pronotum widest *at* middle; (margins of pronotum angulately projecting, rather than rounded); median carinae of pronotum slightly converging; length, 5.1–5.5 mm. .... *leachi* Van Duzee 1929 California.
- 23 (10). Anterolateral margins of the pronotum distinctly serrate, *never deeply* sinuate; corium in the macropterous *always* strongly dilated at base, never straight laterally ..... 24  
 Margins of pronotum entire, sometimes evenly granulate, very rarely denticulate, often deeply sinuate; corium either dilated at base (lateral margin sinuate), or not so dilated (lateral margin straight) ..... 48
- 24 (23). Antennal segment III almost three-quarters of II; color uniform dull black; length, 8–8.3 mm.  
*montanus* Bergroth 1913  
 Quebec, Colorado (altitude 10,000 ft.).  
 Antennal segment III one-half, or less, as long as II ..... 25
- 25 (24). Antennal segment II at middle, *almost or quite* as thick as anterior femora; antennae bicolorous ..... 26  
 Antennal segment II at middle *distinctly* more slender than anterior femora, *never* with a pale ring in the middle ..... 27
- 26 (25). Antennal segment II black; disc of scutellum dark in apical half; length, 5–6.5 mm. .... *depictus* Van Duzee 1917  
 Pacific coast; on live oak.  
 Antennal segment II brown, biannulate; disc of scutellum pale reddish; length, 4–6 mm.  
*concinus* Bergroth 1892  
 Southern California; on *Platanus*.
- 27 (25). Antennal segment II cylindrical, at least from near the base to the middle, often enlarged *a very little* near the apex ..... 28  
 Antennal segment II *distinctly* clavate, gradually enlarging from near base to apex, rarely cylindrical in apical one-third, or suddenly enlarged in apical one-third and about twice as thick at apex as at middle ..... 40
- 28 (27). Antennal segment II *longer* than the head; length, 8.5–11.5 mm. .... *debilis* Uhler 1876  
 Massachusetts, New York, Western States, British Columbia; on *Cryptoporus valvatus* on *Pinus*.



- Antennal segment II *shorter* than the head ..... 29
- 29 (28). Antennae very small, scarcely longer than the head, slender; scutellum broad, sides arcuate, apical half pale; length, 5.8 mm. .... *parvicornis* Parshley 1921  
Oregon, New Mexico, California; on *Polyporus valvatus* growing on *Pinus ponderosa* and *Pinus jeffreyi*.  
Antennae much longer than head; scutellum otherwise ... 30
- 30 (29). Antennal segment III pale in apical two-thirds; disc of *pronotum* strongly elevated before and behind transverse impression; length, 5.8-6.7 mm.  
*cincticornis* Bergroth 1906  
Alabama.  
Antennal segment III unicolorous or *narrowly* pale at apex; disc of pronotum either flat or as above ..... 31
- 31 (30). Disc of *pronotum* rather flat, the transverse depression slight and ill-defined ..... 32  
Disc of *pronotum* strongly elevated before and behind the *very* distinct transverse impression ..... 38
- 32 (31). Sides of abdomen rather strongly crenate; pronotum widest *at middle*; length, 7.6 mm. (female).  
*consors* Parshley 1921  
Massachusetts.  
Sides of abdomen notched or entire; pronotum widest *well behind* middle ..... 33
- 33 (32). Scutellum *much* longer than head (about one-quarter longer); length, 7.5-8.5 mm. .... *furvus* Parshley 1921  
Arizona.  
Scutellum *not* much longer than the head, or shorter ..... 34
- 34 (33). Rostrum *not* passing base of prosternum; length, 7.5-9 mm.  
*taylori* Van Duzee 1920  
California, Utah, Vancouver Island.  
Rostrum extending *on to mesosternum* ..... 35
- 35 (34). Rostrum extending *almost or quite* to middle of mesosternum; (granulation of the head rough; antennal segment II about equal in length to the width of the head including one eye, rarely slightly longer; anterolateral margin of pronotum usually straight, oblique, with variably coarse teeth; form elongate; length, 6-9.7 mm.) ..... *proboscideus* Walker 1873  
Alaska, Hudson's Bay, British Columbia, south to Colorado and Arizona, Northern States and New England; on spruce and *Pinus*.

- Rostrum *not* passing anterior one-quarter of mesosternum. 36
- 36 (35). Scutellum *shorter* than head; (granulation of head smooth; antennal segment II *at least* equal to the width of the head *including both eyes*; sides of the pronotum slightly arcuate, with very fine irregular teeth; form broad; length, 7–8.3 mm. .... *basalis* Parshley 1921  
Maine, New Hampshire, New York (in mountains).  
Scutellum *subequal* to head in length ..... 37
- 37 (36). Rostrum reaching *anterior* margin of mesosternum; antennae subequal in length to, or slightly shorter than, the length of the head and the pronotum taken together, segment II not quite twice III; length, 5.6–6.23 mm. .... *intermedius* Usinger 1936  
California.  
Rostrum reaching anterior one-quarter of the mesosternum; antennae *slightly* longer than length of the head and pronotum taken together; antennal segment II nearly two-and-one-half times as long as III; length, 9.38 mm., width, 4.29 mm. (female).  
*serratus* Usinger 1936  
Alberta; on *Polyporus valvatus* on *Pinus ponderosa* and *Abies concolor*.
- 38 (31). Vertex finely and evenly granulated; lateral expansions of pronotum *moderate, very narrow* anteriorly, hardly reflexed; length 6.4–7.5 mm.  
*persimilis* Van Duzee 1916  
Rocky Mountains; on Douglas spruce.  
Vertex with *two* rows of coarse granules; lateral expansions *wide, continued more broadly to anterior angles*, somewhat reflexed ..... 39
- 39 (38). Antennal segment II equal in length to width of the head *with one eye*; marginal teeth of pronotum large and irregular; length, 6.9–8.6 mm.  
*medioximus* Parshley 1921  
Pacific coast.  
Antennal segment II equal to width of head *with both eyes*; marginal teeth of pronotum small and even; length, 8.2–9.75 mm. .... *vadosus* Van Duzee 1920  
British Columbia, Montana.
- 40 (27). Antennal segment II about equal to the distance of the head *between* the eyes, rarely slightly greater; length,

- 4.5–8.5 mm. .... *similis* Say 1832  
 United States east of the Rocky Mts.; on *Betula*, elm,  
 maple, *Polyporus betulinus*.
- Antennal segment II *at least* equal to the width of the  
 head including *one* eye ..... 41
- 41 (40). Antennal segment II *not or but very slightly* more than  
 three times as long as III ..... 42
- Antennal segment II *distinctly* more than three times as  
 long as III ..... 45
- 42 (41). Rostrum extending to middle of prosternum; antennal seg-  
 ment II about twice as long as III; anterolateral mar-  
 gins of pronotum straight, oblique; length, 6.5–7.1 mm.  
*opertaneus* Parshley 1921  
 Minnesota.
- Rostrum extending to mesosternum; antennal segment II  
*more than* twice as long as III; sides of pronotum  
 arcuate ..... 43
- 43 (42). Black; (pronotal margins with numerous fine teeth); anten-  
 nal segment II *moderately* clavate, *shorter than* the  
 width of the head including both eyes; length, 6.8–8.8  
 mm. .... *shermani* Heidemann 1907  
 Quebec, Ontario, North Carolina to Georgia.
- Brown; antennal segment II *strongly* clavate, *equal to or*  
*greater than* width of head including both eyes ..... 44
- 44 (43). Blackish-brown with obscure yellow markings; antennal  
 segment II *equal to* the width of head including both  
 eyes; rostrum extending *nearly* to middle of meso-  
 sternum; scutellum *longer than* pronotum; length,  
 7–9.6 mm. .... *acutus* Say 1832  
 United States; on *Quercus*.
- Light brown; antennal segment II *longer than* the width  
 of the head including both eyes; rostrum extending  
*behind* middle of mesosternum; scutellum *as long as*  
 the pronotum; length, 8–9.5 mm.  
*paganicus* Parshley 1929  
 British Columbia, Ontario; on *Pinus ponderosa*.
- 45 (41). Antennal segment II *gradually* enlarged from near base.  
 46
- Antennal segment II cylindrical from base to near middle,  
*strongly* enlarged in apical third; length, 8–11 mm.  
*approximatus* Parshley 1921  
 Maine, New Jersey, Georgia, Mississippi; on *Pinus*.

- 46 (45). Antennal segment II nearly cylindrical beyond middle, *sometimes very slightly* enlarged at apex, III more slender than II at middle; grayish granules of dorsal surface dense; length, 7.5–10 mm.  
*hesperius* Parshley 1921  
 Colorado, Arizona.  
 Antennal segment II evenly enlarged from near base to apex, III thicker than II at middle; grayish granules sparse, if present ..... 47
- 47 (46). Pronotum nearly flat, transverse depression slight, carinae feeble, sides scarcely reflexed; rostrum *not* reaching middle of mesosternum; color uniformly reddish- grayish-brown; length, 8.5–10 mm.  
*inornatus* Uhler 1876  
 Quebec and New England west to Wisconsin and South Dakota and southeast to Georgia.  
 Pronotum uneven, transverse depression distinct, carinae well developed, anterolateral margins reflexed; rostrum extending nearly or quite onto metasternum; coloration more or less distinctly variegated; length, 9–10.5 mm. .... *blaisdelli* Van Duzee 1920  
 West of the Rockies; on *Poria* sp. on *Pinus ponderosa*.
- 48 (23). Corium strongly dilated at base, width of hemelytra at this point greater than the width of the pronotum, even in brachypterous forms; pronotum sometimes widest well before middle ..... 49  
 Corium slightly, or not, dilated at base, its width about equal to that of the pronotum, which is *very rarely* widest much before middle ..... 58
- 49 (48). Antennal segment III *pale* ..... 50  
 Antennal segment III *concolorous* ..... 53
- 50 (49). Pronotum widest *behind* middle; (antennal segment II slightly thicker than the anterior femora; length, 5 mm.) ..... *insignitus* Parshley 1921  
 Massachusetts.  
 Pronotum widest *at* or *before* middle ..... 51
- 51 (50). Antennal segment III two-thirds the length of II; rostrum reaching middle of *anterior* coxae; length, 8 mm. (female) ..... *patibulus* Van Duzee 1927  
 California.  
 Antennal segment III more or less one-half length of II; rostrum reaching *beyond* middle of *anterior* coxae ... 52

- 52 (51). Rostrum reaching *almost* to posterior margin of *anterior coxae*; head longer than broad; length, 10.2 mm.  
*linsleyi* Usinger 1936  
 California.  
 Rostrum reaching *almost* to posterior margin of *proster- num*; head as long as broad; length, 4.7–5.5 mm.  
*uniformis* Heidemann 1904  
 Eastern United States; on *Pinus*.
- 53 (49). Antennal segment II almost cylindrical, about as long as head ..... 54  
 Antennal segment II *distinctly* clavate, shorter than the head; (sexes similar) ..... 55
- 54 (53). Blackish-brown; antennal segment II longer than the distance between the eyes; rostrum reaching just beyond the apex of the mesosternum (♂) or to the middle of the mesosternum (♀); pronotum much reduced (this is a stenopterous ♂ and brachypterous ♀ form); length, 7.5 (male)–10.7 mm. (female).  
*orbiculus* Van Duzee 1920  
 Western States; on lodgepole pine.  
 Light brown; antennal segment II equal in length to the width of the head with both eyes; rostrum just reaching the mesosternum; pronotum with the lateral margins broadly expanded, (reflexed and entire, with very fine denticulations); macropterous; length, 7.5 mm.  
*gracilis* Parshley 1929  
 Alberta.
- 55 (53). Pronotum widest *well behind* middle; length, 6.5–8 mm.  
*borealis* Heidemann 1909  
 Quebec and Maine to Saskatchewan and California.  
 Pronotum widest *near* middle ..... 56
- 56 (55). Antennal segment II slightly enlarged from near base; length, 8–9.5 mm. .... *compressus* Heidemann 1907  
 Western North America; on *Pinus contorta murrayana*.  
 Antennal segment II cylindrical toward base, enlarged from near middle; length, less than 8 mm. .... 57
- 57 (56). Black, except spots of connexivum; sides of scutellum strongly sharply elevated; length, 6.5–7.3 mm.  
*tuberculifer* Kirby 1837  
 Across northern North America, south through the Rocky Mountains.

Brown; corium marked with yellow; sides of scutellum moderately elevated; length, 7.5 mm.

*parshleyi* Van Duzee 1920

British Columbia, California.

- 58 (48). Scutellum distinctly pentagonal, broad, sides very strongly and sharply elevated; sides of pronotum parallel in basal half; length, 5.7–8 mm. .... *funestus* Bergroth 1913  
Distributed as *A. tuberculifer*, Arizona.

Scutellum and pronotal margins otherwise; less than 6 mm.  
long ..... 59

- 59 (58). Antennal segment III about two-thirds as long as II ..... 60  
Antennal segment III *distinctly* less than two-thirds, usually not more than one-half the length of II ..... 62

- 60 (59). Antennae *pale brown*; anterolateral margins of pronotum straight; male genital segment with ventral orifice; length, 3.7–5 mm. .... *falleni* Stål 1860  
Neogaenic; on *Pinus*.

Antennae *black-and-white*; anterolateral margins of pronotum moderately sinuate; male segment without orifice ..... 61

- 61 (60). Apical *half* of antennal segment II yellowish-white; rostrum extending over anterior *third* of the mesosternum; length, 3.75–4.5 mm. .... *snowi* Van Duzee 1920  
Arizona, New Mexico.

Apical *one-third* of antennal segment II white; rostrum extending over anterior *one-fifth* of the mesosternum; length, 4.5 mm. .... *mexicanus* Usinger 1936  
Mexico.

- 62 (59). Antennal segment II *at base* nearly as broad as an eye; *strongly* flattened, narrowed only at extreme base; length, 5–5.7 mm. .... *angustellus* Blanchard 1852  
South America.

Antennal segment II otherwise ..... 63

- 63 (62). Antennae moderately robust, segment II strongly narrowed at basal third ..... 64

Antennae slender, segment II slightly and gradually enlarged from near base, sometimes rather abruptly thickened near apex ..... 65

- 64 (63). Scutellum at middle *narrower* than the corium *at the same level*, the discal elevation extending beyond this point; female genital lobes *convexly* arcuate posteriorly; length, 4.5–6.4 mm. .... *lugubris* Fallén 1807  
Holarctic.

Scutellum at middle *wider* than the corium, discal elevation not extending beyond this point; female genital lobes *concavely* arcuate posteriorly; length, 5.4 mm.

*arizonicus* Parshley 1921

Arizona.

65 (63). Pronotum widest *well* behind middle; posterolateral margins rounded or nearly parallel ..... 66

Pronotum widest *slightly* behind middle; posterolateral margins straight and distinctly convergent ..... 71

66 (65). Antennae biannulate with white; corium *not* hyaline ..... 70

Antennae *not* biannulate with white; corium *largely* hyaline, *without* distinct transverse veinlets ..... 67

67 (66). Head about as long as the pronotum ..... 68

Head *much* longer than the pronotum; (antennae longer than the head and pronotum taken together; antennal segment II more than twice III, subequal in length to the width of the head with both eyes); length, 4.5–6.1 mm., width, 1.55–2.5 mm. .... *furnissi* Usinger 1936  
California; on *Pinus ponderosa*, *P. lambertiana*, *Pseudotsuga taxifolia*.

68 (67). Antennal segment II slightly longer than the width of the head including one eye, slightly more than twice as long as III; (rostrum reaching anterior margin of the mesosternum; lateral margins of the pronotum granulate, *without* anterior teeth; length, 5.15 mm.)

*fuscipennis* Usinger 1936

Washington.

Antennal segment II subequal in length to width of head with one eye ..... 69

69 (68). Pronotum widest *at* basal third, margins finely granulate; length, 4–5 mm. .... *brunnicornis* Blatchley 1926  
North Carolina, Florida.

Pronotum widest *before* basal third, margin evenly granulate, with a few coarse teeth anteriorly; (rostrum extending to middle of mesosternum); length, 4.7–5.8 mm., ..... *gracilicornis* Stål 1873  
Georgia, Mississippi, Texas, Arizona, New Mexico, Cuba; on *Taxodium distichum*.

70 (66). Genital lobes of female extending beyond second genital segment; length, 4.6–5.9 mm. .... *abbas* Bergroth 1889  
Nearctic; on *Taxodium* and *Pinus*.

Genital lobes of female truncate, not extending beyond

apex of second genital segment; (male unknown);  
length, 5 mm. .... *breviatus* Bergroth 1887  
Florida.

- 71 (65). Brown; pronotum and corium extensively marked with  
yellow; antennal segment II *equal* to width of head  
*between* the eyes; length, 4-5 mm.

*marginatus* Uhler 1893

Utah.

Black; pronotum concolorous; antennal segment II *longer*  
72

- 72 (71). Antennal segment III pale in apical one-third; corium *not*  
hyaline; length, 4.2-5 mm.

*uniannulatus* Parshley 1921

New York, District of Columbia, Michigan, Alberta.

Antennal segment III *entirely* black; corium *largely* hya-  
line; length, 3.7-4.5 mm. ... *evermanni* Van Duzee 1920  
Southwestern States.

Family V. **DYSODIIDAE** Reuter 1912

KEY TO SUBFAMILIES

- A. Scutellum large, extending much beyond the middle of the ab-  
domen, covering the hemelytra, with an obtuse longitudinal  
carina; antennae short, the two basal segments extremely  
short, taken together shorter than the apical process of the  
head ..... Subfamily 1. **CALISIINAE** Stål 1873, p. 276  
(One genus only, *Calisius* Stål 1860)
- B. Scutellum moderate, triangular or rounded at the apex, heme-  
lytra free, corium distinct; antennae moderately long,  
segment I hardly or but little shorter than the apical pro-  
cess of the head, II always going beyond the process  
Subfamily 2. **MEZIRINAE** Van Duzee 1916, p. 271

Subfamily 1. **Calisiinae** Stål 1873

Genus *Calisius* Stål 1858

KEY TO SPECIES

- A. Antennal segment I *slightly surpassing* apex of the antenni-  
ferous spine; anterior pronotal carinae parallel; scutellum  
with a transverse series of 8 or 9 black granules close to  
the apical margin; length, 3.7-3.8 mm.

*cotubernalis* Bergroth 1913

Florida, West Indies.



- B. Antennal segment I *scarcely reaching* the apex of the antenniferous spine; the two convergent carina of the anterior lobe of the pronotum connected at their apex by a transverse ridge; scutellum *without* a transverse series of granules, its apical margin distinctly crenulated; length, 3.8 mm.

*anaemus* Bergroth 1913  
(*pallipes* Heidemann 1904)

Florida.

Subfamily 2. **Mezirinae** Van Duzee 1916

KEY TO GENERA

- 1 (2). Scutellum triangular not, or hardly, transverse; antennal segment IV not, or but slightly, longer than III, generally shorter; margins of rostral sulcus straight, generally parallel ..... 2  
Scutellum broad apically, obtusely rounded, transverse; antennal segment IV much longer than III; rostral sulcus lanceolate .....VII. *Aneurus* Curtis 1825, p. 275
- 2 (1). Venter slightly convex, *without* a slight ruga or carina near the lateral margins and at base of segments III, IV and V ..... 3  
Venter mostly—strongly depressed and flat or flattish, *with* a subtle ruga or carina near the basal margins of segments III, IV and V, frequently also with a longitudinal carina or series of granules near the lateral margins .....VI. *Neuroctenus* Mayr 1866, p. 275
- 3 (2). Pronotum with a truncate base, lateral margins biemarginate or bisinuate near middle, or with a small lobe or tooth; rostral sulcus lanceolate ..... 4  
Pronotum with a sinuate base before the scutellum, or lobate or sublobate before the basal angles of the scutellum; lateral margins straight or unisinate at or near middle, neither bisinuate nor armed with a lobe or small tooth; rostral sulcus mostly linear ..... 5
- 4 (3). Antennal segment I extending beyond the apical process of the head by nearly one-half its own length; thorax anteriorly produced into a very distinct collar, anterolateral margins produced beyond the collum in a distinct lobe ..... (*Carventus* Stål 1866)  
Antennal segment I nearly reaching the apex of the apical

process of the head; apex of the thorax scarcely produced into a collar, lateral margins anteriorly forming an abrupt obtuse angle, not lobate.

I. *Proxius* Stål 1873, p. 272

- 5 (3). Spiracles proportionally less distant from lateral margins of venter, spiracle of segment V close to the margin; (antennal segment I subequal to III or slightly longer; posterior femora without large spines).

(*Hesus* Stål 1862)

Spiracles very distant from margins, spiracle of segment V not close to margin ..... 6

- 6 (5). The greater part of antennal segment I extended beyond the very short anterior process of the head; (antennal segment I shorter than III, last three segments somewhat thick, all pilose; antennal segment II shorter than IV); veins of membrane absent; (abdominal margins entire).....II. *Aphleboderphis* Stål 1860, p. 273  
Antennal segment I scarcely exceeding the long or longish apical process, or going beyond it by hardly more than one-half of itself; veins of membrane always distinct.

7

- 7 (6). Veins of membrane scarcely distinguishable; base of thorax faintly roundedly-truncate.

III. *Pictinus* Stål 1873, p. 273

Veins of membrane quite distinct; base of thorax truncate or sinuate in front of scutellum ..... 8

- 8 (7). Base of pronotum *trisinuate* in front of scutellum; ventral spiracles nearer to the side margins than to the anterior and posterior margins of the segments; length less than 4 mm. ....IV. *Nannium* Bergroth 1898, p. 273

Base of pronotum *truncate* in front of the scutellum; ventral spiracles equidistant from lateral, anterior and posterior margins of the segments; (antennal segment III distinctly longer than II); length 5 mm. or more.

V. *Mezira* Amyot & Serville 1843, p. 274

Genus I. *Proxius* Stål 1873

- A. Antennal segment III *one and one-half times* as long as II; middle of scutellum with a T-shaped elevation; length, 3.5-4 mm. .... *gypsatus* Bergroth 1898  
Florida to Panama and Venezuela.

- B. Antennal segment III *twice* as long as II; middle of scutellum with an *inverted* T-shaped elevation; length, 4.5 mm.  
*schwarzii* Heidemann 1904  
 Florida. (Known only from the type.)

Genus II. *Aphleboderrhis* Stål 1860

To the key characters may be added the following from Stål's original characterization: Body oblong, subovate; head subquadrate, median lobe triangular little produced, slightly incised; head behind eyes roundedly truncate, laterally subspinose; pronotum laterally sinuate; membrane of hemelytra veined.

There is one North American species recorded north of Mexico:

*A. pubescens* Walker 1873

In this the anterior angles of the pronotum are not dilated; the head is as long as broad, the apical process parallel, not cleft at the tip; antennal segment IV longer than III; antennae, legs and body with erect bristly hairs; length, 5-6 mm., width, 2.1-2.7 mm.

Texas.

Genus III. *Pictinus* Stål 1873

In this genus, in addition to the key characters, are the following few: Scutellum triangular (which distinguishes it from *Aneurus* Curtis); margins of the rostral sulcus straight, parallel; venter convex; antennal segment I hardly exceeding the apical process of the head; veins of the membrane hardly discernible (in which it resembles *Aneurus*).

The single species recorded north of Mexico is

*P. aurivillii* Bergroth 1887

In this species the apical process of the head is simple, conical; antennal segment III evidently longer; anterior angles of the pronotum always simple, hardly lobate; feet rufotestaceous, concolorous; length, 4.5 mm.

Georgia, Florida, Louisiana.

Genus IV. *Nannium* Bergroth 1898

Additional to the key characters for the genus are: The pronotum is distinctly toothed on each side at the apex below, and has two prominent tubercles anteriorly; the venter is convex; the mesosternal orifices prominent and surrounded by a raised carina. The one North American species is

*N. pusio* Heidemann 1909.

These few characters are taken from the original description: Short apical process of the head feebly emarginate; antenniferous tubercles prominent, sharply pointed; antennae as long as head and thorax taken together, segment II shorter than I, III longest, IV pyriform, as long and as stout as I; rostrum reaching base of head; pronotal margins finely serrate; length, 3–3.6 mm., width, 1–1.2 mm.

Ohio; appears thus far to be known only from the type locality.

Genus V. *Mezira* Amyot & Serville 1843

KEY TO SPECIES

1. Small species, *not over* 5.5 mm. in length ..... 2  
 Larger species, *at least* 6.5 mm. in length ..... 3
2. Scutellum densely and evenly granulated, *without* an elevation at the base, the median carina very faint or obsolete; length, 4.8–5.5 mm. .... *granulata* Say 1832  
 Eastern and southern United States to Texas, Mexico and Cuba.

Scutellum *with* a smooth transverse elevation at the base, the disc divided by a distinct entire longitudinal median carina; length, 4.5–4.8 mm. .... *novella* Blatchley 1924  
 Florida.

3. Apical margin of corium *evenly rounded* ..... 4  
 Apical margin of corium *sinuate* ..... 6
4. Lateral margins of pronotum *deeply notched* before the middle; anterior lobe of pronotum narrower than the posterior lobe, its sides lamellately expanded laterally and anteriorly; carinae strongly elevated; whole upper surface very rough, pubescent; length, 7.5–8.5 mm. .... *lobata* Say 1832  
 United States, to Texas and California.

Lateral margins of the pronotum evenly or abruptly narrowed in their anterior half, *but not with a distinct notch*; upper surface rather smooth, evenly granulate ..... 5

5. Oblong-ovate; lateral margins of the pronotum rather abruptly narrowed in their anterior half and slightly projecting forward at the anterior angles; carinae moderately distinct; length, 8–9 mm. .... *emarginata* Say 1832  
 North Carolina to Texas and west to California.

Sides not ovate, subparallel; lateral margins of pronotum evenly narrowed anteriorly, straight or only *slightly* sinuate at middle; anterior angles *not at all* projecting in front; length, 6.72–7.15 mm. .... *vanduzeei* Usinger 1936  
 Arizona.

6. Antennal segment I *going beyond* the apical process of the head by at least one-third its length, only moderately thickened in its apical two-thirds; length, 7.46–7.69 mm.

*pacifica* Usinger 1936

(*moesta* of Am. authors, not Stål)

Washington to California and Idaho.

- Antennal segment I *scarcely surpassing* the apical process of the head, very abruptly and strongly thickened in its apical two-thirds; length, 7.5–8 mm. .... *reducta* Van Duzee 1927  
California.

#### Genus VI. *Neuroctenus* Fieber 1861

##### KEY TO SPECIES

1. Apex of head *not* distinctly cleft; juga rounded and contiguous in front of the tylus ..... 2  
Apex of head *distinctly* cleft; juga surpassing tylus, not contiguous in front of it ..... 3
2. Scutellum *without* trace of a carina in the apical half; antennal segment III slightly longer than II; length, 4.5–6 mm.

*simplex* Uhler 1876

New York to Florida.

- Scutellum *with* a faint median carina in apical half; antennal segments subequal; length, 5.5–6.5 mm.

*elongatus* Osborn 1903

Ohio to North Carolina.

3. Abdomen broadly ovate; entire disc of scutellum granulate, *not* rugose; spinous processes behind eyes distinct, acute; length, 6–7 mm. .... *pseudonymus* Bergroth 1898

(*ovatus* Bergroth 1887)

Indiana, Ohio, North Carolina, District of Columbia.

- Abdomen with sides parallel; posterior part of the scutellum transversely *rugose*, anterior part granulose; head behind eyes rounded, *without* spinous processes (antennal segment III longest and slenderest) length, 5.8–6.2 mm.

*hopkinsi* Heidemann 1904

Maryland, Georgia.

#### Genus VII. *Aneurus* Curtis 1825

##### KEY TO SPECIES

1. Antenniferous spines *absent*, or *very short and obtuse* ..... 2  
Antenniferous spines *distinct*, short, *acute* ..... 3

2. Antennal segments I, II, III, subequal; IV as long as II and III taken together; *postocular* spines prominent, *acute*; length, 4.5-4.7 mm. .... *politus* Say 1832  
 Florida, West Indies, Central America.  
 Antennal segments I to IV gradually increasing in length; *post-ocular* spines *obtuse*; length, 3.7-4 mm.  
*tenuicornis* Champion 1898  
 Florida, Georgia, Central America.
3. Antennal segment III three-quarters or more the length of IV; length, 5.5-6.3 mm. .... *inconstans* Uhler 1871  
 Quebec and New York to Indiana.  
 Antennal segment III *not more* than one-half length of IV; not more than 5.3 mm. in length ..... 4
4. Antennal segment II *distinctly* longer than I; IV *more* than twice as long as III; length, 5-5.3 mm.  
*simplex* Uhler 1871  
 Oregon east to Massachusetts; (a northern species).  
 Antennal segment II *not* longer than I, IV *not* more than twice III ..... 5
5. Antennal segment II *as long* as I, I *not* as broad as tylus; length, 4.5-4.8 mm. .... *septentrionalis* Walker 1873  
 Canada.  
 Antennal segment II *shorter* than I, I broader than tylus ..... 6
6. Head slightly *wider than long*; disc of pronotum rugose or tuberculate anteriorly, finely granulate posteriorly; (color pale reddish-brown); length, 2.7-3 mm.  
*minutus* Bergroth 1886  
 Florida and Georgia to Texas, Arizona, Mexico, West Indies.  
 Head slightly *longer than wide*; disc of pronotum very finely granulose, vaguely rugose posteriorly; length, 3.6-4 mm.  
*fiskei* Heidemann 1904  
 New York to Georgia and Indiana; from hickory limbs.

Family VI. TERMITAPHIDIDAE Myers 1924

KEY TO GENERA

- A. Body egg-shaped, surrounded by a strongly incurved and up-curved dorsolateral segmentally divided lamina, the edges of which are further divided into distinct, often quite distantly separated lobules, each with a long fine, almost smooth flagellum ..... *Termitaphis* Wasmann 1902

(Only one species of this genus so far known, *T. circumvallata* Wasmann 1902, from Colombia, South America.)

- B. Entire body strongly flattened above and below and surrounded by a flat lateral segmentally divided lamina, the margin of which is crenulate forming short non-separated lobules, each provided with a short circular, clavate or lanceolate flabellum with serrate edges ..... *Termitaradus* Myers 1924

Genus *Termitaradus* Myers 1924

KEY TO SPECIES

(To females only of the American species of the genus)

1. Twelve lobes only to body margin on each side.
 

*insularis* Morrison 1923

Trinidad, B. W. I.; in the nests of *Leucotermes tenuis* Haglund.

Thirteen to 14 lobes on the body margin on each side ..... 2
  2. Lobules of abdominal lobes II to VI *not more* than four.
 

*trinidadensis* Morrison 1923

Trinidad, B. W. I.; in nests of *Leucotermes tenuis* Haglund.

Lobules of abdominal lobes II to VI, *six or more* ..... 3
  3. Flabella elongate, much more than twice as long as broad, lanceolate, very acute at apex; (abdominal lobe VIII with three lobules); length (male), 2.35 mm., (female), 2.40 mm. .... *panamensis* Myers 1924
- Panama; in nests of *Leucotermes tenuis* Haglund and *L. convexinotatus* Snyder.
- Flabella short and rounded, at most hardly more than twice as long as broad ..... 4
4. Abdominal lobe VIII with *two* lobules; anterior abdominal segments with normally *seven or more* lobules on each margin; (lobules of abdominal lobes II to VI not more than seven; flabella rounded) ..... *mexicana* Silvestri 1911
- Mexico; in nests of *Leucotermes tenuis* Haglund.
- Abdominal lobe VIII with *three lobules*; anterior abdominal segments with normally *six or fewer* lobules on each margin ..... *guianae* Morrison 1923
- British Guiana; lives in nests of *Leucotermes crinitus* Emerson.

REFERENCES

This list contains only those references since the Van Duzee Catalogue of 1917, which describe new genera, new species and other

forms in the families in this part of the Synopsis, only. The genera, species and other forms described are noted, together with their distribution and page reference. However, to avoid repetition of references in subsequent parts, *all other* descriptions in these references are similarly cited, except those in the family Miridae, all of which are omitted and will be referred to in the corresponding part. Synonymical, distributional, habitat and food-plant references are likewise omitted, as well as revisions of groups which contain *no* North American species. Omitted also are references which deal *only* with families in the following parts. So far as it goes, this list supplements the Van Duzee Catalogue.

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## EXPLANATION OF PLATES

(All figures in Plates XIII–XVI redrawn from Hemiptera of Connecticut by Theodore de la Torre-Bueno, except figure 3, Plate XIV, redrawn by J. R. de la Torre-Bueno from Ferris and Usinger, The Family Polycetenidae.)



PLATE XIII

Fig. 1. *Apateticus bracteatus*, ventral view.

- |   |                             |
|---|-----------------------------|
| R—rostrum; all segments<br>in Roman numbers,<br>numbered from base. | MTST—metasternum.           |
| F—femur.  | SPI—abdominal spine.        |
| TR—trochanter.  | O—ostiole.                  |
| COX—coxa.   | OS—ostiole sulcus or canal. |
| PRST—prosternum.  | SP—spiracle.                |
| MSST—mesosternum.   | TB—trichobothria.           |
|   | GS—genital segment.         |
|   | M—membrane.                 |

Fig. 2. The same, dorsal view.

- |  |   |
|--|---|
| ANT—antenna; segments<br>numbered from base<br>in Roman. | BA—basal angle of the pro-<br>notum.                                  |
| TY—tylus.  | BASE—base of the pronotum;<br>base of the scutellum,<br>respectively. |
| J—jugum.   | APEX—apex of scutellum.   |
| AR—arolium.  | BAS—basal angle of the scu-<br>tellum.                                |
| CL—claw.   | F—femur.  |
| EY—compound eye.   | T—tibia.  |
| OC—ocellus.  | TAR—tarsus; segments num-<br>bered from base in<br>Roman.             |
| AA—anterior angle of the<br>pronotum.                    | SC—scutellum.   |
| AM—anterior margin of the<br>pronotum.                   | CL—clavus.  |
| CAL—callus.  | CLS—claval suture.  |
| ALM—anterolateral margin of<br>the pronotum.             | COR—corium.   |
| PNT—pronotum.  | EMB—embolium.   |
| DISC—disc of pronotum; disc<br>of scutellum.             | CON—connexivum; segments<br>numbered from base<br>in Roman.           |
| HA—humeral angle; the<br>humerus.                        | M—membrane.   |
| PLM—posterolateral margin of<br>the pronotum.            |   |



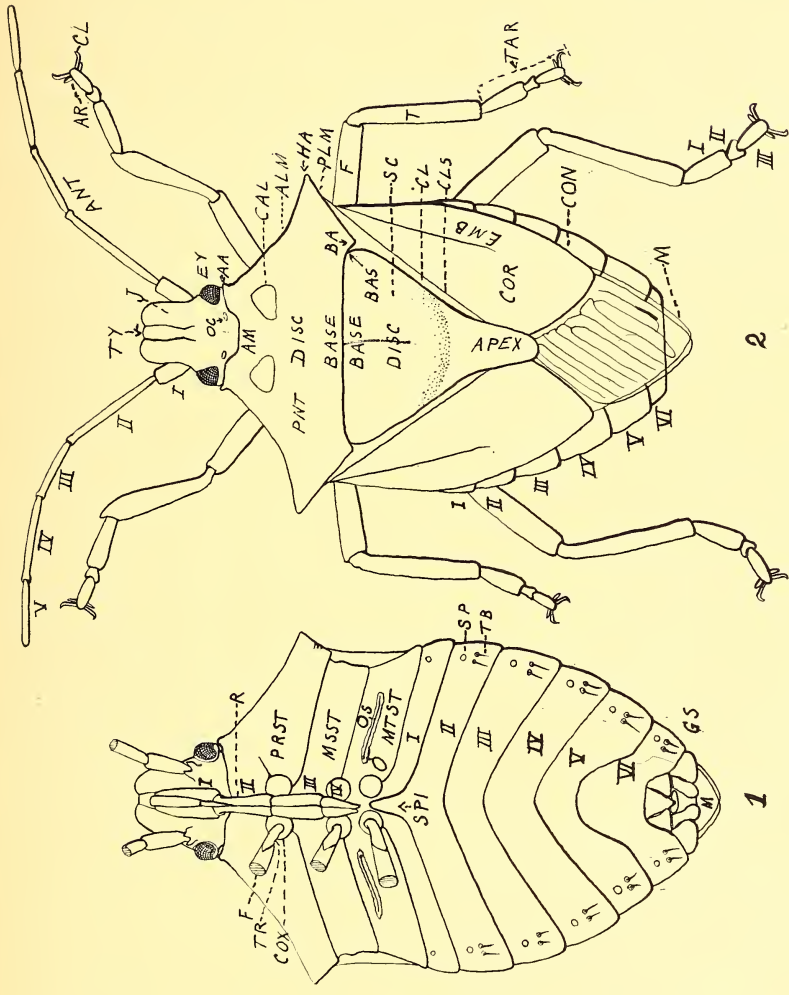
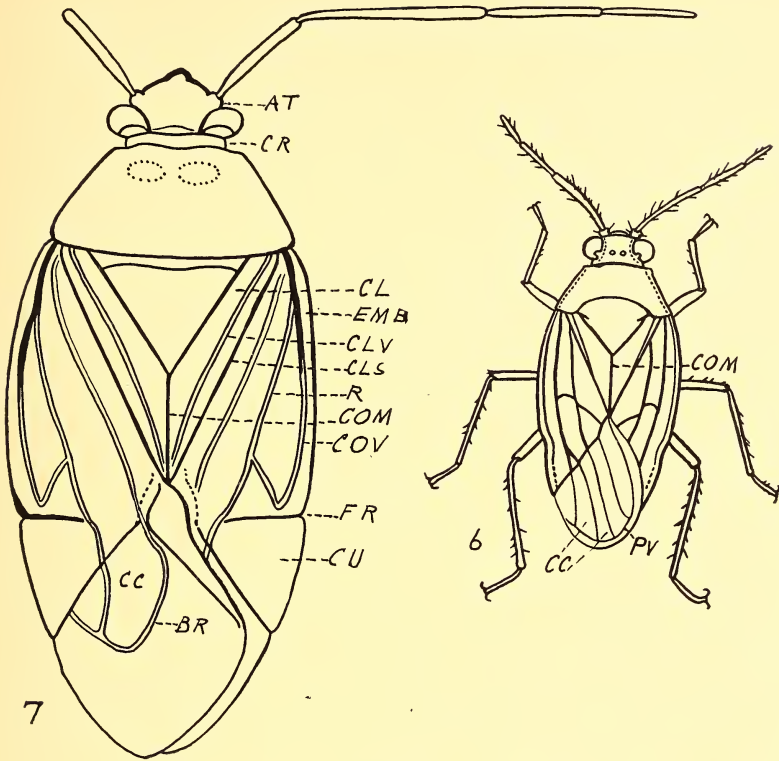


PLATE XIV

- Fig. 3. *Eoctenes* (Family Polycetenidae). CT—ctenidia.  
 Fig. 4. Palae of Corixidae (*Arctocorixa lucida* and *A. parshleyi*).  
 Fig. 5. *Arctocorixa interrupta*, dorsal view; wings of one side removed to show: STR—strigil.  
 Fig. 6. *Pentacora ligata*, dorsal view.  
 COM—commissure. CC—closed cells of membrane.  
 PV—peripheral vein.
- Fig. 7. *Lygus vanduzeei*, dorsal view.  
 AT—antennal, or antenniferous, tubercle. R—radius.  
 CR—collar. COM—commissure.  
 CL—clavus. COV—costal vein.  
 EMB—embolium. FR—fracture.  
 CLV—claval vein. CU—cuneus.  
 CLS—claval suture. BR—brachium, or cubitus.  
 CC—closed cell.
- Fig. 8. The same, claws. AR—arolium.  
 Fig. 9. The same, part of metasternum more enlarged to show: O—ostiole; PT—ostiole peritrema.



7

6

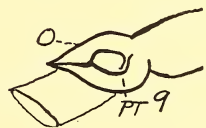
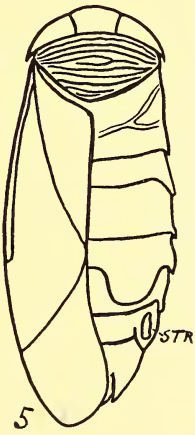
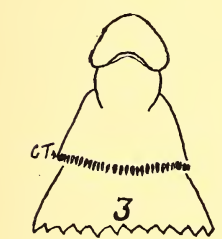


PLATE XV

Fig. 10. The same, from side.

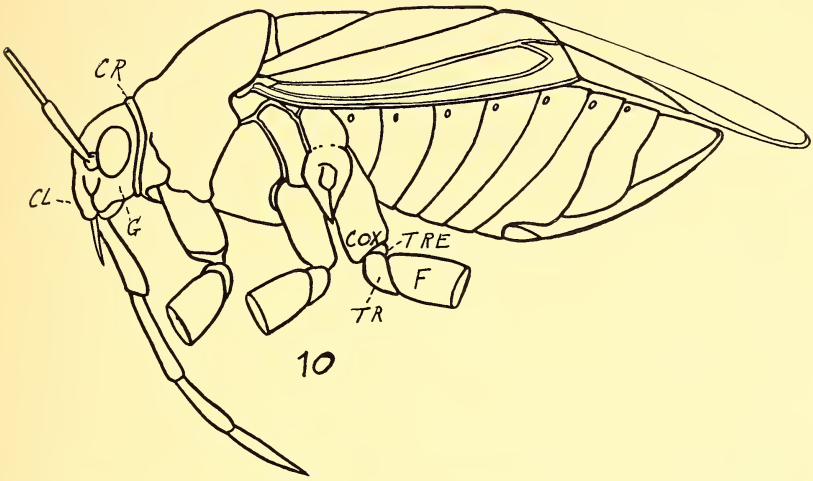
|             |                  |
|-------------|------------------|
| CR—collar.  | TRE—trochantine. |
| CL—clypeus. | TR—trochanter.   |
| G—gena.     | F—femur.         |
| COX—coxa.   |                  |

Fig. 11. *Corythucha ciliata*, side view. DE—discal elevation;  
BUC—buccula.

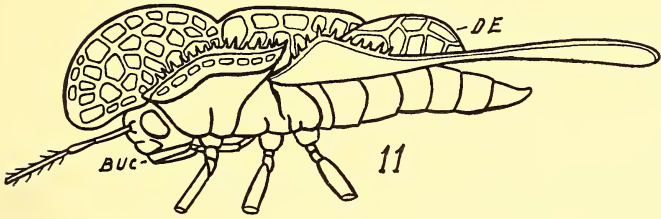
Fig. 12. The same, dorsal view of head and thorax. HD—hood;  
PAN—paranota.

Fig. 13. *Physatochila plexa*, hemelytron; sketch. SA—subcostal  
area.

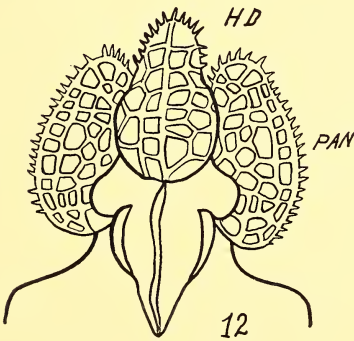
Fig. 15. *Pygolampis pectoralis*, hemelytron. CC—closed cells.



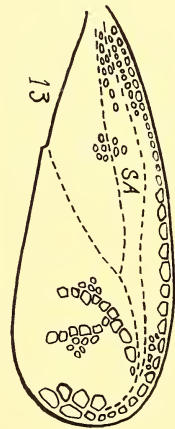
10



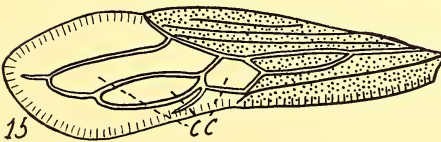
11



12



13



15

PLATE XVI

Fig. 14. *Nabis ferus*, hind wing. HAM—hamus.

Fig. 16. *Ligyrocoris diffusus*, dorsal view.

TY—tylus.

CL—clavus.

J—jugum.

CLS—claval suture.

COL—collum or neck.

COM—commissure.

CR—collar.

Fig. 17. The same, side view.

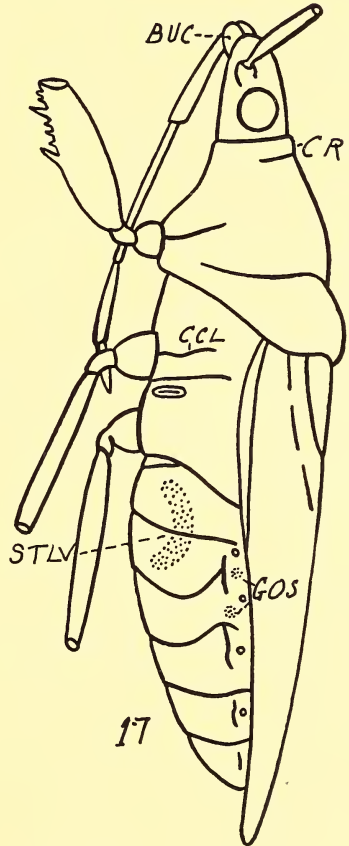
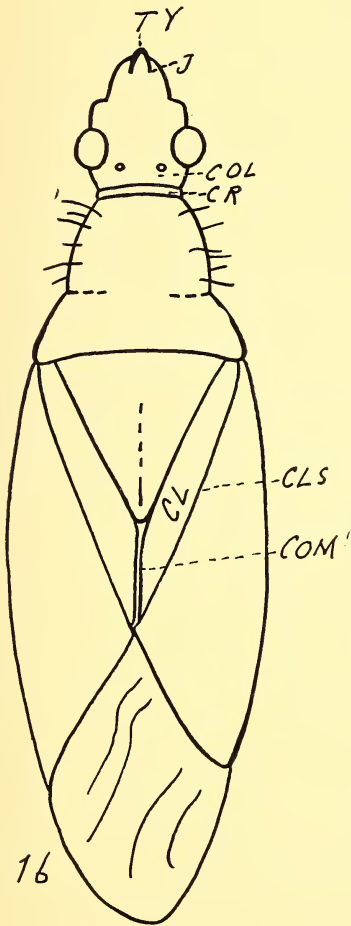
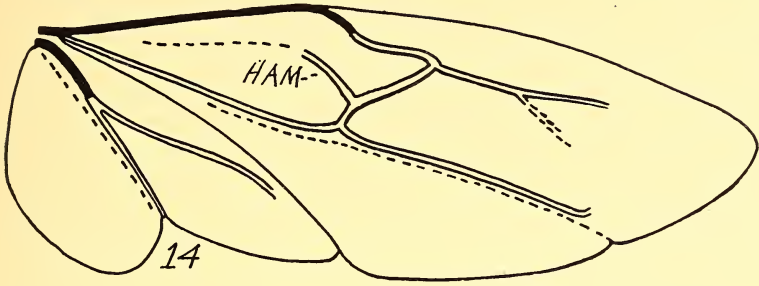
BUC—buccula.

STLV—strigose lunate vitta.

CR—collar.

GOS—glandular opaque spots.

CCL—coxal cleft.







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## PODALONIA (HYMENOPTERA: SPHECIDAE) OF NORTH AND CENTRAL AMERICA\* †

BY WILLIAM DONALD MURRAY

### INTRODUCTION

The North American wasps of the genus *Podalonia* were monographed in 1927 by H. T. Fernald. In this work Fernald noted several problems which were still unsolved. One problem centered around *luctuosa*. Over 350 specimens of *luctuosa* were examined, but only one male which could be considered to belong to this species was seen. One mated pair came to the attention of Fernald. The female of this pair had the black abdomen of *luctuosa*, but the male had the red and black abdomen of *violaceipennis*. As a possible explanation, Fernald proposed the theory that the female *violaceipennis* is sometimes dimorphic, *luctuosa* being one of these forms, and that in rare instances the male also becomes entirely black. As a conclusion, Fernald stated: "On the whole it seems best to leave *luctuosa* as a species separate from *violaceipennis*, for the present, until more pairs have been captured and the evidence they may give becomes available."

In 1931 Fernald believed he had sufficient evidence to conclu-

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\* A thesis submitted to the faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

† Paper No. 1780 Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul.

sively place *luctuosa* as one of the forms of the dimorphic species *violaceipennis*. His evidence was: two mated pairs, in both cases the female with the abdomen black but the male with the abdomen red and black; a reared male. The reared specimen was reported to Fernald by Walter Carter. Carter observed several female *luctuosa* digging and storing their nests. He marked these nests and later collected three or four cocoons from them. From one of these cocoons there emerged a red and black male.

Other problems still to be solved concerned several species of uncertain position. Additional evidence was needed before the position of these species, namely, *jason* (Cam.), *mexicana* (Saus.), *morrisoni* (Cam.) and *piceiventris* (Cam.), could be determined with certainty.

The writer, on examination of wasps determined as *luctuosa* in the University of Minnesota collection, discovered that this species had been collected commonly in the northern part of Minnesota but never in the southern part of this state. In view of the value of the study of male genitalia in separating closely related species, the writer desired to undertake a critical study of these structures in the species of this genus. When the genitalia of a long series of males determined as *violaceipennis* were examined, it was found that they were not all alike. One type was quite distinct from all the others. The males which possessed this type were placed together, and, of the specimens collected in Minnesota, it was at once apparent that every one had been taken in the northern part of the state.

The remarkable correlation between the collecting data of *luctuosa* and the series of males whose distribution in Minnesota was limited to the northern part of the state, and the distinctness of the male genitalia of this series as compared with the genitalia of other specimens determined as *violaceipennis*, raised the question as to whether *luctuosa* was one form of a dimorphic species or whether it was a distinct species the male of which had never been determined. Through the courtesy of Dr. J. Bequaert and Mr. C. F. W. Muesebeck, the writer was able to examine the specimens of *luctuosa* reported by Fernald as having been taken in mating. A study of these showed that, contrary to Fernald's conclusion, the genitalia of the males were quite distinct and separable from the genitalia of *violaceipennis* males. A comparison of figures 1 and 16 makes this evident. In view of these findings, the writer believed it would be desirable and worthwhile to make an exhaustive study of the genus *Podalonia* and to prepare a revision of this genus.



## METHODS AND MATERIALS

The male genitalia in the genus *Podalonia* are usually hidden by the abdominal segments. To extract the genitalia, the specimen is relaxed in a jar containing a liberal amount of relaxing fluid. The relaxing fluid which proved to be very satisfactory is a mixture of equal parts of ethyl acetate, 95% ethyl alcohol, and distilled water. A drop of this fluid is placed on the tip of the abdomen to assist in the softening of the genitalia and the posterior abdominal segments. When the specimen is sufficiently relaxed, it is removed from the relaxing jar and an insect pin is inserted into the abdomen immediately ventrad of the genitalia. This is to insure a slight opening. Another insect pin, the tip of which has been bent to form a hook, is inserted into this opening, and with the aid of the hook the genitalia are extracted.

Since the genitalia are usually rather heavily sclerotized, it is desirable to clear them in potassium hydroxide in order to see easily some of the structures. When sufficiently cleared, they are washed in distilled water and placed in a small vial containing glycerine. This vial is then placed on the same pin as the specimen from which the genitalia are extracted. When it is desired to make a study of the genitalia, they are removed from the vial and placed in a small watch glass containing distilled water.

Approximately 5050 specimens have been examined in the course of this study. The writer has examined the holotypes of the following species: *communis* (Cresson), *pacifica* (Melander & Brues), *nicholi* (Carter), *valida* (Cresson), *robusta* (Cresson), and *argenti-frons* (Cresson). The allotypes of *valida* (Cresson) and *grossa* (Cresson), and paratypes of *alpestris* (Cameron), *atriceps* (Smith) ♂, *montana* (Cameron), *jason* (Cameron), and *compacta* Fernald have also been examined. Through the courtesy of Dr. J. Carl of the Museum of Natural History of Geneva, a male and a female of the type series of *mexicana* (Saussure) have been examined and designated as lectotype and lectoallotype respectively. Dr. R. B. Benson made comparisons with the following types located in the British Museum (Natural History): *luctuosa* (Smith), *alpestris* (Cameron), *piceiventris* (Cameron), *montana* (Cameron), *jason* (Cameron), *quadridentata* (Cameron), *sonorensis* (Cameron), *cementaria* (Smith) and *atriceps* (Smith) ♂. The only types not seen by either Dr. Benson or the writer are *violaceipennis* (LePeletier), *morrisoni* (Cameron) and *atriceps* (Smith) ♀. *Violaceipennis* was described from Philadelphia, and since only one species of *Podalonia* has ever been taken in this vicinity, that species receives

the name *violaceipennis*. The holotype male of *morrisoni* has apparently been lost. The male genitalia of *morrisoni* are figured by Cameron, and the drawing compares favorably with specimens examined by the writer (see note below on Cameron's drawings). The holotype female of *atriceps* has apparently been lost, but the description indicates strongly that it is not a *Podalonia* but a *Sphex*. Some doubt must be placed on two of Cameron's species, *quadridentata* and *piceiventris*. In the taxonomic part of this paper each of these species has been placed in synonymy with another species, *quadridentata* with *montana* and *piceiventris* with *communis*. However, each of these species varies from the typical and because of the lack of specimens other than the holotypes it is not possible to decide definitely on their validity as distinct species.

A note is necessary here regarding the figures of male genitalia in Cameron's work on Central American species. The legends for some of these drawings have apparently been incorrectly associated with the figures. The clue that such a possibility exists was found in the drawings of *morrisoni* and *montana*. *Morrisoni*, as determined by the writer from the original description, has a strong tooth at the base of each penis valve. It is the only species of this genus in the New World having this tooth. But Cameron's figure of *montana* shows this tooth while his figure of *morrisoni* does not show it. The figure of *morrisoni* resembles closely the genitalia of *montana*, and so it becomes apparent that the legends for these two species have been reversed. Cameron's figure of *Ammophila varipes* has sagittae resembling those of *Podalonia* and entirely different from *Sphex*. Further, the penis valvae and the sagittae closely resemble those structures as they occur in *communis* or *communis* subspecies *alpestris*. It thus seems that this drawing with the legend *Ammophila varipes* is actually a figure of *Podalonia communis* subspecies *alpestris*. The drawing with the legend *alpestris* is almost certainly that of *luctuosa*, judging from the penis valvae and sagittae. Where Cameron obtained the specimen cannot be determined at present. The writer has not seen any specimens of *luctuosa* which were collected south of the United States, and if this species does occur in Mexico or Central America it must be exceedingly rare.

Detailed data for the specimens studied during the preparation of this revision are recorded and deposited in the library of the University of Minnesota. Because of the need for economy, detailed data for the commoner species have been omitted from this paper. Where they are included, the present location of each specimen is indicated in brackets following the citation of other data concerning

the specimen. Initial letters are used to designate institutional and individual collections as follows:

- AES—American Entomological Society, Philadelphia Academy of Sciences, Philadelphia, Pa.  
AMNH—American Museum of Natural History, New York, N. Y.  
BM—British Museum (Natural History), London, England.  
CAS—California Academy of Sciences, San Francisco, Calif.  
CH—Dr. C. H. Hicks, Burbank, California.  
CNM—Canadian National Museum, Ottawa, Canada.  
CS—Colorado State College, Fort Collins, Colorado.  
CU—Cornell University, Ithaca, New York.  
HF—Dr. H. T. Fernald, Winter Park, Florida.  
INHS—Illinois State Natural History Survey, Urbana, Ill.  
IWC—Iowa Wesleyan College, Mount Pleasant, Iowa.  
JB—Dr. Joseph Bequaert, Harvard School of Tropical Medicine, Boston, Mass.  
KS—Dr. K. S. Salman, Berkeley, California.  
KSC—Kansas State College, Manhattan, Kansas.  
KU—Kansas University, Lawrence, Kansas.  
MC—Massachusetts State College, Amherst, Mass.  
MCZ—Museum of Comparative Zoology, Cambridge, Mass.  
MHNG—Museum d'Histoire Naturelle de Genève, Geneva, Switzerland.  
MSC—Montana State College, Bozeman, Montana.  
OAC—Oregon Agricultural College, Corvallis, Oregon.  
OAMC—Oklahoma Agr. & Mech. College, Stillwater, Oklahoma.  
OS—Dr. O. A. Stevens, Fargo, North Dakota.  
OSU—Ohio State University, Columbus, Ohio.  
RB—Mr. R. H. Baker, College Station, Texas.  
RD—Dr. Richard Dow, Boston, Mass.  
RMB—Mr. R. M. Bohart, University of California, Los Angeles, California.  
ROMZ—Royal Ontario Museum of Zoology, Toronto, Ontario, Canada.  
RR—Mr. R. R. Dreisbach, Midland, Michigan.  
SD—South Dakota State College, Brookings, South Dakota.  
UA—University of Alberta, Edmonton, Alberta, Canada.  
UAES—Utah State Agricultural College, Logan, Utah.  
UBC—University of British Columbia, Vancouver, British Columbia.  
UC—University of Colorado, Boulder, Colorado.  
UM—University of Minnesota, St. Paul, Minnesota.

- UN—University of Nebraska, Lincoln, Nebraska.  
 USNM—United States National Museum, Washington, D. C.  
 USPH—United States Public Health Service, Hamilton, Mont.  
 WJ—Mr. W. W. Jones, Douglas, Arizona.  
 WS—Dr. W. C. Stehr, Athens, Ohio.  
 WSC—Washington State College, Pullman, Wash.

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## MORPHOLOGY

Fernald (1927) has given a good account of the general structure of these wasps. In the present discussion it is necessary to consider several points not touched upon by Fernald. Among other morphological characters, the male genitalia usually possess characters which are of much taxonomic value. Not only do these characters assist in the separation of many of the species, but they also show relationships among the species. Detailed drawings of these genitalia have been prepared in place of involved descriptions. The most useful characters are found in the penis valvae, the sagittae, and the volsellae.

The metanotal flange, first mentioned by the writer (1938) in a paper on *Sphex*, is of much importance in separating the species. It is a thin, almost membranous process with a texture almost identical with that of the tegula. It begins below and extends behind the hind wing on the metanotum. It is entirely absent in some species. When present, it may be small, moderate, or large in size,

and may or may not be emarginate. The species in this genus which possess this flange seem to possess a clear phylogenetic relationship to each other. The species which do not possess it seem to be divided into at least two and probably more groups, on the basis of genitalia and other characters.

Immediately in front of the anterior ocellus, the frons usually forms a slight depression which is more or less attenuated anteriorly. The size and shape of this depression is of some importance in the separation of the species.

The female genitalia are so uniform in their structure that they appear to be of no taxonomic value. It is sometimes necessary to use a combination of characters in order to definitely determine a female specimen. Several characters in the females of *luctuosa* and *communis* illustrate why this is true. In *luctuosa* the arolium is usually extremely small, while in *communis* it is small but usually distinctly larger than in *luctuosa*. The average size of the arolium in *luctuosa* is definitely smaller than the average size in *communis*, but some specimens of both species are found in which the arolium is intermediate in condition between the two species. The punctuation of the mesopleuron presents a similar situation. In *communis* the punctures on this plate are quite large and round, while in *luctuosa* they are generally smaller, elongated posteriorly, and there are frequently fine, forward-slanting striae between these punctures. But some specimens of either species may be found in which the punctuation of the mesopleuron is intermediate in condition between the two species. The characters which have been found to be of value in the separation of the female *luctuosa* from the female *communis* are: the punctuation of the clypeus, the frons near the frontal suture, and the mesopleuron, the shape of the clypeus, the strength of the suture marking the upper edge of the clypeus, the strength and depth of the frontal suture, the size of the arolium, the shape of Cell  $R_4$  (third submarginal), and a few others. All of these characters occasionally exhibit intermediate conditions between *communis* and *luctuosa*, but each character varies entirely independently of the other characters. In a given specimen the arolium may show an intermediate condition between *luctuosa* and *communis*, but the punctuation of the mesopleuron may show very clearly which species is concerned. Occasionally both these characters exhibit an intermediate condition in the same specimen. It is then necessary to use some of the other characters mentioned. It is theoretically possible for all of these characters to show an intermediate condition in the same specimen, but the

chances for this to occur are too slight to cause much concern. The writer has been able to determine without hesitation every one of the females of these two species, 1521 females of *communis* and *luctuosa* having been examined.

#### BIOLOGY

The biology of these solitary wasps has been studied rather carefully by several writers, and numerous persons have recorded interesting observations on their habits. It is unfortunate that specimens observed in the field are not more often caught and definitely labelled with a record of the observation. The habits of some of the species are unquestionably different from the habits of others, but it is almost impossible to point to any of the records of the habits or biology of these wasps and say what species is concerned. Nevertheless, all of the biological observations which are recorded in the literature are of much value in giving us an insight into the private lives of these solitary wasps. Species of *Podalonia* are somewhat timid or wary, but if caution is observed, the females may be approached closely and so can be easily observed. To be impatient or in a hurry will mean that results will be difficult or impossible to obtain.

The most complete observations have been made on *luctuosa*, Newcomer (1930) and Hicks (1931b, 1932) having published rather lengthy accounts of this species. The following discussion is based on their observations, and must be taken to represent the habits of *communis* as well as *luctuosa*, since both species were under observation but were not distinguished. The wasp comes forth and starts nesting as soon as the sun has sufficiently warmed the earth in the spring. This is before few other insects have emerged. The search for and capture of the prey, which consists of cutworms, is usually the first task of the wasp in nesting. Among the determined species of cutworms taken by this wasp are *Lycophotia saucia* Hubn., *Lycophotia margaritosa* Haw., *Chorizagrotis agrestis* Grt., *Euxoa testula* Sm. These cutworms, being nocturnal feeders, hide by day, concealed beneath the soil or some suitable object, and it is a task for the wasp to find them. The wasp hunts rapidly, almost feverishly, running from one grass clump to another, and inspecting the ground carefully. When searching for a larva, she follows a different method than she does when searching for a place to dig a nest. In the former case, she does not dig at any one spot to any great depth, but seems to carefully scour the ground but little below the surface. Also, she often snoops around stones, pulls away dead stems of plants, and looks beneath rubbish, all of

which she does not do while looking for a place to dig a nest. When a wasp finds a spot where she seems to suspect prey, she often works very excitedly for a time, even though she may not unearth a cutworm at that particular site. Again, she may begin digging in a given place but not stay long enough to secure her cutworm even though one is present.

The typical female continues her nesting as follows. After she finds a larva and brings it to the surface, she usually takes a few minutes to brush herself off. She then returns to the larva, grasps it just back of the head, and twists her abdomen towards its head on the ventral side. There she stings it between its first pair of true legs. She then advances progressively backward, moving the tip of her abdomen along the ventral side and appearing to feel with its tip before inserting the sting. The wasp may sting the larva many times, each time in a different segment of the ventral side. When she has finished, the larva is limp and motionless. Then the wasp begins a period of malaxation. Held ventral side up, her jaws open and close in the region back of the larva's head, while her short tongue laps the liquid issuing from its mouth.

After the period of malaxation, the female grasps the caterpillar firmly by the neck, ventral side up, and, straddling it, proceeds to run with it. The wasp usually carries her worm up into a clump of grass or weeds and hangs it over the axil of a leaf, or sometimes she hangs it in the crotch at the base of a low twig. After hanging up the worm, she looks for a place to dig her nest, and though the place selected is usually close by, it may be as far as twenty feet from the worm. The wasp uses her mandibles and forelegs to dig with, kicking the dirt out behind with her middle and hind legs. As the digging proceeds, she brings up load after load of soil particles held tightly between her mandibles and fore legs. These are dropped at the entrance, and are often kicked some distance as the wasp starts back into the hole. While the digging is going on in the nest the wasp's wings buzz loudly, but they are quiet when she is outside. The construction of the nest, which is about two inches deep and somewhat enlarged at the bottom, requires from ten minutes to half an hour. The work is usually continuous, though sometimes the wasp will flatten herself out at the entrance of the hole for a brief rest.

When the nest has been completed, the wasp returns to her cutworm, and she may have to search for a long time before finding it. When she arrives at her nest with the cutworm, she drops it with its head at the mouth of the nest, enters the hole, turns around,

comes up, and drags the cutworm down after her. When the worm is at the bottom of the nest, she deposits an egg on it. The process of filling the hole usually requires only about five minutes, but sometimes takes longer, and frequently sticks and stones of various sizes are seized and placed in it. The wasp may then place her head against the stones and press them against the dirt, while her feet are braced and her wings buzzing. She does not, however, hold the stone in her mandibles as some *Sphex* do. These stones are always left in the hole. When the hole has been filled, there follows a rather indiscriminate scratching of dirt on the surface. Newcomer saw one female continue this apparently aimless scratching for nearly half an hour, her accuracy gradually becoming more vague until finally she got entirely away from the location of the hole. After having completed the nest, a wasp may immediately begin a search for another cutworm or she may fly off and feed at mustard blossoms or other flowers. There is apparently never more than one larva and one egg to a given nest, although the wasp is an industrious worker and provisions many cells. Hicks states that one female wasp dug and provisioned seven burrows over a period of time.

Newcomer observed one wasp which demonstrated that its instincts were not iron bound. While digging her nest, a wasp was interrupted by Newcomer, who placed an active cutworm near the hole. She would not use this worm, and became so confused that she could not find the worm she had previously caught. Finally she started in search of another worm, and on finding it in a clump of grass, returned to her nest and cleaned it out, and then buried the worm in it. Thus she was capable of reversing the process, and going in search of another worm with which to provision the nest she had already constructed.

To the writer this last observation seems to indicate how the habits of *Sphex* may have originated. In *Sphex* the nest is constructed first and then a search is made for the worm. It would certainly seem that the method which *Sphex* uses is more recent and highly evolved than the method which *Podalonia* uses. There are other evidences which indicate that *Sphex* has evolved from *Podalonia* or from the stock of *Podalonia*. *Sphex* exhibits more intelligence in picking up stones and using them as tools in pounding down the earth. *Podalonia* does not hold the stones, but may press against them with her head.

The egg is attached to one of the anterior or medial segments of the worm. In twenty cases which Newcomer recorded, one egg



was placed on the third segment, one on the fourth, three on the fifth, ten on the sixth, and five on the seventh. Under artificial conditions at room temperature the egg hatches in eight or ten days. The larva's head is at the end of the egg attached to the worm, and, when fully developed, the larva merely makes a hole in the shell and starts to feed.

Larval growth requires about nine days under artificial conditions. The larva then spins a cocoon of brown silk, the construction of which requires a couple of days. Newcomer apparently believed that these wasps overwintered in these cocoons, as he had not noticed any adults after May. However, collecting data for several thousand specimens studied during the course of the present research show that *luctuosa* and *communis* are taken in abundance throughout the summer. During the summer, however, they are feeding and mating, but seldom if ever are they nesting, so they would therefore be found about flowers and seldom about their nesting grounds. Collecting data bring to light another very significant fact. The females of *luctuosa* and *communis* always occur later in the fall than the males, and they always occur much earlier in the spring than the males. This indicates the following life cycle: the females are fertilized during the summer and fall; the males die in late summer or early fall, while the females seek places in which to hibernate over the winter; in the spring the females emerge from hibernation and begin nest-building; the wasps which emerge from these nests consist of both males and females, and thus both sexes are found throughout the summer.

The Peckhams made careful studies of the habits and life histories of a great many different genera of social and solitary wasps. Their observations, however, were limited almost entirely to the region about Milwaukee, Wisconsin. In the introduction of their book "Instincts and Habits of the Solitary Wasps," they give a brief generalized life history of solitary wasps. They infer that these wasps overwinter in the cocoon, and make the following statement: "Probably no solitary wasp lives through the winter, those that come out in the spring or summer perishing in the autumn."

Hicks (1931a) made some very significant observations on the overwintering of *luctuosa* females. He has observed this wasp begin her capture of subterranean larvae very early in the spring or late winter (she may nest as early as December in southern California). This wasp is active very early in the season when few other insects are abroad. Near Owens Lake, at Boulder, Colorado, on September 15, Hicks made the following observation. A wasp was seen to make

her way to an open tunnel at the edge of a mound of sand. Reaching the entrance, she went in. Hicks then dug the mound away, exposing the tunnel. This tunnel was found to be almost vertical in position, with a nearly even diameter of 9 millimeters, and a total length of 17 centimeters. At the bottom was the wasp under observation and three more females resting together. During the active nesting season *Podalonia* females are distinctly solitary and very pugnacious whenever they have a chance meeting. This tunnel, in contrast to those constructed for prey which seldom measure more than three inches in length and usually less, was more than seven inches in length and more vertical in position. It appeared that it had been especially constructed or appropriated for winter quarters.

On September 26, Hicks watched another female enter a long tunnel. This one was nearly ten inches deep. That these females were not decrepit nor near the end of their days was evidenced by the fact that they lived for many weeks in cages in a greenhouse under conditions of high temperature and humidity.

Near Burbank, California, females were observed by Hicks during the winter, previous to Christmas. On December 28, a female was found already with captured prey. The weather was chilly, but she provisioned her nest. She was less active at this cool temperature and rested more often than usual. She soon made her way, in an erratic manner, to the edge of a plowed area some fifteen feet away, and suddenly disappeared into a tunnel. The tunnel was nearly 10 centimeters long. This place of refuge was the more interesting because of the fact that the soil in which it had been dug had been plowed not later than a month before. Since few wasps other than this species were about at this time, it seemed highly probable that she had constructed it.

Collecting data accumulated during the present research reveal that males have been collected extremely rarely in April, only occasionally in May, but abundantly in June, July, and August. They are present but scarce in September, and a straggler has been picked up in October. Females have been collected or observed every month of the year in California, and as early as the middle of March in Colorado. They become very abundant in April and May. Over the entire country the females are generally collected a month and a half to two months before any males are taken. This is about the length of time necessary for development of the wasp from egg to adult.

These collecting data added to Hicks' observations provide rather conclusive proof that *luctuosa* and *communis* overwinter in the adult stage. However, they do not prove that these two species

may not overwinter also as pupae or prepupae in their nests. The principal evidence at present that these two species do overwinter exclusively in the adult stage is found in the observation by Newcomer, namely, that there appears to be but one generation a year, as these wasps were never seen nesting after May.

At least some of the species of *Podalonia* differ in their biology from *luctuosa* and *communis* in that they nest at a different time of the year, and select different ecological areas for nesting. Balduf (1936) reported an observation made on August 26 at Lake Winnibigoshish, Minnesota, on *Podalonia violaceipennis* (examination of this material shows that *robusta* is also concerned). The wasps were seen dragging mature larvae of the notodontid moth, *Symmerista albifrons* S. & A. over the broad sandy beach. The caterpillars were buried near the water under the low growth of willow and poplar. The caterpillars had developed on the oaks bordering the lake, and the wasps dragged them for as much as 275 feet to get them to suitable nesting places.

Krombein (1936) made observations on *P. violaceipennis* about June 23 at Buffalo, New York. This species was noted nesting in only one situation: in little pockets of soil formed between two roots of several uprooted stumps.

On August 11, at Universal City, California, Hicks (1933) obtained a nest of a species of *Podalonia*, then considered to be *violaceipennis* but now believed to have been *sericea*.

Norman Appleton, parasitologist in charge of the Tent-caterpillar Laboratory at Santa Fe, New Mexico, sent several specimens of *occidentalis* to the writer and reported that this species was working with much effectiveness on the tent-caterpillar. He said that this species was active in June.

Thus some of these other species of *Podalonia* nest in mid or late summer. Collecting data of the commoner species show that the females and males both make their appearance at about the same time in the late spring or summer. It therefore seems almost certain that these species overwinter as pupae or prepupae.

Wasps of the genus *Podalonia* are affected either directly or indirectly by several parasites or predators. In the act of nest provisioning, the wasp hangs the caterpillar on a small twig or branch, or over the axil of a leaf, while she digs her nest. This habit seems to be a method of protecting the caterpillar from ants or other scavengers. Newcomer (1930) observed ants actually taking the caterpillar from the wasp while the wasp was trying to take the caterpillar to her nest.

These wasps appear to be unable to recognize a caterpillar which

has been parasitized, and so may store their nests with one of these parasitized worms. Hicks (1932) dug up one wasp nest and kept the caterpillar in the laboratory. Seventeen larvae of the ichneumonid parasite, *Meteorus vulgaris*, emerged from the caterpillar and pupated, and the adults subsequently emerged. The *Podalonia* egg hatched and the larva developed to maturity, and a normal female was produced except that she was smaller than the average. In another case eight larvae of the fly *Wagneria carbonaria* Panz. emerged, and in this case as before the wasp developed to an undersized adult.

Hicks (1933) also discovered a parasite which destroys the wasp larva completely. A species of *Podalonia*, then considered to be *violaceipennis*, takes as prey *Zale lunata* (Drury) and *Homoptera salicis* Behr. But sometimes a species of *Paniscus*, possibly *semirufus* Hgn., has already placed an egg on the caterpillar. In one case both parasites began development on the same host larva, *Paniscus* between the fore legs and *Podalonia* on an abdominal segment. Each fed in its respective position until about half grown, when the food gave out. The *Paniscus* larva attacked the *Podalonia* larva and devoured it. It was then able to complete its development to an adult. Observations indicated that in all cases the wasp larva was completely destroyed and devoured by the ichneumonid.

While the female *Podalonia* is preparing its nest, flies of the Sarcophagid tribe *Miltogrammini* have been frequently observed. Newcomer (1930) records the following observations. The commonest of these inquilines is *Hilarella hilarella* (Zett.). Often it is seen closely following a wasp that is carrying a cutworm, making short flights and alighting on convenient weeds to watch the progress of the wasp. Frequently when a wasp is constructing her nest, one or more of these flies may be seen on a grass blade or a stone, always facing the wasp. This fly deposits living young in the wasp's nest. It is always done after the wasp has dragged her prey into the hole, or while she is pulling it down the hole and before she has come out again. The fly alights at the mouth of the hole at the proper moment, almost instantaneously drops a few maggots into it, and immediately flies off. The fly larvae are sticky and adhere readily to the cutworm. They usually destroy the wasp egg in a very few minutes. In several cases, however, both maggots and wasp larvae were found feeding on the cutworm. However, the wasp larva invariably dies before it is very old. From two to seven maggots have been found in a single nest.

Another fly, *Taxigramma heteroneura* (Meig.), has similar hab-

its. A third species is *Metopia leucocephala* (Rossi). This species has been found attacking other species of Hymenoptera. It is not as common as the other two. This fly sits on a grass blade or a convenient stone and watches the construction of the nest. When the wasp has finished this and has gone for the cutworm, the fly crawls down the hole, deposits its young at the bottom and comes out before the wasp returns.

The wasp never seems to be aware of the existence of any of these inquilines. The flies usually keep at a certain distance and are not active while the wasp is watching.

#### CLASSIFICATION

##### Genus *Podalonia* Spinola

Fernald in 1927 gave a careful review of the history of the genus *Podalonia*. In view of the present findings, it seems desirable to consider the validity of *Podalonia* as a genus distinct from *Sphex*. There is no doubt but that the two groups are very closely related, but the present work shows that they can be separated by characters which the writer believes to be of true phylogenetic significance. The genitalia of *Sphex* and *Podalonia* are quite similar but for one invariable exception: the sagittae are distinctly different in shape in the two genera. A glance at any of the drawings of the genitalia of these two genera will demonstrate this fact. As a character to be used in both sexes, the shape of the first abdominal tergite is the best character which can be used. In *Podalonia* the petiole is composed of part of the first abdominal sternite, and the first abdominal tergite is considerably expanded posteriorly. This tergite is generally more expanded in the females than in the males, but in both sexes the condition is distinct from that in *Sphex*. In *Sphex* the petiole is composed of the entire first abdominal segment including both dorsal and ventral parts, the first tergite being only slightly expanded posteriorly. The spiracle of this first tergite is found at about the middle of the plate in *Podalonia*, and about two-thirds of the way back in *Sphex*. Several other characters have been found to be useful but they are not very reliable. The characters mentioned have been found to be reliable in every species of *Sphex* and *Podalonia* which the writer has seen, and it is almost certain that they will be found to be reliable over the entire world.

#### KEY TO SPECIES

In species with an \* it is necessary to examine the genitalia (in doubtful specimens).

|   |                               |
|---|-------------------------------|
| 1. Males. Inner margin of eyes converging below; antennae 13-segmented; 7 visible abdominal segments .....  | 2                             |
| Females. Inner margin of eyes parallel or nearly so; antennae 12-segmented; 6 visible abdominal segments .....  | 25                            |
| 2. Abdomen entirely black or blue-black .....   | 3                             |
| Abdomen entirely red, red and black, or red and blue .....  | 10                            |
| 3. Abdomen distinctly black .....   | 4                             |
| Abdomen distinctly blue or blue-black .....   | 6                             |
| 4. With a metanotal flange .....  | <i>melaena</i>                |
| Without a metanotal flange .....  | 5                             |
| 5. Clypeus slightly reflexed, scarcely bending down to lateral margin; pilosity of thorax entirely black.   |                               |
|   | <i>sonorensis differentia</i> |
| Clypeus not at all reflexed, almost flat across the central part but bending down to lateral margin; pilosity of thorax partly white .....  | <i>communis intermedia</i>    |
| 6. Head and thorax entirely blue .....  | <i>caerulea</i>               |
| Head and thorax entirely or almost entirely black .....   | 7                             |
| 7. Without a metanotal flange .....   | <i>sonorensis differentia</i> |
| With a metanotal flange .....   | 8                             |
| 8. Pleura very coarsely punctate, metapleuron and propodeal side appearing very coarsely reticulate; frontal suture usually appearing extremely wide; frons granulate, with a great many large deep punctures .....   | <i>*argentifrons</i>          |
| Pleura moderately punctate, metapleuron and propodeal side more or less prominently ridged; frontal suture usually distinct but not extremely wide; large punctures of frons sparse to moderate in number .....   | 9                             |
| 9. Mesopleuron with a moderate number of large and a great many tiny punctures, short white sericeous hairs arising from the tiny punctures; surface of mesopleuron between punctures scarcely or not at all creased, but distinctly reticulate; extreme southwestern United States ..... | <i>*parallela</i>             |
| Mesopleuron with a moderate number of large but only a few tiny punctures, rarely with short sericeous hairs arising from the tiny punctures; surface of mesopleuron creased into more or less prominent ridges; distributed throughout most of the western half of North America .....   | <i>*mexicana</i>              |
| 10. A spur at apex of fore coxa within .....  | 11                            |
| No spur at apex of fore coxa within .....   | 12                            |
| 11. Legs at least partly bright red; without a metanotal flange.  |                               |
|   | <i>morrisoni</i>              |
| Legs entirely black; with a metanotal flange .....  | <i>valida</i>                 |

12. Without a metanotal flange ..... 13  
 With a metanotal flange (in some individuals this may be im-  
 perfectly developed, and a careful examination is neces-  
 sary) ..... 16
13. Clypeus more or less broadly transverse (fig. 48); abdomen red  
 and black ..... *\*luctuosa*  
 Clypeus narrowly transverse (figs. 45, 46, 47) ..... 14
14. Clypeus slightly reflexed, scarcely bending down to lateral  
 margin; pilosity of thorax usually entirely black; abdomen  
 usually red and dark blue ..... *\*sonorensis*  
 Clypeus not at all reflexed, almost flat across central part but  
 bending down to lateral margin; pilosity of thorax at least  
 partly white; abdomen red and black ..... 15
15. Pilosity of clypeus entirely black; distributed throughout most  
 of western half of North America ..... *communis*  
 Pilosity of clypeus partly white; Mexico and Central America.  
*communis alpestris*
16. Propodeum with a dense pubescent patch on each side of petiole  
 attachment; metapleuron glossy, with many large deep  
 punctures; moderately large species ..... *pubescens*  
 Propodeum with a rather thin pubescent patch on each side of  
 petiole attachment, or with none at all ..... 17
17. Propodeum with a rather thin pubescent patch on each side of  
 petiole attachment; clypeus broadly transverse as in fig.  
 43; very large species ..... *montana*  
 Propodeum without a pubescent patch; moderate-sized spe-  
 cies ..... 18
18. Head and pleura very coarsely punctate, metapleuron and pro-  
 podeal side appearing very coarsely reticulate; abdomen  
 red and blue; clypeus as in fig. 36 ..... *\*puncta*  
 Head and pleura moderately punctate, metapleuron and pro-  
 podeal side more or less ridged ..... 19
19. Metapleuron with many large deep punctures, approximately  
 anterior half highly glossy; metanotal flange quite large;  
 thoracic pilosity entirely black; clypeus as in figure 27.  
*\*clypeata*  
 No such combination of characters ..... 20
20. Metanotal flange very large, usually with a strong emargi-  
 nation ..... *\*violaceipennis*  
 Metanotal flange moderate or small, or if large without a  
 prominent emargination ..... 21
21. Metanotal flange small; thoracic pilosity mostly white; cell  
 R4 (3rd submarginal) almost always twice as wide at bot-

- tom as at top; clypeus usually broadly transverse; abdomen red and black .....\**occidentalis*
- No such combination of characters ..... 22
22. Mesopleuron glossy, with abundant white sericeous hairs; frontal depression deep and well-marked; metapleuron rather crinkly; pilosity of thorax mostly white; metanotal flange usually large .....\**sericea*
- Mesopleuron distinctly reticulate, with no sericeous hairs, or with a few very short hairs; frontal depression moderate or small ..... 23
23. Pilosity of thorax usually partly white except in eastern United States; abdomen usually red and dark blue; metapleuron more or less distinctly ridged .....\**robusta*
- Thoracic pilosity almost without exception entirely black; abdomen red and black ..... 24
24. Metanotal flange usually moderately large; petiole about equal in length to hind coxa and trochanter together .....*mickeli*
- Metanotal flange always small; petiole distinctly shorter than hind coxa and trochanter together; Western Coast only.  
*compacta*
25. Abdomen entirely black or blue-black ..... 26
- Abdomen entirely red, red and black, or red and blue ..... 34
26. Clypeal margin with two small teeth (fig. 35); abdomen dark blue ..... *sonorensis differentia*
- Clypeal margin without teeth ..... 27
27. Abdomen distinctly black ..... 28
- Abdomen distinctly blue or blue-black ..... 31
28. With a metanotal flange; metapleuron with large distinct punctures, flat-topped ridges, and a glossy surface ..... *melaena*
- Without a metanotal flange ..... 29
29. Frontal suture rather deep to anterior ocellus; frontal depression granulate, rather dull; punctures of mesopleuron usually moderate in size, shallow and elongated posteriorly; arolium very small, barely projecting beyond base of claws (fig. 28) ..... *luctuosa*
- Frontal suture obsolescent in frontal depression; frontal depression with smooth reticulation, frequently glossy; punctures of mesopleuron usually large, round; arolium distinctly projecting between claws ..... 30
30. Arolium medium to small in size (fig. 29); clypeus broadly, but not very strongly, bulging; North America and Mexico.  
*communis*



- Arolium large (fig. 30); clypeus rather strongly bulging in center; Central America ..... *communis alpestris*
31. Clypeus highly glossy, moderately bulging, with a great many rather uniformly-sized large round punctures; frontal depression smoothly reticulate, crescent-shaped, well-defined by large punctures which are very abundant over all of frons except in the depression ..... *puncta*  
 Clypeus with a moderate number of variable-sized punctures; frontal depression attenuated anteriorly, not well-defined by large punctures ..... 32
32. Pleura very coarsely punctate, metapleuron and propodeal side appearing very coarsely reticulate; frontal suture usually appearing extremely wide; frons granulate, with a great many large deep punctures ..... *argentifrons*  
 Pleura moderately punctate, metapleuron and propodeal side more or less prominently ridged; frontal suture usually distinct but not extremely wide; large punctures of frons sparse to moderate in number ..... 33
33. Mesopleuron with surface creased into more or less prominent ridges; clypeus slightly to moderately bulging and with smooth reticulation; distributed throughout most of western half of North America ..... *mericana*  
 Mesopleuron with surface between punctures scarcely or not at all creased, but distinctly reticulate; clypeus usually moderately bulging and distinctly reticulate; extreme southwestern United States ..... *parallela*
34. Clypeal margin with teeth ..... 35  
 Clypeal margin without teeth ..... 39
35. A spur at apex of fore coxa within ..... 36  
 No spur at apex of fore coxa within ..... 37
36. Legs at least partly bright red; clypeal margin with two small teeth; without a metanotal flange ..... *morrisoni*  
 Legs black; clypeal margin with several strong teeth; with a metanotal flange ..... *valida*
37. Without a metanotal flange; abdomen red and dark blue; clypeal margin with two small teeth (fig. 39) ..... *sonorensis*  
 With a metanotal flange; abdomen red and black or entirely red; clypeal margin with broad, strong teeth ..... 38
38. Metanotal flange very large, slightly emarginate; metapleuron with a very glossy surface between the punctures; length 15-18 mm. .... *clypeata*

- Metanotal flange moderately large; metapleuron with many large punctures, little surface between these punctures; length 20 mm. .... *montana*
39. Propodeum with prominent pubescent patch on each side of petiole attachment ..... *pubescens*  
 Propodeum without prominent pubescent patch on each side of petiole attachment ..... 40
40. Metanotal flange very large and with a strong emargination; clypeus bulging only slightly in center, with many large and tiny punctures, distinctly reticulate, giving a dull appearance; metapleuron with almost no regular ridges, anterior part reticulate or granulate, occasionally glossy. .... *violaceipennis*  
 Metanotal flange moderate or small, or if large without a strong emargination ..... 41
41. Clypeus bulging only very slightly in center, with many large punctures, surface reticulate; abdomen red and black; cell R4 (3rd submarginal) almost always twice as wide at bottom as at top; metanotal flange small ..... *occidentalis*  
 No such combination of characters ..... 42
42. Clypeus strongly bulging, reticulate, with many large punctures; mesopleuron with a great many tiny punctures and a smooth, highly glossy surface; frontal depression deep and fairly well marked; metanotal flange usually large; abdomen usually red and dark blue, rarely red and black, rarely entirely red ..... *sericea*  
 No such combination of characters ..... 43
43. Petiole slender, distinctly longer than hind coxa; clypeus moderately to rather strongly bulging, peak of bulge below middle of clypeus dorso-ventrally; clypeus reticulate throughout; abdomen red and dark blue, rarely red and black. .... *robusta*  
 Petiole rather stout, very slightly longer than hind coxa or even shorter; clypeus glossy between peak of bulge and margin; abdomen red and black ..... 44
44. Metanotal flange usually moderately large; petiole about equal in length to hind coxa or slightly longer; clypeus strongly bulging ..... *mickeli*  
 Metanotal flange always small; petiole distinctly shorter than hind coxa; clypeus moderately bulging; Western Coast only ..... *compacta*

## SYSTEMATIC TREATISE OF THE SPECIES

1. *Podalonia morrisoni* (Cameron)

(Figures 5, 34, 39, 57)

1888. *Ammophila morrisoni* Cameron, Biol. Centr.-Amer., Hym. 2: 21. Male.
1903. *Ammophila morrisoni* Melander, Psyche 10: 156-164. Male.
1924. *Psammophila nicholi* Carter, Ent. News 35: 366. Female.
1927. *Podalonia nicholi* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 17-20. Female, male.
1927. *Podalonia morrisoni* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, p. 38. Male.

Male.—(See figure 5 for genitalia.) Length 17 mm. Head: clypeal margin broadly truncate, central part arcing upwards slightly; clypeus somewhat reflexed; entire front of head between eyes unusually narrow for genus; frontal suture distinct and broad up to the moderately deep frontal depression, but obsolete in this depression; frontal depression very minutely reticulate, with many tiny but no large punctures, rest of frons with many moderate-sized and tiny punctures; pilosity of head white. Thorax: collar rather narrowly rounded; mesopleuron with many moderate-sized punctures, most of these with a small crescent-shaped ridge in front of them, and with very many tiny punctures; metapleuron and propodeal side with the punctures confused, in no definite arrangement, surface more or less scratchy; propodeal disk with sharply defined ridges, those of anterior part slanting posteriorly from median line, those of posterior part running almost transversely; no metanotal flange; pilosity of thorax white, quite dense. Legs; fore coxa with spur on inner side; coxae and trochanters black, anterior portion of front and middle femora red, posterior portion black, hind femora entirely black except for red tip; front and middle tibiae entirely red, hind tibiae red anteriorly and black posteriorly; tarsi black. Petiole: black, with white pilosity anteriorly. Abdomen: first segment red with several dorsal black spots, second and third segments red, fourth red ventrally and black dorsally, rest of abdomen black.

Female.—Length 18 mm. Head: clypeus very broadly but not strongly bulging; clypeal margin with two teeth, each tooth about as close to middle of clypeal margin as to nearest eye; eyes slightly converging below; frons with a moderate number of

large punctures, a very large number of tiny punctures, the tiny punctures almost giving a reticulated appearance to the surface; frontal suture evident to anterior ocellus, but tending to become obsolescent in frontal depression; pilosity of head white. Thorax: a weak silvery pubescent patch beside petiole attachment; pilosity of thorax white, not as heavy as in male. Legs: all coxae, a line on posterior side of fore and middle and all of hind trochanters, black, otherwise legs red. Abdomen: entirely red.

Redescribed from a male collected in Imperial Co., California, May 1911 (J. C. Bridwell); female redescribed from the holotype of *P. nicholi* (Carter), collected in Tucson, Arizona, April 5, 1924 (A. A. Nichol); both are located in the collection of the University of Minnesota, St. Paul, Minn.

*Holotype*.—Male, Northern Sonora, Mexico (Morrison). According to H. T. Fernald, and confirmed by R. B. Benson, the type specimen cannot be located in the British Museum, and a specimen labelled "*Ammophila morrisoni* Cam. Type" is a female *sonorensis*. The figure of the genitalia (see note on Cameron's drawings under the section "Methods and Materials") and the original description are available for comparisons.

*Allotype*.—Female, Tucson, Arizona, April 5, 1924 (A. A. Nichol). The holotype of *nicholi* Carter becomes the allotype of *morrisoni*.

Fernald (1927) designated an allotype male of *nicholi*. This specimen was collected in Southern California, and is deposited in the collection of the American Entomological Society, Philadelphia, Pa.

Specimens examined: 1 ♂, 6 ♀; total specimens 7.

CALIFORNIA: Imperial Co., 4 ♀, May 1911 (J. C. Bridwell) [USNM, UM]; Los Angeles Co., ♀ [USNM].

Variations.—Female: margin of clypeus may become worn and cause teeth to show less distinctly; larger punctures of mesopleuron may be practically absent; mesopleuron may have short, moderately strong ridges; posterior trochanters may be partly red.

The series of specimens examined indicates that only one species is involved, and that *nicholi* must become a synonym of *morrisoni*. This is substantiated by the original descriptions of *morrisoni* and *nicholi* and the genitalia drawing by Cameron as compared with specimens at hand.

2. *Podalonia luctuosa* (Smith)

(Figures 1, 28, 48, 63)

1856. *Ammophila luctuosa* Smith, Cat. Hym. Brit. Mus. 4: 224. Female.
- ?1865. *Ammophila communis* Cresson, Proc. Phila. Ent. Soc. 4: 462. Male (in part).
1865. *Ammophila luctuosa* Cresson, Proc. Phila. Ent. Soc. 4: 462. Female (in part).
- ?1867. *Ammophila luctuosa* Saussure, Reise d. Novara, Zool. 2, pt. 1, Hym., p. 25. Female.
1882. *Ammophila luctuosa* Provancher, Natural. Canad. 13: 13. Female.
1882. *Ammophila communis* Provancher, Natural. Canad. 13: 13. Male (in part).
1883. *Ammophila luctuosa* Provancher, Faun. entom. Canad. Hym. 2: 614. Female.
1883. *Ammophila communis* Provancher, Faun. entom. Canad. Hym. 2: 614. Male (in part).
- ?1888. *Ammophila luctuosa* Cameron, Biol. Centr.-Amer., Hym. 2: 23. Female.
1902. *Psammophila luctuosa* Melander & Brues, Biol. Bul. 3: 40-42. Female (in part).
1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40-42. Male (in part).
1902. *Psammophila pacifica* Melander & Brues, Biol. Bul. 3: 40-42. Male.
1903. *Ammophila luctuosa* Melander, Psyche 10: 156-164. Female (in part).
1903. *Ammophila pacifica* Melander, Psyche 10: 156-164. Male.
1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male (in part).
1908. *Psammophila luctuosa* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Female (in part).
1917. *Psammophila violaceipennis* Mickel, Univ. Nebr. Studies 17: 87-88. Male (in part).
1917. *Psammophila luctuosa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).
1917. *Psammophila violaceipennis* Rohwer, Proc. U. S. Nat. Mus. 53: 241. Male only.
- ?1917. *Psammophila luctuosa* Rohwer, Proc. U. S. Nat. Mus. 53: 241. Female (in part).

1917. *Psammophila luctuosa* Rohwer, Conn. Geol. & Nat. Hist. Surv. 22: 681. Female.
1917. *Psammophila violaceipennis* Rohwer, Conn. Geol. & Nat. Hist. Surv. 22: 681. Male (in part).
1925. *Psammophila luctuosa* Carter, Canad. Ent. 57: 132. Female only (in part).
- ?1925. *Psammophila violaceipennis* Carter, Canad. Ent. 57: 132. Male (in part).
1927. *Podalonia luctuosa* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 21-26. Female only (in part).
1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male only (in part).
1929. *Podalonia violaceipennis* Bequaert, Bul. Brook. Ent. Soc. 24: 220-221. Male, female (in part).
- ?1930. *Podalonia luctuosa* Newcomer, Ann. Ent. Soc. Amer. 31: 17-43. Female (in part).
1931. *Podalonia violaceipennis* form *luctuosa* Fernald, Canad. Ent. 63: 278-279. Female (in part).
- ?1931. *Podalonia luctuosa* Hicks, Pan-Pacific Ent. 8: 49-51. Female.
- ?1931. *Podalonia luctuosa* Hicks, Bul. Southern Calif. Acad. Sci. 30: 75-82. Female.
- ?1932. *Podalonia violaceipennis* form *luctuosa* Hicks, Psyche 39: 150-154. Female.

Male.—(See figure 1 for genitalia.) Length 17 mm. Head: clypeus broadly truncate, with no central emargination; frontal suture distinct to anterior ocellus; a broad and quite shallow frontal depression; surface of frontal depression finely reticulate and with very many small punctures, rest of frons with only a few small punctures but with numerous large punctures; pilosity of head black. Thorax: collar narrowly rounded; rectangle with rather shallow, moderate-sized punctures, mesopleuron with these punctures elongated; metapleuron with the moderate-sized punctures elongated and with fine ridges between them; propodeal side with many moderate-sized to small punctures, fine ridges as on metapleuron; tiny punctures scarcely evident anywhere on thorax, but the surface is roughened or reticulate; no metanotal flange; pilosity of thorax entirely white except on anterior part of prothorax, where it is black. Wings: vein R5 (2nd transverse cubital) nearly perpendicular to vein Rs (radial). Abdomen: first two, and anterior half of third, segments red, rest of abdomen black.

Female.—Length 16 mm. At first glance appearing quite different from male; structurally, however, practically identical except for usual sexual differences. Head: clypeus slightly to very moderately bulging in middle, sloping gradually to upper edge, which is curved and not very distinctly marked; surface of clypeus with many large punctures, very few small punctures, distinctly reticulate on upper half but rather glossy on lower part; frontal depression distinctly reticulate. Thorax: pilosity black. Legs: arolium very small, barely projecting beyond base of claws. Abdomen: entirely black.

Redescribed from a male and a female located in the collection of the University of Minnesota at St. Paul, Minn. Male, Parkdale, Colorado, June 15, 1926 (E. G. Anderson); female, Westcliff, Colorado, June 19, 1926 (E. G. Anderson).

*Holotype*.—Female, Rocky Mountains. It is located in the British Museum (Natural History) in London.

*Allotype*.—Male; the holotype of *pacifica* becomes the allotype of *luctuosa*. It was collected at Pacific Grove, California, July 9, 1897, by Miss Rose Patterson, and is now located in the Museum of Comparative Zoology at Cambridge, Mass.

Specimens examined: 722 ♂, 747 ♀; total specimens 1469.

*Luctuosa* has been collected in the following states and provinces: MAINE, NEW HAMPSHIRE, VERMONT, MASSACHUSETTS, CONNECTICUT, NEW YORK, MICHIGAN (May 21–Oct. 12), WISCONSIN, MINNESOTA (May 16–Sept. 15), NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, MONTANA (Apr. 26–Aug. 16), WYOMING, COLORADO (Mar. 20–Nov. 1), NEW MEXICO, UTAH (Mar. 11–Oct. 4), ARIZONA, IDAHO, NEVADA, WASHINGTON (Mar. 21–Sept. 9), OREGON, CALIFORNIA (Jan.–Dec.), NOVA SCOTIA, NEW BRUNSWICK, QUEBEC, ONTARIO, MANITOBA, SASKATCHEWAN, ALBERTA, BRITISH COLUMBIA, YUKON TERRITORY.

Variations.—Rarely with a very slight metanotal flange; rarely with frontal suture obsolescent or entirely obsolete; in eastern specimens rectangle usually with fine ridges running forwards and downwards, these not usually present in western specimens; in some western specimens punctures of rectangle may be rather large, deep and round, almost as in *communis*. Male: length 12–20 mm.; in eastern United States and Canada pilosity usually entirely black, in western United States and Canada pilosity usually white on most of thorax; all gradations between the two conditions found in Minnesota; clypeal margin occasionally not broadly truncate but more rounded, sometimes making an extra bend before extending transversely to center; frontal depression sometimes with only a few punctures;

rarely pilosity of cheeks white, though with a few hairs black basally, and tips of a few hairs on frons white, otherwise head black pilose. Female: length 12–20 mm.; clypeus rarely almost flat, with no bulge whatever; upper edge of clypeus occasionally not defined at all; arolium sometimes large enough to be confusing with *communis*; one female with dull red spots on dorsum of first, second, and third abdominal segments.

*Luctuosa* is extremely closely related to *communis*. The most reliable characters to use in separating these two species are given following the description of *communis*.

3. *Podalonia communis* (Cresson)

(Figures 2, 29, 47, 62)

1865. *Ammophila communis* Cresson, Proc. Phila. Ent. Soc. 4: 462. Male (in part).  
 1865. *Ammophila luctuosa* Cresson, Proc. Phila. Ent. Soc. 4: 462. Female (in part).  
 ?1867. *Ammophila luctuosa* Saussure, Reise D. Novara, Zool. 2, pt. 1, Hym., p. 25. Female.  
 ?1888. *Ammophila luctuosa* Cameron, Biol. Centr.-Amer., Hym. 2: 23. Female.  
 ?1888. *Ammophila piceiventris* Cameron, Biol. Centr.-Amer., Hym. 2: 22. Female.  
 1888. *Ammophila piceiventris* var. Cameron, Biol. Centr.-Amer., Hym. 2: 22. Female.  
 1902. *Psammophila luctuosa* Melander & Brues, Biol. Bul. 3: 40–42. Female (in part).  
 1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40–42. Male (in part).  
 ?1903. *Ammophila piceiventris* Melander, Psyche 10: 156–164. Female.  
 1903. *Ammophila luctuosa* Melander, Psyche 10: 156–164. Female (in part).  
 1903. *Ammophila violaceipennis* Melander, Psyche 10: 156–164. Male (in part).  
 1908. *Psammophila luctuosa* H. S. Smith, Univ. Nebr. Studies 8: 330–331. Female (in part).  
 1917. *Psammophila violaceipennis* Mickel, Univ. Nebr. Studies 17: 87–88. Male (in part).  
 1917. *Psammophila luctuosa* Mickel, Univ. Nebr. Studies 17: 87–88. Female (in part).  
 1917. *Psammophila luctuosa* Rohwer, Proc. U. S. Nat. Mus. 53: 241. Female.



1925. *Psammophila luctuosa* Carter, Canad. Ent. 57: 132.  
Female only (in part).
- ?1925. *Psammophila violaceipennis* Carter, Canad. Ent. 57: 132.  
Male (in part).
1927. *Podalonia luctuosa* Fernald, Proc. U. S. Nat. Mus. 71,  
Art. 9, pp. 21-26. Female only (in part).
1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus.  
71, Art. 9, pp. 30-37. Male only (in part).
1929. *Podalonia violaceipennis* Bequaert, Bul. Brook. Ent. Soc.  
24: 220-221. Male, female (in part).
1930. *Podalonia luctuosa* Newcomer, Ann. Ent. Soc. Amer. 31:  
17-43. Female (in part).
- ?1931. *Podalonia luctuosa* Hicks, Pan-Pacific Ent. 8: 49-51.  
Female.
- ?1931. *Podalonia luctuosa* Hicks, Bul. Southern Calif. Acad. Sci.  
30: 75-82. Female.
1931. *Podalonia violaceipennis* form *luctuosa* Fernald, Canad.  
Ent. 63: 278-279. Female (in part).
- ?1932. *Podalonia violaceipennis* form *luctuosa* Hicks, Psyche 39:  
150-154. Female.

Male.—(See figure 2 for genitalia.) Length 15 mm. Head: clypeal margin narrowly transverse, transverse part about equal in length to each side part; clypeus almost flat across central part, but bending down to lateral margin; frontal suture weak, entirely obsolete in front of ocellus; frontal depression weak, smoothly reticulate and with many small punctures, rest of frons similar but also with many large punctures; pilosity of head black. Thorax: collar narrowly rounded; rectangle with many large round punctures, surface reticulate and without ridges; mesopleuron with many large round punctures, those lower down tending to elongate slightly; metapleuron with the moderate-sized punctures slightly elongated and with fine ridges between them; propodeal side with many moderate-sized punctures, fine ridges as on metapleuron; tiny punctures scarcely evident anywhere on thorax, but the surface is roughened or reticulate; no metanotal flange; pilosity of prothorax and mesonotum black, of rest of thorax white. Wings: vein R5 (2nd transverse cubital) slanting somewhat outwardly from junction with vein Rs (radial). Abdomen: first, second, and anterior half of third segments red, rest of abdomen black.

Female.—Length 15.5 mm. At first glance appearing quite different from male; structurally, however, practically

identical except for the usual sexual differences. Head: clypeus moderately bulging in middle, receding as much laterally as ventrally, receding more rapidly dorsally to form a distinctly marked upper edge; frontal depression smoothly reticulate, somewhat glossy. Thorax: pilosity black. Legs: arolium small, but showing entirely free between claws. Abdomen: entirely black.

Redescribed from a male and a female located in the collection of the University of Minnesota, St. Paul, Minn. Male, Pingree Park, Larimer Co., Colorado, Aug. 20, 1926 (R. W. Dawson); female, Westcliff, Colorado, June 9, 1926 (E. G. Anderson). The male was compared with the holotype.

*Holotype*.—Male, Colorado. It is in the collection of the American Entomological Society, Philadelphia, Pa.

*Allotype*.—The female described herein is designated as the allotype.

*Piceiventris* was described by Cameron, the description apparently being based on one female specimen. R. B. Benson found that this agrees with *communis* in structure, and believed it to be merely a variety of that species. The type was collected at Quetzaltenango, Guatemala. It is not possible to decide conclusively whether or not *piceiventris* should rank as a distinct species until additional specimens have been collected from this geographical region.

Specimens examined: 592 ♂, 774 ♀; total specimens 1366. *Communis* has been collected in the following states, provinces, and countries: NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, MONTANA, WYOMING, COLORADO (Mar. 19–Sept. 7), NEW MEXICO, UTAH (Apr. 8–Oct. 3), ARIZONA, IDAHO, NEVADA, WASHINGTON (Mar. 17–Oct. 15), OREGON, CALIFORNIA (Apr. 8–Nov. 1), ALBERTA, BRITISH COLUMBIA (Apr. 5–Nov. 10), MEXICO.

Variations.—Rarely with a very slight metanotal flange; occasionally frontal suture very distinct to anterior ocellus, sometimes suture entirely absent except for short distance between the antennal bases; pleura sometimes with very coarse irregular ridges. Male: length 12–18 mm.; abdomen occasionally all black except for red on apex of first and base of second segments; transverse part of clypeal margin sometimes curved upwards in middle. Female: length 11–18 mm.; lower margin of clypeus sometimes quite irregular; in one specimen first dorsal abdominal segment dark red.

*Communis* is very closely related to *luctuosa*. The males of these two species are best and most easily separated by the male

genitalia and by the shape of the clypeal margin, which is narrowly transverse in *communis* and broadly transverse in *luctuosa*. It is frequently necessary to use a combination of characters in order to separate the females. In *communis*: frontal suture obsolescent in frontal depression; frontal depression with smooth reticulation, frequently glossy; punctures of mesopleuron large and round; arolium small, but distinctly projecting between claws; vein R5 (2nd transverse cubital) slanting somewhat outwardly from the junction with vein Rs (radial); upper edge of clypeus distinctly and rather deeply marked. In *luctuosa*: frontal suture rather deep to anterior ocellus; frontal depression granulate, rather dull; punctures of mesopleuron moderate in size, elongated posteriorly and frequently with fine ridges between them; arolium very small, barely projecting beyond base of claws; vein R5 (2nd transverse cubital) nearly perpendicular to vein Rs (radial); upper edge of clypeus frequently not very distinctly marked.

4. *Podalonia communis* subspecies **intermedia** new subspecies  
(Figure 62)

Male.—Length 14 mm. Head, thorax and abdomen black. Pilosity of head, prothorax, mesonotum and part of mesopleuron black, of most of mesopleuron and metapleuron white; propodeum with bluish-black and black pilose hairs, with a few white hairs; petiole with black pilosity.

Female. Unknown.

*Holotype*.—Male, Dist. Fedrl., Mexico (L. Conradt). It is deposited in the United States National Museum, Washington, D. C.

This subspecies is structurally identical with the typical *communis*. Its abdomen is entirely black instead of red and black, and the pilosity is black over a greater part of the thorax than in *communis*. The holotype is the only known specimen of this subspecies.

5. *Podalonia communis* subspecies *alpestris* (Cameron)  
(Figures 30, 46, 62)

1856. *Ammophila atriceps* Smith, Cat. Hym. Brit. Mus. 4: 221. Male only.

1888. *Ammophila alpestris* Cameron, Biol. Centr.-Amer., Hym. 2: 21. Male.

1903. *Ammophila alpestris* Melander, Psyche 10: 156-164. Male.

1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male (in part).

Male.—Length 14 mm. Clypeal margin narrowly transverse, the central part arcing upwards slightly; pilosity of head mixed black and white on clypeus, black on frons and vertex, white on cheeks.

Female.—Length 16 mm. Clypeus slightly more bulging in middle than in typical *communis*; arolium large, being considerably larger than in typical *communis* and almost as large as in *violaceipennis*.

The description of the male is from Cameron's paratype, this having been compared with the holotype by Dr. R. B. Benson; data for this specimen: Volcan de Chiriqui, 4000–6000 ft. (Champion). It is located in the British Museum (Natural History) in London. The description of the female is from a specimen located in the United States National Museum, Washington, D. C.; data for this specimen: La Carpentera, Costa Rica, April 1924 (H. W. Atkinson).

*Holotype*.—Male, Volcan de Chiriqui 4000–6000 ft. (Champion). It is located in the British Museum (Natural History), London.

*Allotype*.—The female described herein is designated as the allotype.

*Ammophila atriceps* was described by Smith in 1856 from a female and a male collected in Mexico. According to Fernald (1927), and confirmed by R. B. Benson (in lit.), the holotype cannot be located in the British Museum. Therefore the original description only is available for comparison. Since Smith described the female of *atriceps* first, the female must stand as the type of the species on the basis of priority. The description of the female indicates, however, that Smith did not have a specimen of *Podalonia* but instead a specimen of *Sphex*. Smith mentions that the thorax has long thin griseous pubescence, and in North America this occurs in the female of only one species of *Podalonia*, namely *P. morrisoni*. The description indicates that *morrisoni* could not be the species in question. Further, his description of *atriceps* is placed among the descriptions of other species of *Sphex*, and he does not mention the petiole as being short. He mentions that the petiole is short in all the species of New World *Podalonia* which he personally studied. The species *atriceps* must therefore be placed in the genus *Sphex*.

There is one male specimen, located in the British Museum, which may be considered as the male type of *atriceps*. This male, however, is a *Podalonia*. In the males of *Podalonia* the first abdominal tergite is not as conspicuously expanded as it is in the

females. Smith apparently confused this condition with the condition in *Sphex*. The female and male of *atriceps* were apparently collected at the same locality and Smith assumed them to belong to the same species. Dr. Benson studied the male type of *atriceps* and found it to be conspecific with *Podalonia alpestris*.

Specimens examined: 21 ♂, 4 ♀; total specimens 25.

COSTA RICA: La Carpentera, 19 ♂, April 1924 (W. M. Mann) [USNM, UM]; San Jose, ♂, 1928 (M. Valerio) [USNM]; Volcano Arazu, ♀, Feb. 23, 1902 (L. Bruner) [UN]; Volcano Arazu, 2 ♀, June 22, 1902 (M. Cary) [UN].

Variations.—Male: clypeal margin more variable than in *communis*, in some specimens margin exactly as in typical *communis*, in others more broadly truncate and frequently arcing upwards in center.

There may be some question as to whether *alpestris* should rank as a subspecies of *communis* or as a distinct species. There are not enough data at present to give a conclusive decision. Present data show that *alpestris* has a distribution range which is adjacent to that of *communis* but does not overlap it. Several structural characters show slight modifications, but the genitalia are identical with *communis*. The modifications exhibited by *alpestris* may be at least indirectly caused by the extension of *communis* far into the tropical region.

#### 6. *Podalonia sonorensis* (Cameron)

(Figures 3, 35, 45, 53)

1888. *Ammophila sonorensis* Cameron, Biol. Centr.-Amer., Hym. 2: 21. Male, female.
- ?1903. *Ammophila sonorensis* Melander, Psyche 10: 156-164. Female.
- ?1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male (in part).
1927. *Podalonia sonorensis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 20-21. Female.
1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male (in part).

Male.—(See figure 3 for genitalia.) Length 10 mm. Head: clypeal margin extending downwards and somewhat inwards from eyes for a short distance, then slightly more inwards for about an equal distance, then transversely to center, transverse part about one-third length of entire margin; clypeus appearing slightly concave below middle from

nearly one side to the other, giving a reflexed appearance; frontal suture weak, a very thin line visible to anterior ocellus; frontal depression very slight, granulate; rest of frons reticulate, with large punctures, only a very few tiny punctures; pilosity of head black. Thorax: collar rather narrowly rounded; rectangle with many large punctures, some with short ridges between them; meso- and metapleura and propodeal side with many large punctures so close together as to give a very coarsely reticulated appearance; no metanotal flange; pilosity of thorax black. Petiole: black, slightly bulging ventrally on posterior half. Abdomen: first two and anterior half of third segments red, rest of abdomen dark bluish-black.

Female.—Length 14 mm. Head: clypeus quite bulging in middle dorso-ventrally, bulge receding quite strongly above; clypeus with many large deep punctures, a few small punctures; surface of dorsal and lateral areas shallowly reticulate, rest of clypeus glossy; clypeal margin with a small tooth far out on each side. Petiole: about as long as hind coxa. Abdomen: first segment dark blue-black with a red border, second and third red with some dorsal black markings, the third with a black posterior border, rest of abdomen dark blue.

Redescribed from a male collected at Las Vegas, New Mexico, now located in the collection of Massachusetts State College, and from a female collected at Starkville, Colorado, June 13, 1919, now located in the collection of the American Museum of Natural History at New York. Both were compared with the type located in the British Museum (Natural History) by R. B. Benson.

*Holotype*.—Female, Northern Sonora, Mexico (Morrison). It is located in the British Museum (Natural History), London. In the British Museum is a female labelled "*Ammophila morrisoni* Cam. Type" which is not that species at all but is a female *sonorensis*, this having been determined by Dr. R. B. Benson.

*Allotype*.—Male, Northern Sonora, Mexico (Morrison). This was apparently deposited in this museum, but, according to Fernald, all that remains is a mount of the genitalia.

Specimens examined: 2 ♂, 1 ♀; total specimens 3.

COLORADO: Westcliff, ♂ [HF].

This species is related to *communis*, though the relationship is not a very close one. The female can be distinguished from *communis* by the small clypeal teeth and the red on the abdomen. The male can be distinguished from the male of *communis* as follows.

In *sonorensis*: clypeus slightly reflexed; pleura with large punctures so numerous and close together as to give a very coarsely reticulated appearance; pilosity of thorax entirely black. In *communis*: clypeus almost flat across central part but bending down to lateral margin; pleura with many punctures which are well separated; pilosity of prothorax and mesonotum may be black, but that of rest of thorax almost always entirely white.

7. *Podalonia sonorensis* subspecies **differentia** new subspecies

(Figure 53)

1927. *Podalonia luctuosa* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 21-26. Male.

1927. *Podalonia argentifrons* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 26-30. Male (in part).

1931. *Podalonia violaceipennis* form *luctuosa* Fernald, Canad. Ent. 63: 278-279. Male.

Male.—Length 10 mm. Head and thorax black. Legs piceous. Abdomen dark bluish-black.

Female.—Length 14 mm. Head and thorax black. Abdomen dark bluish-black.

*Holotype*.—Male, Troublesome, Colorado, June 9, 1908 (S. A. Rohwer), located in the United States National Museum at Washington, D. C.

*Allotype*.—Female, Yellowstone Nat. Park, Wyoming, July 9, 1930, located in the American Museum of Natural History, New York.

Specimens examined: 5 ♂, 2 ♀; total specimens 7.

*Paratypes*.—

COLORADO: Powderhorn, ♂, June 23, 1926 (E. G. Anderson) [UM].

MONTANA: ♀ [AES].

NORTH DAKOTA: Bowman, ♂, June 23, 1918 (O. A. Stevens) [OS].

ALBERTA: Lethbridge, 2 ♂, June 5, 29, 1922 (W. Carter) [CNM, UM].

Variations.—The piceous color of the legs of the holotype is merely a superficial variation. The abdomen is sometimes decidedly bluish. Male: length 10-12 mm.

Except for the color differences of the abdomen, this subspecies is identical with *sonorensis* in all important characters, including the male genitalia. Since both *sonorensis* and *differentia* occur over a wide but scarcely overlapping geographical range, and because of the lack of any structural differences, it is believed best to consider them as subspecies of the same species.

The holotype male has caused confusion by the belief that it was the long sought male of *luctuosa*. It was caught at the same time and place as a female of *communis*, but it was not in copulation with it and has no connection with that species. The male resembles *communis* subspecies *intermedia* superficially, but differs by the same structural characters that separate *sonorensis* from *communis*. The female resembles *communis* and *luctuosa*, but is easily distinguished by the shape of the clypeus and by the clypeal teeth.

8. *Podalonia melaena* new species

(Figures 9, 37, 40, 51)

1927. *Podalonia argentifrons* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 26-30. Male, female (in part).

?1927. *Podalonia luctuosa* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 21-26. Female (in part).

Male.—(See figure 9 for genitalia.) Length 19 mm. Head: clypeal margin very broadly truncate, a very slight central emargination; distal part of clypeus prominently reflexed; frontal suture distinct to anterior ocellus, though weaker in the slight frontal depression; frontal depression finely reticulate and with tiny punctures, rest of frons similar but with many large punctures; pilosity of head black. Thorax: collar rather narrowly rounded; mesopleuron with many deep large punctures; from some of the tiny punctures arise short white sericeous hairs; mesopleuron very finely and indistinctly reticulate and moderately glossy; metapleuron with deep large punctures arranged more or less in rows, coarse flat-topped ridges between most of these rows, this flat surface rather glossy and with occasional tiny punctures; propodeal side with large punctures more numerous than on metapleuron, in more regular rows, and with ridges more numerous, more regular, and more sharply defined; metanotal flange moderate in size; pilosity of thorax black or bluish-black. Petiole: black, long, curved slightly before junction with first abdominal tergite. Abdomen: entirely black with no bluish reflection; white sericeous hairs quite abundant on latter part of first, all of second, and anterior part of third tergites.

Female.—Length 17 mm. Head: clypeus only slightly bulging in center, large punctures irregular in size and shape, most numerous on sides, tiny punctures scattered, surface weakly reticulate. Thorax: short ridges anterior to most of the large punctures on mesothorax, very few tiny punctures on



this plate; surface of entire pleura rather glossy. Abdomen: slender, black, but in certain lights several of the segments, especially the fourth and fifth, may have an almost indiscernible bluish tint.

*Holotype*.—Male, Boulder, Colorado, July 3, 1922; it is located in the American Museum of Natural History at New York.

*Allotype*.—Female, Kits Peak Rincon Baboquivari Mts., Arizona, Aug. 1–4, 1916; it is located in the American Museum of Natural History, New York.

Specimens examined: 11 ♂, 7 ♀; total specimens 18.

*Paratypes*.—

ARIZONA: Santa Cruz Village, Cobabi Mts., ♀, Aug. 10–12, 1916 [AMNH]; Tucson, ♂ (F. H. Snow) [KU]; Tucson, ♂, Oct. 2–25, 1916 [AMNH]; Tucson, ♀, June, July 1910 (Bridwell) [USNM]; Tucson, 18 mi. S., ♀, July 31, 1924 (E. P. Van Duzee) [CAS]; Tucson, Sabino Cyn., ♀, Oct. 17, 1936 (E. P. Van Duzee) [UM].

CALIFORNIA: Descanso, San Diego Co., ♀, Aug. 14, 1917 [JB]; Moke-lumne Hill, ♂ (Bridwell) [USNM]; Pasadena, ♀, May 5, 1928 (C. H. Hicks) [CH].

COLORADO: Jim Creek nr. Boulder, ♂, July 25, 1922 [AMNH].

IDAHO: Warren, Idaho Co., ♂ [RD].

NEVADA: 3 ♂ [AES, UM].

NEW MEXICO: Alamogordo, ♂, May 13, 1902 [AES].

WASHINGTON: Pine Canyon, Brookside Sunset Trail, Orondo, ♂, June 24, 1918 (A. C. Burrill) [WSC].

Variations.—Male: length 14.5–19 mm.; clypeal margin sometimes transverse with no central emargination; rarely clypeus but slightly reflexed; frontal depression occasionally quite distinct; in one specimen metapleuron not ridged, surface between punctures distinctly though finely reticulate posteriorly, smooth anteriorly; first several abdominal segments rarely with a very slight reddish tint. Female: length 17–18 mm.

The entirely black abdomen distinguishes this species from the *argentifrons* group, and the metanotal flange separates it from the *luctuosa* group. The female *melaena* resembles *mexicana* in the shape of the clypeus, and this along with other resemblances probably indicates a relationship between these two species. In *melaena*: abdomen black; metapleuron glossy, with flat-topped ridges and large distinct punctures. In *mexicana*: abdomen always distinctly blue or blue-black; metapleuron moderately or slightly glossy, with distinct, sharply-defined ridges, medium-sized punctures.

9. *Podalonia puncta* new species

(Figures 4, 36, 56)

1865. *Ammophila luctuosa* Cresson, Proc. Phila. Ent. Soc. 4: 462. Female (in part).  
 ?1902. *Psammophila luctuosa* Melander & Brues, Biol. Bul. 3: 40-42. Female (in part).  
 ?1903. *Ammophila luctuosa* Melander, Psyche 10: 156-164. Female (in part).  
 ?1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male (in part).  
 1917. *Psammophila luctuosa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).  
 1927. *Podalonia argentifrons* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 26-30. Female (in part).  
 1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male (in part).

Male.—(See figure 4 for genitalia.) Length 14 mm. Head: clypeal margin extending downwards and slightly inwards for a distance, then bending and extending slightly more inwards for about an equal distance, then bending and extending slightly upwards to center; frontal suture almost completely obsolete, evident below frontal depression but not evident in depression; frontal depression only slightly lower than rest of frons, well marked by complete absence of large punctures, these punctures being very abundant elsewhere on frons; large punctures of frons smaller and closer together towards compound eyes; frontal depression reticulate and with a few tiny punctures; pilosity of head very dense, black. Thorax: all pleura very heavily punctured, these punctures usually so close together as to leave a very narrow ridge between them; on mesopleuron these punctures somewhat more separated, leaving some flat surface between them; metanotal flange medium; pilosity very dense, black. Petiole: black. Abdomen: all of first except base, all of second, and anterior two-thirds of third segments yellowish-red; base of first segment black; remainder of abdomen bluish.

Female.—Length 16 mm. At first glance appearing quite different from male; structurally, however, practically identical except for the usual sexual differences. Head: clypeus considerably bulging centrally from top to bottom, not much from side to side, upper edge well marked; surface of clypeus glossy, with a great many large round punctures from which strong pilose hairs arise; frontal suture obsolescent in frontal depres-

sion, though with a thin line visible to anterior ocellus. Abdomen: blue.

*Holotype*.—Male, Alamogordo, New Mexico, April 22, 1902. It is in the collection of the American Entomological Society, Philadelphia, Pa.

*Allotype*.—Female, Hamilton Co., Kansas (F. H. Snow). It is deposited in the collection of the University of Kansas, Lawrence, Kansas.

Specimens examined: 5 ♂, 22 ♀; total specimens 27.

*Paratypes*.—

COLORADO: ♀ [AES]; Lamar, 2 ♀, June 4–11, 1919 [AMNH, UM]; Russell, 2 ♀, July 12 (H. S. Smith) [UN]; Ute Creek, 2 ♀, July 3 (L. Bruner) [UN]; Ute Creek, 2 ♀, June 24 (H. S. Smith) [UN]. KANSAS: Clark Co., ♂, Aug. 26, 1911 (F. X. Williams) [KU]; Garden City, 2 ♀, June 1895 (H. W. Menke) [MCZ]; Hamilton Co., 6 ♀ (F. H. Snow) [KU]; Meade Co., ♀, May 16 [KSC].

NEW MEXICO: Clouderoft, ♂, Aug. 3–10, 1903 (W. Knaus) [USNM]; Las Vegas, 25 mi. N. of, ♀, June 28, 1931 (H. A. Scullen) [OAC]; Mesilla, ♂, April 10, 1909 (C. N. Ainslie) [AES].

OKLAHOMA: Ardmore, ♀, June 1, 1909 (F. C. Bishopp) [AES].

TEXAS: ♀ [AES]; ♂ [UM].

Variations.—Male: length 10–14 mm.; clypeal margin somewhat variable; occasionally margin extending downwards and slightly inwards only a very short distance before bending considerably more inwards, this second part extending a considerable distance before bending inwards and slightly upwards to center; rarely first bend scarcely evident, in this case the margin bearing a resemblance to the margin in some males of *communis*. Female: length 13–18 mm.; metapleuron sometimes more or less clearly ridged rather than coarsely reticulated; sometimes with slight ridges anterior to some of punctures of mesopleuron; rarely clypeus only slightly bulging.

The color combination of the abdomen of the male and female makes this a very unusual species. The bluish abdomen of the female shows that this species belongs to the *argentifrons* group, but the male is unusual in being the only one of this group in which the abdomen is partly red. The male is distinctive from all other known species of *Podalonia* by the shape of the clypeus, the very heavy punctation of the head and thorax, and the red and blue abdomen. The female can be distinguished from other species in the *argentifrons* group by the highly glossy, moderately bulging clypeus, this plate bearing a great many rather uniformly-sized large round punctures, by the smooth frontal depression, and by the weak frontal suture, especially in the frontal depression.

10. *Podalonia argentifrons* (Cresson)

(Figures 7, 38, 52)

1865. *Ammophila argentifrons* Cresson, Proc. Phila. Ent. Soc. 4: 462-463. Male (in part).
- ?1888. *Ammophila argentifrons* Cameron, Biol. Centr.-Amer., Hym. 3: 23.
- ?1902. *Psammophila luctuosa* Melander & Brues, Biol. Bul. 3: 40-42. Female (in part).
- ?1902. *Psammophila argentifrons* Melander & Brues, Biol. Bul. 3: 40-42. Male (in part).
1903. *Ammophila luctuosa* Melander, Psyche 10: 156-164. Male, female (in part).
1908. *Psammophila luctuosa* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Male, female (in part).
1917. *Psammophila luctuosa* Mickel, Univ. Nebr. Studies 17: 87-88. Male, female (in part).
1927. *Podalonia argentifrons* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 26-30. Male, female (in part).

Male.—(See figure 7 for genitalia.) Length 14 mm. Head: clypeal margin extending downwards and slightly inwards for a short distance, then bending and extending more inwards for a slightly greater distance, finally bending to extend transversely to center, a slight emargination at center; clypeus scarcely bulging; frontal suture so wide as to be marked by a double line, except just in front of anterior ocellus, where it becomes obsolescent; frontal depression moderately deep, surface reticulate and without punctures; frons with many large, slightly elongated punctures, a moderate number of small punctures between the large ones; large punctures about their diameters apart for a short distance above antennae; pilosity of head black. Thorax: mesopleuron with a great many deep, large punctures, some more or less confluent, almost no small punctures, surface weakly reticulate; metapleuron and propodeal side with large punctures so abundant and close together as to give a coarsely reticulated appearance to these plates; metanotal flange rather small; pilosity of thorax black. Abdomen bluish-black.

Female.—Length 14 mm. Head: clypeus moderately bulging centrally, turning down abruptly near margin, not bulging laterally; clypeus with a good many large punctures which vary in size from average-sized large ones down to small ones, very few tiny punctures, surface reticulate; frontal suture very wide; frons with a great many deep large punctures, surface

granulate. Thorax: metapleuron and propodeal side with some distinct slanting ridges.

Redescribed from a male and a female which have been compared with the holotype. Male, Halsey, Nebraska, Aug. 16, 1925 (R. W. Dawson); female, Halsey, Nebraska, Aug. 29, 1924 (R. W. Dawson). Both are located in the collection of the University of Minnesota.

*Holotype*.—Male, Colorado Territory. It is in the collection of the American Entomological Society, Philadelphia, Pa.

*Allotype*.—Female, March 9, 1916 (E. O. Van Duzee). Fernald designated the allotype in 1927. It is located in the collection of the California Academy of Sciences. The writer was unable to examine the allotype.

Specimens examined: 62 ♂, 60 ♀; total specimens 122.

*Argentifrons* has been collected in the following states and provinces: NORTH DAKOTA, SOUTH DAKOTA (July 22–Sept. 9), NEBRASKA, MONTANA, WYOMING, COLORADO (May 16–Aug. 19), NEW MEXICO (Apr. 10), UTAH, ARIZONA, IDAHO, NEVADA, OREGON, CALIFORNIA (Mar.–Dec. 3), MANITOBA, ALBERTA.

Variations.—Rarely frontal suture narrow and similar to *mexicana*. Male: length 12–16 mm.; clypeal margin somewhat variable; punctures on propodeal side and metapleuron, and rarely on mesopleuron, sometimes so close together as to give a very coarsely reticulated appearance to these plates. Female: length 13–17 mm.; clypeus somewhat variable, occasionally resembling *mexicana* with regards to the amount of bulge and character of punctation.

This species is very closely related to *mexicana*. The most useful characters to use in separating these two species are given following the description of *mexicana*.

#### 11. *Podalonia mexicana* (Saussure)

(Figures 6, 26, 41, 66)

1865. *Ammophila argentifrons* Cresson, Proc. Phila. Ent. Soc. 4: 462–463. Male (in part).

1865. *Ammophila luctuosa* Cresson, Proc. Phila. Ent. Soc. 4: 462. Female (in part).

1867. *Ammophila mexicana* Saussure, Reise d. Novara, Zool. 2, pt. 1, Hym., p. 25. Male, female.

?1888. *Ammophila argentifrons* Cameron, Biol. Centr.-Amer., Hym. 3: 23.

?1902. *Psammophila luctuosa* Melander & Brues, Biol. Bul. 3: 40–42. Male, female (in part).

?1902. *Psammophila argentifrons* Melander & Brues, Biol. Bul. 3: 40–42. Male, female (in part).

1903. *Ammophila luctuosa* Melander, Psyche 10: 156-164.  
Male, female (in part).
1908. *Psammophila luctuosa* H. S. Smith, Univ. Nebr. Studies  
8: 330-331. Male, female (in part).
1917. *Psammophila luctuosa* Mickel, Univ. Nebr. Studies 17:  
87-88. Male, female (in part).
1925. *Psammophila luctuosa* Carter, Canad. Ent. 57: 131-136.  
Male only (in part).
1927. *Podalonia argentifrons* Fernald, Proc. U. S. Nat. Mus.  
71, Art. 9, pp. 26-30. Male, female (in part).

Male.—(See figure 6 for genitalia.) Length 14 mm. Head: clypeal margin extending downwards and somewhat inwards a short distance, then bending sharply and extending almost transversely but slightly downwards for a shorter distance, then bending slightly and extending transversely to center, curving gently upwards near center to form a shallow emargination; clypeus very slightly bulging; frontal suture not sharply defined; frontal depression moderate in size, not well defined; surface immediately in front of anterior ocellus with smooth reticulation, elsewhere frons with only a few well-scattered large punctures and a great many tiny punctures which extend up to frontal suture except immediately in front of anterior ocellus; pilosity of head black. Thorax: collar moderately rounded; mesopleuron with many large punctures which have a slight tendency to form rows, short ridges in front of most of the punctures; a few small punctures on plate, some of these with very short sericeous hairs, surface of plate distinctly reticulate; metapleuron and propodeal side with large punctures tending to elongate, more or less lined up in rows with ridges between; metanotal flange moderate; most of thoracic pilosity white with black bases. Abdomen: dark blue.

Female.—Length 15 mm. Head: clypeus slightly bulging, central part not much more so than lateral parts, lower part descending rather quickly to margin; a moderate number of large and medium-sized punctures but no small punctures, surface reticulate; frontal suture distinct to ocellus; frons with only a few large punctures except near eyes, these punctures somewhat elongated, a great many shallow tiny punctures, surface reticulate. Thorax: metapleuron and propodeal side with much stronger ridges than in male.

Redescribed from a male and a female which were compared with the lectotype and lectoallotype respectively; both are in the collection of the University of Minnesota. Male, Beach, North Dakota,

Aug. 16, 1921 (C. N. Ainslie); female, Flagstaff, Arizona, June 30.

*Lectotype*.—Male, Cordova t.c., Cn. de Saussure.

*Lectoallotype*.—Female, Cordova t.c., Cn. de Saussure. The lectotype and lectoallotype, along with the other specimens of Saussure's type series, are located in the Museum of Natural History of Geneva, Geneva, Switzerland.

Specimens examined: 237 ♂, 195 ♀; total specimens 432.

*Mexicana* has been collected in the following states, provinces and countries: NORTH DAKOTA, NEBRASKA, KANSAS, MONTANA, WYOMING, COLORADO (May 17–Oct. 8), NEW MEXICO, UTAH, ARIZONA, IDAHO, NEVADA, WASHINGTON (May 15–Sept. 10), OREGON, CALIFORNIA, SASKATCHEWAN, ALBERTA (May 13–Sept. 9), BRITISH COLUMBIA, MEXICO.

Variations.—Frontal suture occasionally so broad as to be similar to the condition in *argentifrons*; surface of mesopleuron occasionally strongly ridged; rarely metanotal flange quite small; sometimes tiny punctures on frons very few in number. Male: length 10–15 mm.; shape of clypeal margin somewhat variable; mesopleuron sometimes with short prominent ridges, and ridges of metapleuron and propodeal side may be quite strong; thoracic pilosity sometimes entirely black. Female: length 13–18 mm.; occasionally clypeus almost flat; clypeus sometimes smooth and highly glossy, in other cases more or less finely reticulate and dull; number of punctures on clypeus somewhat variable, though number of large punctures usually small; rarely clypeus resembling that of *argentifrons*.

*Mexicana* and *argentifrons* are very closely related, but are reliably separated by a number of characters. In the male *mexicana*: largest punctures of frons between antennal bases below, anterior ocellus above, and compound eyes on each side are rather few in number and well separated, and tiny punctures are well distributed between the larger ones, especially noticeable in region of frontal suture; frontal suture only a thin line, sometimes more or less obsolescent; metapleuron more or less prominently ridged, with large punctures rather shallow, more or less elongated, and moderately abundant. In the male *argentifrons*: largest punctures of frons very numerous about halfway between antennae and anterior ocellus, less than their diameters apart and sometimes even touching each other; frons usually quite granulate, small punctures almost entirely absent; frontal suture usually so wide as to form a trough; metapleuron and propodeal side with large punctures so abundant and close together as to give a coarsely reticulated appearance to these plates. In the female *mexicana*: frons with largest punctures well separated, usually, though not always, with some tiny punctures

between the large ones; frontal suture as in male; clypeus with large punctures sparsely scattered, surface more or less glossy and only slightly bulging; thoracic pleura moderately punctate, more or less prominently ridged. In the female *argentifrons*: frontal suture as in male except usually somewhat deeper; clypeus usually conspicuously reticulate, bulging considerably in central portion and receding rather rapidly to distal margin; large punctures of clypeus more numerous than in *mexicana*; thoracic pleura very coarsely punctate, occasionally ridged.

12. *Podalonia valida* (Cresson)

(Figures 14, 31, 43, 59)

1865. *Ammophila valida* Cresson, Proc. Phila. Ent. Soc. 4: 461. Female.
1872. *Ammophila grossa* Cresson, Trans. Amer. Ent. Soc. 4: 209. Female.
- ?1874. *Ammophila quadridentata* Fox, Proc. Calif. Acad. Sci. 4: 101, ser. 2. Female.
- ?1902. *Psammophila grossa* Melander & Brues, Biol. Bul. 3: 40-42. Male, female.
1902. *Psammophila valida* Melander & Brues, Biol. Bul. 3: 40-42. Female.
1903. *Ammophila grossa* Melander, Psyche 10: 156-164. Male, female (in part).
1903. *Ammophila valida* Melander, Psyche 10: 156-164. Female.
- ?1908. *Psammophila grossa* H. S. Smith, Univ. Nebr. Studies 8: 330. Male, female (in part).
1917. *Psammophila valida* Mickel, Univ. Nebr. Studies 17: 87. Male, female.
1924. *Psammophila valida* Carter, Ent. News 35: 365. Male.
1925. *Psammophila valida* Carter, Canad. Ent. 57: 132. Male, female.
1927. *Podalonia valida* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, p. 17. Male, female (in part).

Male.—(See figure 14 for genitalia.) Length 20 mm. Head: clypeal margin extending downwards and somewhat inwards for some distance, then bending and extending almost transversely but slightly downwards to center, which is marked by a slight emargination; clypeus slightly bulging above middle, slightly concave below middle; frontal suture distinct to anterior ocellus, a slight depression before the ocellus; area between lateral ocelli and compound eyes depressed below rest of frons and vertex; entire frons with silvery sericeous hairs;



head with pilose hairs mostly black basally and white apically, though with some hairs all black and with some all white. Thorax: collar moderately rounded; mesopleuron prominently reticulate, with many large round punctures; metapleuron with large punctures tending to elongate posteriorly, some coalescing, but not much indication of ridges; propodeal side with a great many large punctures, with ridges between some of these punctures; metanotal flange moderate in size and with a weak emargination; pilose hairs of prothorax black basally and white apically, otherwise thoracic pilosity entirely white. Legs: a spur at apex of fore coxa within. Petiole: long, black, posterior part curving upwards slightly. Abdomen: first segment red except for black dorsal line, second and third entirely red, fourth red with a broad black dorsal stripe which widens posteriorly, fifth and sixth black dorsally and red ventrally, seventh black.

Female.—Length 24 mm. Head: clypeus strongly bulging in center, area between bulge and margin rather glossy; margin with two strong lateral teeth which divide the margin into approximately thirds, irregular small teeth between these two large teeth; clypeal margin with central emargination; pilosity of head black. Thorax: punctures of metapleuron joined by distinct ridges; pilosity of thorax black. Abdomen: entirely red.

Redescribed from a male and a female located in the collection of the University of Minnesota; male, Dickenson, North Dakota (C. N. Ainslie); female, Kittson Co., Minnesota, Aug. 6, 1936 (D. G. Denning). The female was compared with the holotype.

*Holotype*.—Female, Colorado Territory; it is located in the collection of the American Entomological Society, Philadelphia, Pa.

*Allotype*.—Male, Lethbridge, Alberta, Aug. 6, 1923 (H. L. Seaman); designated by Walter Carter and now located in the Canadian National Museum, Ottawa.

*Grossa* was described by Cresson from a female collected in Texas by L. Heiligbrodt. The holotype is in the United States National Museum. In 1902 Melander and Brues described the male of *grossa* from two specimens collected at Austin, Texas, and one of these specimens was designated as allotype. This allotype is in the collection of Washington State College, Pullman, Washington.

Specimens examined: 73 ♂, 90 ♀; total specimens 163.

*Valida* has been collected in the following states and provinces: MINNESOTA (Aug. 7–Sept. 26), IOWA, NORTH DAKOTA (June 19–Sept.), SOUTH DAKOTA, NEBRASKA, KANSAS, TEXAS (April 13–May

10), MONTANA, COLORADO (July 1–Sept. 7), NEW MEXICO, UTAH, ARIZONA, WASHINGTON (May), CALIFORNIA, SASKATCHEWAN, ALBERTA (July 27–Sept. 15), BRITISH COLUMBIA.

Variations.—Rarely fore-coxal tooth very small and blunt, being represented by a slight elevation only at location where tooth is normally present; metapleuron and propodeal side sometimes with flat glossy areas between punctures; sometimes these plates regularly ridged. Male: length 16–22 mm.; head pilosity entirely black in some specimens; clypeus sometimes scarcely bulging. Female: length 16–24 mm.; clypeal teeth vary in number and size, even on opposite sides of the same specimen; rarely with petiole red; occasionally several posterior abdominal segments black, this condition being caused in at least one specimen by *Stylops*.

Cresson apparently believed that *grossa* was not conspecific with *valida* because of the fact that the posterior part of the abdomen was black in *grossa*, while in *valida* the abdomen was entirely red. The writer agrees with Fernald in placing *grossa* in synonymy with *valida*. Many species of *Podalonia* vary in the extent of red on the abdomen, and color as a specific character is misleading. A study of the structure reveals the true situation. For distinctions between *valida* and *montana*, see the notes following the description of *montana*.

13. *Podalonia montana* (Cameron)

(Figures 11, 32, 59)

1888. *Ammophila montana* Cameron, Biol. Centr.-Amer., Hym. 2: 20. Male.  
 1888. *Ammophila jason* Cameron, Biol. Centr.-Amer., Hym. 2: 20. Female.  
 ?1888. *Ammophila quadridentata* Cameron, Biol. Centr.-Amer., Hym. 2: 23. Female.  
 ?1894. *Ammophila quadridentata* Fox, Proc. Calif. Acad. Sci. 4: 101, ser. 2. Female.  
 ?1903. *Ammophila quadridentata* Melander, Psyche 10: 156–164. Female.  
 ?1903. *Ammophila jason* Melander, Psyche 10: 156–164. Female.  
 ?1903. *Ammophila montana* Melander, Psyche 10: 156–164. Male.  
 1927. *Podalonia valida* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 13–16. Male, female (in part).  
 1927. *Podalonia quadridentata* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, p. 17. Female.

(To be concluded in number 2)

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## PODALONIA (HYMENOPTERA: SPHECIDAE) OF NORTH AND CENTRAL AMERICA

BY WILLIAM DONALD MURRAY

(Continued from number 1)

Male.—(See figure 11 for genitalia.) Length 20 mm. Head: clypeal margin extending downwards and somewhat inwards for some distance, then bending and extending almost transversely but slightly downwards to center, this marked by a slight emargination; clypeus slightly bulging above middle, slightly concave below middle; frontal suture becoming obsolete in front of anterior ocellus; almost no frontal depression whatever; frons with a great many tiny punctures, especially along frontal suture, and with many large punctures; pilosity of head black, a few hairs white. Thorax: collar moderately rounded; mesopleuron with many large round punctures and with a great many tiny punctures from which short white sericeous hairs arise, surface rather glossy and not conspicuously reticulate; metapleuron and propodeal side with many large punctures, some forming rows and with ridges between them; only a small amount of surface between the large punctures, this with tiny punctures and somewhat glossy; a small, rather inconspicuous pubescent patch on propodeum on each side of petiole attachment; metanotal flange moderately large; pilosity of prothorax and mesonotum mostly black, of rest of thorax white. Legs: no spur whatever at apex of fore coxa within. Abdomen: first two segments red with a black dorsal stripe, third segment red on ventral half, black on dorsal half, rest of abdomen black.

Female.—Length 20 mm. Head: clypeus with two broad emarginate teeth; clypeus quite bulging in center, margin appearing slightly reflexed; area between bulge and marginal teeth very glossy and almost without punctures, elsewhere clypeus with many large and small punctures and with a moderately glossy surface; frontal suture quite distinct except in front of anterior ocellus, where it disappears in the short but wide frontal depression; pilosity of head black. Thorax: mesopleuron with a great many very large punctures, leaving only a small amount of intervening surface; these punctures, even where coalescing, not forming rows to any extent; surface between punctures with only a few small punctures and with a distinct reticulation; large punctures of propodeal side so numerous as to leave almost no intervening space, thus giving a very coarsely reticulated appearance to this plate; pilosity of thorax black except on propodeal disk where there are a few long white hairs. Abdomen: entirely dark red.

Redescribed from a male and a female which were compared by Dr. R. B. Benson with the holotypes of *montana* and of *jason* respectively. Male, female, Xucumanatlán, Guerrero, July (H. H. Smith), P. Cameron collection. They are located in the British Museum (Natural History) in London.

*Holotype*.—Male, Mexico, Ventanas in Durango (Förster).

*Allotype*.—The holotype of *jason* is herein designated as the allotype of *montana*; female, Guatemala, San Gerónimo (Champion). The holotype and allotype are located in the British Museum (Natural History) in London. The holotype of *quadridentata* was collected in Mexico, Ventanas in Durango (Förster), and is also located in the British Museum.

The specimens which Dr. R. B. Benson compared with *montana* and *jason*, and which were studied by the writer, are undoubtedly the male and female of the same species. This is based on a study of the structure of those two specimens. Dr. Benson studied the holotype of *quadridentata* and stated (in lit.) that it agrees very closely with *jason* except that the propodeal side is punctured between transverse striae, whereas it is densely punctured without transverse striae in *jason*. Individual variation might easily account for this difference, and the writer believes that *jason* and *quadridentata* are only slight variations of the same species. This species receives the name *montana* through page priority.

Specimens examined: 1 ♂, 2 ♀; total specimens 3.  
MEXICO: ♀ [USNM].

The male of *montana* resembles closely the male of *valida*, from which it is distinguished by the absence of a fore-coxal spur, by differences in punctuation, and by the genitalia. The female is distinguished from *valida* by the absence of a fore-coxal spur, and from *clypeata* by the much larger size and strongly fuliginous wings, as well as by differences in punctuation. See also the note following the description of *pubescens*.

#### 14. *Podalonia pubescens* new species

(Figures 13, 42, 55)

1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male, female (in part).

Male.—(See figure 13 for genitalia.) Length 17 mm. Head: clypeal margin extending downwards and inwards for a short distance, then bending and extending almost transversely but slightly downwards to center, this being marked by a slight emargination; clypeus somewhat bulging in center, very slightly concave below bulge, giving it a slightly reflexed appearance; frontal suture distinct for only a short distance above base of antennae; frontal depression moderately large and deep, with the area immediately anterior of ocellus glossy and inconspicuously reticulate, otherwise with small punctures; rest of frons with large and small punctures and with a glossy surface; pilosity of head black. Thorax: collar moderately rounded; mesopleuron with large punctures well-spaced, with a great many tiny punctures which become more numerous below and from which white sericeous hairs arise; surface of mesopleuron very glossy; metapleuron with large punctures much closer together, many coalescing, but with considerable surface evident, this surface with a few tiny punctures and highly glossy; propodeal side with large punctures very close together, leaving almost no surface in between; on posterior part of this plate tiny punctures much more numerous, and sericeous hairs arise from them, these being so long and abundant as to form a conspicuous pubescent patch; metanotal flange moderate in size; pilose hairs of thorax mostly white with black bases. Petiole: very long and slender, curved slightly beyond middle. Abdomen: first segment red with a black dorsal stripe, second and third segments red, rest of abdomen black with a dark bluish tint.

Female.—Length 19 mm. Head: clypeal margin with a conspicuous central indentation; clypeus moderately bulging

in center, with a great many medium-sized and small punctures, surface glossy; frons, especially laterally, with a great many medium-sized punctures; grayish-brown sericeous hairs on clypeus and frons; pilosity of head black. Thorax: pilosity black except on propodeum, this plate with hairs black with white tips. Abdomen: entirely red.

*Holotype*.—Male, Post Creek Canyon, Pinaleno Mts., Fort Grant, Arizona, July 15–18, 1917. The holotype was donated to the collection of the University of Minnesota by Dr. J. Bequaert.

*Allotype*.—Female, Big Bend Park, Brewster Co., Texas, July 27, 1937 (Rollin H. Baker). The allotype was donated to the collection of the University of Minnesota, St. Paul, Minn., by Mr. Baker.

Specimens examined: 12 ♂, 12 ♀; total specimens 24.

*Paratypes*.—

ARIZONA: Huachuca Mts., ♀, July 8, 1932 (R. H. Beamer) [KU]; Huachuca Mts., Carr Cyn., ♂, June 6, 1930 (G. Linsley) [CAS]; Palmerlee, ♂ (N. Banks) [MCZ]; Post Creek Cañon, Pinaleno Mts., Fort Grant, ♂, ♀, July 15–18, 1917 [JB]; Santa Rita Mts., 7 ♂, 6 ♀, June, July (F. H. Snow) [KU, UM].

TEXAS: Big Bend Park, Brewster Co., ♂, ♀, July 24, 27, 1937 (R. H. Baker) [RB].

MEXICO: Canon del Hillcoat, Sierra del Carmen, Coah, ♀, July 10, 1938 (R. H. Baker) [RB]; Chihuahua City, ♀, Aug. 16–18, 1906 (P. P. Calvert) [HF].

Variations.—Male: length 15–18 mm.; clypeal margin somewhat variable, in some cases with a broad central emargination; propodeal side sometimes with some surface between the punctures. Female: length 16–22 mm.; large punctures on upper part of frons occasionally elongated. One female which was stylopized shows strong tendencies towards maleness; the dorsal part of the third and fourth, and all of the fifth and sixth segments are black, and the sericeous hairs of the head and pleura are more developed than usual for the females.

The prominent pubescent patches on the propodeal end are very distinctive for this species. The male of *montana*, however, has a slight patch on the propodeum on each side of the petiole attachment, and also conspicuous sericeous hairs on the pleura, and might cause confusion. The shape of the clypeus is useful in separating the males of these two species, being more nearly flat in *montana* and with the margin more smoothly bending laterally and with a broader transverse section. The genitalia of these two species are



quite similar. The female of *montana* is at once distinguished from the female of *pubescens* by the toothed clypeus.

15. *Podalonia clypeata* new species

(Figures 10, 27, 33, 54)

?1908. *Psammophila grossa* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Female (in part).

?1908. *Psammophila violaceipennis* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Male (in part).

1917. *Psammophila grossa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).

1917. *Psammophila violaceipennis* Mickel, Univ. Nebr. Studies 17: 87-88. Male (in part).

1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male (in part).

Male.—(See figure 10 for genitalia.) Length 14 mm. Head: clypeal margin extending downwards and somewhat inwards for a short distance, then bending and extending farther inwards for a longer distance, this part with a very slight upward curve, then bending inwards to the middle, with a conspicuous central emargination; clypeus strongly bulging in center, distinctly concave between center and margin; frontal suture moderately strong; frontal depression very small, evident immediately in front of anterior ocellus only; frons with many large punctures and a great many tiny ones, surface glossy, pilosity of head black. Thorax: collar moderately rounded; mesopleuron with large punctures abundant and quite deep and distinct, and with scattered tiny punctures, surface with smooth reticulation, almost glossy; metapleuron with a great many large punctures, some tending to form rows, almost no tiny punctures; anteriorly with surface glossy, posteriorly reticulated and weakly ridged; propodeal side with large punctures extremely numerous and forming more or less distinct rows separated by ridges, surface between punctures glossy; metanotal flange very large, slightly emarginate; pilosity of thorax entirely black. Wings: almost hyaline. Abdomen: first two segments red, third red except for a narrow posterior band, rest of abdomen black; abdomen somewhat compressed, rather unusual for the genus.

Female.—Length 15 mm. Head: clypeal margin with two broad emarginate teeth; clypeus quite bulging in center, with many large and tiny punctures, surface faintly reticulate later-

ally, glossy elsewhere; pilosity of head black. Wings: moderately fuliginous. Abdomen: with the slightly compressed appearance as in male; first three and anterior half of fourth segments bright orange-red, rest of abdomen black.

*Holotype*.—Male, Halsey, Nebraska, Aug. 29, 1924 (R. W. Dawson); it is deposited in the collection of the University of Minnesota, St. Paul, Minn.

*Allotype*.—Female, Middle River, Minnesota, Aug. 9, 1935 (D. G. Denning); it is deposited in the collection of the University of Minnesota.

Specimens examined: 11 ♂, 24 ♀; total specimens 35.

*Paratypes*.—

KANSAS: ♀ [AES]; ♀, Aug. 28, 1898 [AES]; Graham Co., ♀, Aug. 16, 1912 (F. X. Williams) [KU]; Phillips Co., ♀, Aug. 30, 1912 (F. X. Williams) [KU, UM]; Riley Co., ♂, Sept. 11 (G. A. Dean) [UM]; Riley Co., ♂, Sept. 30 (J. B. Norton) [KSC]; Trego Co., ♀, July 12, 1912 (F. X. Williams) [KU]; Wallace, ♀, July 1885 [KSC]; Wichita Co., ♀ (F. X. Williams) [KU].

MINNESOTA: Anoka Co., Sand Dunes, ♀, Aug. 3, 1933 (A. C. Hodson) [UM].

MONTANA: ♀ [AES]; Hamilton, ♂, July 30, 1928 [MSC].

NEBRASKA: Halsey, ♂, 2 ♀, Aug. 11, 14, 15, 1925 (R. W. Dawson) [UM, BM]; Halsey, 2 ♀, Aug. 12, 1912 (J. T. Zimmer) [UN]; Monroe Canon, Sioux Co., 4 ♀, Aug. 3, 21, 1908 (R. W. Dawson) [UN]; Monroe Canon, Sioux Co., ♂, Aug. 9, 1908 (L. Bruner) [UM]; Sioux Co., 2 ♀ [UN]; West Point, 2 ♀ [UN].

OKLAHOMA: Cherokee, ♀, July 4, 1934 (A. E. Pritchard) [OAMC].

OREGON: Camp Umatilla, ♂, June 27, 1882 [MCZ].

WASHINGTON: Colville V., Loon Lake, ♂, July 25, 1882 [MCZ]; Little Spokane, 3 ♂, July 26, 1882 [MCZ, UM].

UNLABELED: ♀, Aug. 28, 1898 [AES].

Variations.—Male: length 14–16 mm.; some variation in extent of red on abdomen; rarely surface of metapleuron mostly wavy, glossy only anteriorly. Female: length 15–18 mm.; wings sometimes almost hyaline; occasionally mesopleuron with moderately strong ridges, the glossy surface being quite reduced in extent; abdomen sometimes very strongly compressed.

The male of this species is most similar to the male of *violaceipennis*. In *clypeata*: clypeal margin conspicuously emarginate in center, curving of margin distinctive as shown in figure 27; only a slight frontal depression, and surface of almost entire frons glossy; almost entire anterior half of metapleuron glossy; metanotal flange

conspicuously but not deeply emarginate. In *violaceipennis*: clypeal margin scarcely if at all emarginate in center; a large and distinct frontal depression, surface of depression finely reticulate and dull; anterior part of metapleuron usually finely reticulate; metanotal flange large and deeply emarginate.

The female of this species is distinct from the females of all other species except *montana* by the shape of the clypeal teeth. The size and shape of the metanotal flange, as well as other structural characters, separate this species from *montana*. Small specimens of *valida* might be confused with this species, but that species has a spur on the anterior coxa.

16. *Podalonia violaceipennis* (LePeletier)

(Figures 16, 22, 49)

1845. *Ammophila violaceipennis* LePeletier, Hist. Nat. Ins. Hym. 3: 370. Female.
1856. *Ammophila violaceipennis* Smith, Cat. Hym. Brit. Mus. 4: 224.
1856. *Ammophila cementaria* Smith, Cat. Hym. Brit. Mus. 4: 224. Female.
1902. *Psammophila violaceipennis* Melander & Brues, Biol. Bul. 3: 40-42.
1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40-42. Male (in part).
1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male, female (in part).
- ?1903. *Ammophila grossa* Melander, Psyche 10: 156-164. Female (in part).
1908. *Psammophila violaceipennis* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Male (in part).
- ?1911. *Ammophila* sp. Turner, Psyche 18: 13-14. Female.
1915. *Psammophila violaceipennis* Parker, Proc. Ent. Soc. Wash. 17: 70-77. Female.
1917. *Psammophila violaceipennis* Mickel, Univ. Nebr. Studies 17: 87-88. Male, female (in part).
- ?1917. *Psammophila grossa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).
1917. *Psammophila violaceipennis* Rohwer, Conn. Geol. & Nat. Hist. Surv. 22: 681. Male, female (in part).
1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, p. 17. Male, female (in part).

1936. *Podalonia violaceipennis* Balduf, Canad. Ent. 68: 137-138. Female (in part).

?1936. *Podalonia violaceipennis* Krombein, Ent. News 47: 93-99. Female.

Male.—(See figure 16 for genitalia.) Length 16 mm. Head: clypeal margin extending downwards and somewhat inwards for a short distance, then bending and extending inwards for an equal distance, then bending and running almost transversely but slightly upwards to center; clypeus slightly and very broadly depressed above margin, rather bulging on upper part; frontal suture distinct to anterior ocellus; frontal depression moderately deep; surface in frontal depression coarsely granulate, rest of frons with a moderate number of large and a considerable number of tiny punctures, surface more or less finely reticulate; pilosity of head long, dense and black. Thorax: collar broadly rounded; mesopleuron with many large punctures, tiny punctures moderately abundant on lower part of mesopleuron, surface rather dull, reticulate; metapleuron with many large punctures, those on posterior part rather elongated, almost no regular ridges, surface on extreme anterior part smooth and glossy, remainder of plate scratchy and rather dull; propodeal side with many large punctures and broken ridges between them on the lower posterior part; pilosity of thorax entirely black. Petiole: slender. Abdomen: first segment except at base, all of second, all except posterior dorsal part of third segments red, rest of abdomen black.

Female.—Length 16 mm. Head: clypeus bulging only slightly in center, many moderate-sized punctures, surface prominently reticulate giving a dull appearance, tiny punctures very abundant and tending to blend in with the surface reticulation; upper edge of clypeus weakly marked, smoothly rounded. Thorax: surface of metapleuron not as wavy as in male, distinctly reticulate except at extreme anterior end. Petiole: rather slender, length compared with length of hind coxa being 1.27 for petiole to 1 for coxa.

Redescribed from a male and a female in the collection of the University of Minnesota; male, Halsey, Nebraska, Aug. 14, 1925 (R. W. Dawson); female, Hennepin Co., Minnesota, Aug. 5, 1930 (C. E. Mickel).

*Holotype*.—Female, Philadelphia; located in the Serville collection. C. E. Mickel, while studying in Europe, found that the Serville Hymenoptera collection containing many of LePeletier's types

now forms a part of the Spinola collection. Therefore the type of *violaceipennis* is very probably in the Spinola collection which forms a part of the collections of the Museo Zoologia et Anatomia Comparata della R. Università, Torino, Italy. The holotype of *violaceipennis* has not been seen by any worker on this group since its original description. Since it was collected at Philadelphia, and since only one species of *Podalonia* has ever been taken near this region, this species is given the name *violaceipennis*.

*Allotype*.—The male described herein is designated as the allotype.

Specimens examined: 94 ♂, 149 ♀; total specimens 243.

*Violaceipennis* has been collected in the following states and provinces: NEW HAMPSHIRE, MASSACHUSETTS (June 25–Oct. 4), NEW YORK, NEW JERSEY (May 30–Oct. 4), PENNSYLVANIA, DELAWARE, VIRGINIA, NORTH CAROLINA (Apr. 4–Nov. 6), GEORGIA, ALABAMA, FLORIDA, OHIO, INDIANA, ILLINOIS, MICHIGAN, WISCONSIN, MINNESOTA (June 3–Sept. 25), NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, OKLAHOMA, COLORADO, ONTARIO.

Variations.—Male: length 11–20 mm.; clypeal margin sometimes slightly emarginate in middle, at other times broadly truncate; in one small specimen margin appearing almost rounded; frontal suture usually not distinct its entire length; frontal depression sometimes rather deep, and small punctures sometimes extend over entire depression; area of metapleuron which is glossy varying from only a very small anterior part to about one-third of plate; rarely thoracic pilosity partially white. Female: length 13–20 mm.; in large specimens clypeus occasionally bulging nearly as much as in some specimens of *robusta*; sometimes surface of clypeus with very little reticulation, thus being rather glossy; upper edge of clypeus sometimes showing a very slight tendency towards being V-shaped, but almost never distinctly so. Rarely several punctures on mesopleuron run together and tend to form weak ridges; metapleuron occasionally with short ridges in front of large punctures; length of petiole in comparison with hind coxa somewhat variable, in one specimen this proportion being 1.1 for petiole to 1 for coxa.

*Violaceipennis* is most closely related to *occidentalis*, *robusta*, *mickeli* and *clypeata*. *Violaceipennis* and *occidentalis* are best distinguished as follows. In the male *violaceipennis*: metapleuron without prominent ridges, but with moderate-sized punctures and a reticulate or granulate surface, anterior surface smoother and occasionally even glossy; metanotal flange very large and rather deeply emarginate; cell R4 (third submarginal) usually not much

wider at bottom than at top. In the male *occidentalis*: punctures and ridges of metapleuron rather confused; metanotal flange quite small and not emarginate; cell R4 usually about twice as wide at bottom as at top. In the female *violaceipennis*: clypeus with many medium-sized punctures, surface reticulate and dull; other characters as in male. In *occidentalis*: punctures of clypeus quite large, surface reticulate but rather glossy.

*Violaceipennis* and *robusta* are best distinguished as follows. In the male *violaceipennis*: clypeal margin more rounded, first bend from the eye being rather slight; metapleuron without prominent ridges; metanotal flange very large and rather deeply emarginate. In the male *robusta*: clypeal margin not evenly rounded, first bend from the eye being rather sharp; metapleuron with distinct ridges, though they may be more or less broken; metanotal flange moderate in size, broadly and weakly emarginate. In the female *violaceipennis*: clypeus only slightly bulging, and at least in center with only moderate-sized and tiny punctures; upper edge of clypeus only lightly marked; other characters as in male. In the female *robusta*: clypeus moderately bulging, some punctures large; upper edge of clypeus very distinctly marked.

The characters given in the key are most useful in separating *violaceipennis* from *mickeli*. If confusing variations occur it will be necessary to check the complete descriptions. The most useful characters to use in separating *violaceipennis* from *clypeata* are given following the description of *clypeata*.

#### 17. *Podalonia occidentalis* new species

(Figures 12, 24, 50)

1865. *Ammophila robusta* Cresson, Proc. Phila. Ent. Soc. 4: 461-462. Female (in part).  
 1865. *Ammophila communis* Cresson, Proc. Phila. Ent. Soc. 4: 461-462. Male (in part).  
 ?1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40-42. Male, female (in part).  
 ?1903. *Ammophila grossa* Melander, Psyche 10: 156-164. Male, female (in part).  
 1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male, female (in part).  
 1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male, female (in part).

Male.—(See figure 12 for genitalia.) Length 14 mm. Head: clypeal margin extending downwards and slightly in-

wards for a short distance, then bending and extending almost transversely but slightly downwards for a shorter distance, there with a slight rounding, the margin then extending transversely to middle; clypeus moderately bulging above middle, slightly and broadly concave below middle; a moderate, not well-defined crescent-shaped depression in front of anterior ocellus; frontal suture distinct to ocellus, though much weaker in depression; surface of depression as well as of rest of frons granulate; frons with very large punctures, almost no tiny punctures; pilosity of head black. Thorax: collar moderately rounded; mesopleuron reticulate, with many large punctures, a few tiny punctures, a few short white sericeous hairs on lower part; metapleuron and propodeal side with many large punctures and confused ridges; metanotal flange small; pilosity of prothorax and mesonotum black, of rest of thorax white. Wings: cell R4 (3rd submarginal) about twice as wide at bottom as at top. Abdomen: first except at base, all of second, third except posterior dorsal part, and ventral half of fourth segments red, rest of abdomen black.

Female.—Length 16 mm. Clypeus bulging only very slightly in center, with many large punctures, surface reticulate; upper margin of clypeus well-marked in the form of a broad, shallow V. Thorax: pilosity entirely black. Abdomen: first, second, third, and ventral part of fourth segments red, rest black with an almost indiscernible bluish tint.

*Holotype*.—Male, Sargent, Colorado, June 24, 1929 (E. G. Anderson); it is located in the collection of the University of Minnesota at St. Paul, Minn.

*Allotype*.—Female, 22 mi. E. of Klamath Falls, Oregon, July 24, 1930 (H. A. Scullen); it is located in the collection of Oregon Agricultural College, Corvallis, Oregon.

Specimens examined: 46 ♂, 57 ♀; total specimens 103.

*Paratypes*.—

ARIZONA: ♂ [AES]; Mt. Lemmon, Santa Catalina Mts., ♀, July 27, 1917 [RD].

CALIFORNIA: Fallen Leaf Lake, El Dorado Co., ♀, July 1931 (O. H. Swezey) [CAS]; Hackamore, Modoc N. F., ♀, June 3, 1931 (K. A. Salman) [USNM]; Huntington Lake, 2 ♀, July 15, 1919 (F. E. Blaisdell) [CAS, UM]; Huntington Lake, 3 ♂, ♀, July 7, 12, 23, 1919 (E. P. Van Duzee) [CAS, UM]; Modoc N. F., ♀, June 26, 1931 (K. A. Salman) [USNM]; Mt. Fallao, ♂, July 1931 (O. H. Swezey) [CAS]; Sequoia Nat. Park, Giant Frst-Mrble Flk Kings R

trail, ♂, July 24, 1907 (J. C. Bradley) [CU]; Strawberry Valley, El Dorado Co., 2 ♀, July 7, Aug. 18, 1912 (E. C. Van Dyke) [CAS]. COLORADO: 5 ♂, 11 ♀ [USNM, UM, AES, HF, KU, INHS]; ♀ (T. D. A. Cockerell) [USNM]; 2 ♀, July (B. C. Kimball) [KSC, UM]; Creede, ♀, June 24, 1926 (E. G. Anderson) [UM]; Chimney Gulch, ♂ (N. Banks) [MCZ]; Elbert, ♂, June 9–11, 1922 [AMNH]; Halfway House, Pikes Peak, ♂, Sept. (Cockerell) [UC]; Halfway House, Pikes Peak, ♂, ♀, July 16–18, 20, 1902 (H. H. Newcomb) [MCZ]; 5 mi. NW. of McCoy, ♂, July 13, 1938 (R. Bauer) [UC]; 8 mi. S. of Mesa, scrub oak zone, ♀, July 12, 1938 (R. Bauer) [UC, UM]; Pikes Peak, ♂ ♀ in copulation, Aug. 19, 1904 [CS]; Pingree Park, ♀, Aug. 16, 1933 (H. G. Rodeck) [UC]; Roan Mts., above Ute trail, ♂, July (Cockerell) [UC]; Silver Plume, ♂, July 10, 1897 [AES]; Steamboat Springs, ♀, July 23, 1933 (H. J. Gibbons) [UC]; Ute Creek, 7 ♂, June 27, 28 (R. W. Dawson) [UN]; Ute Creek, 2 ♂, July 8 (H. S. Smith) [UN]; Virginia Dale, ♀, Aug. 2, 1935 (M. T. James) [CS]; Ward, ♂, June 25, 1922 [AMNH]; Westcliff, ♀, June 19, 1926 (E. G. Anderson) [UM].

IDAHO: Giveout, ♂, ♀, July 7, 1920 [AMNH].

MONTANA: Beaver Cr., ♀, Aug. 1913 (S. J. Hunter) [KU, UM].

NEW MEXICO: Clouderoft, ♀, June 28, 1932 (R. H. Beamer) [KU]; Jemez Mts., ♀, June 11 (Banks) [MCZ].

OREGON: Crater Lake Park, 2 ♂, 2 ♀, July 31, Aug. 8, 13, 25, 1930 (H. A. Scullen) [OAC, BM]; Crater Lake Park, nr headquarters, ♂, July 30, 1930 (F. Lyle Wynd) [OAC, UM]; 22 mi. W. of Crater Lake, Medford Road, ♀, Aug. 7, 1930 (H. A. Scullen) [OAC]; Hood R., ♀, July 17, 1931 (J. Nottingham) [KU]; Lake of the Woods, Klamath Co., ♀, July 18, 1930 (C. L. Godava) [OAC]; Lake of the Woods, Klamath Co., 3 ♂, July 21, 1930 (H. A. Scullen) [OAC, UM]; Lakeview, 2 ♀, July 24, 1930 (H. A. Scullen) [OAC, UM]; Mt. Jefferson, ♀, July 21, 1907 (J. C. Bridwell) [USNM]; Polina Lake, Deschutes Co., Canadian zone, ♂, Aug. 17, 1930 (H. A. Scullen) [HF]; Siskiyou Pass, Jackson Co., ♂, July 15, 1930 (H. A. Scullen) [OAC].

SOUTH DAKOTA: Custer, 2 ♂, 2 ♀ [UN].

UTAH: Beaver Canyon, ♀ [USNM]; Buckskin Valley, Iron Co., 2 ♂, ♀ [USNM, UM].

WASHINGTON: Pullman, ♂, June 20, 1901 [WSC].

WYOMING: Jackson, ♀, July 13–17, 1920 [AMNH].

ALBERTA: Delia, ♂, July 22, 1935 (E. H. Strickland) [UA]; Mayberries, ♀, Aug. 11, 1939 (E. H. Strickland) [UA]; Waterton, 2 ♀, July 10–13, 1923 (E. H. Strickland) [UA, UM].



NO LOCALITY: 6 ♀ [CS, USNM, AES].

Variations.—Sculpture of pleura, and especially of mesopleuron, rather variable; cell R4 (third submarginal) occasionally no wider at top than at bottom; in one specimen only two submarginal cells, the second transverse cubital missing. The shape of the clypeus varies slightly in both sexes.

For the best characters to use in separating *occidentalis* from *violaceipennis*, see the discussion under *violaceipennis*.

Typical specimens of this species are easily distinguished from typical specimens of *mickeli* and *robusta*. However, confusing variations occur in all these species, especially in the males. In the male *occidentalis*: ridges of metapleuron rather confused, generally running downwards and only slightly forwards; metanotal flange always small; thoracic pilosity generally white everywhere except on prothorax and mesonotum; cell R4 almost always twice as wide at bottom as at top; dark part of abdomen usually black. In the male *mickeli*: ridges of metapleuron not very distinct because of dense punctation; metanotal flange usually moderate in size; thoracic pilosity almost always entirely black, though sometimes it is partly white; cell R4 usually not much wider at bottom than at top; dark part of abdomen black. In the male *robusta*: ridges of metapleuron distinct, though more or less broken, generally slanting considerably forwards; metanotal flange varying from small to moderate; thoracic pilosity usually white in distribution range of *occidentalis* and *mickeli*; cell R4 not much wider at bottom than at top; dark part of abdomen usually distinctly bluish. If the specimens vary from the typical to any extent, it is absolutely necessary to rely on the male genitalia for the separation of these species.

The females of these three species are best distinguished by the shape and sculpture of the clypeus. In the female *occidentalis*: clypeus bulging only very slightly in center, surface reticulate. In the female *mickeli*: clypeus strongly bulging, peak of bulge at about center dorso-ventrally, very glossy between peak of bulge and margin, reticulate only along dorsal and lateral parts. In the female *robusta*: clypeus moderately bulging, peak of bulge below center dorso-ventrally, reticulate throughout.

#### 18. *Podalonia sericea* new species

(Figures 15, 23, 64)

- ?1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40–42. Male, female (in part).  
 ?1903. *Ammophila grossa* Melander, Psyche 10: 156–164. Male, female (in part).

- ?1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male, female (in part).  
 ?1908. *Psammophila grossa* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Female (in part).  
 1917. *Psammophila grossa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).  
 1917. *Psammophila violaceipennis* Rohwer, Proc. U. S. Nat. Mus. 53: 241. Female.  
 1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male, female (in part).  
 ?1928. *Podalonia violaceipennis* Williams, Proc. Hawaii Ent. Soc. 7: 163. Male, female.  
 1933. *Podalonia violaceipennis* Hicks, Pan-Pacific Ent. 9: 49-52.

Male.—(See figure 15 for genitalia.) Length 16 mm. Head: clypeal margin extending downwards and somewhat inwards from the eyes for a short distance, bending and extending slightly more inwards for an equal distance, then rounding smoothly and running slightly upwards to center, forming a broad but rather shallow central emargination; clypeus with very heavy white pubescence, black pilosity not very heavy; frontal suture distinct to anterior ocellus; a deep well-marked frontal depression, with many tiny punctures laterally, surface granulate near frontal suture; frons with a good many large somewhat elongated punctures, and a very great many tiny punctures; pilosity of head not heavy, black except on cheeks where some hairs have white tips. Thorax: collar broadly rounded; mesopleuron with large punctures well-spaced, and with a great many tiny punctures from which conspicuous white sericeous hairs arise, giving a marked sericeous appearance to mesopleuron; mesopleuron glossy, not reticulated; metapleuron with many shallow large and small punctures, some low ridges, and a glossy, somewhat wavy surface; propodeal side with rather weak ridges, front part with large punctures making the ridges less obvious; a weak sericeous patch beside petiole attachment; metanotal flange quite large, the edge tending to roll downwards slightly; prothorax and mesonotum with black pilosity, rest of thorax with mostly white pilosity, though with a few hairs black and some black at bases and white at tips. Petiole: slender and nearly straight. Abdomen: first segment black at base, rest of first, all of second and third, and half of fourth segments red, rest of abdomen dark blue.

Female.—Length 17 mm. Head: clypeus strongly bulging, surface reticulate, large punctures variable in size; upper edge of clypeus distinct, curved. Thorax: surface of meso- and metapleura glossy, not reticulate, with many tiny punctures between large ones; a thin spot of brownish sericeous hairs beside petiole attachment, an area on posterior part of metapleuron, a thin band in front of metapleural-propodeal suture, and an area in front of meso-metapleural suture extending somewhat over mesopleuron; pilosity of thorax entirely black. Petiole: only slightly longer than hind coxa, but rather slender. Abdomen: first, second, third, and lateral and ventral parts of fourth segments red, rest of abdomen dark blue.

*Holotype*.—Male, Niles, California, July 11, 1936 (A. E. Pritchard), located in the collection of the University of Minnesota at St. Paul, Minn.

*Allotype*.—Female, Laramie, Wyoming (28 mi. W.) 7700 ft. elev., Aug. 6, 1934 (H. A. Scullen), deposited in the collection of Oregon Agricultural College, Corvallis, Oregon.

Specimens examined: 82 ♂, 94 ♀; total specimens 176.

*Paratypes*.—

ARIZONA: ♂ [USNM]; Phoenix, ♀ [HF]; Prescott, ♀, July 10, 1910 (J. A. Kutsche) [CAS].

CALIFORNIA: Benicia, ♀, Aug. 14, 1910 (J. C. Bridwell) [USNM]; Burbank, ♀, Nov. 15, 1935 (C. H. Hicks) [CH]; Calexico, ♂, ♀, Aug. [MCZ, JB]; Devils Post Pile, ♂, Aug. 28, 1937 (E. G. Anderson) [UM]; Fresno Co., ♂ [USNM]; Giant Frst., Tulage Co., ♂, July 18, 1933 (C. L. Fox) [CAS]; Lond Canon, San Gabriel Mts., ♂, July 13, 1910 (F. Grinnell, Jr.) [USNM]; Los Angeles, 5 ♀, Sept. 16, 17, Oct. 8, 22, Nov. 23, 1927 (C. H. Hicks) [CH, UM]; Meadow Valley, Plumas Co., ♂, ♀, July 1, 4, 1924 (E. C. Van Dyke) [CAS, UM]; Milford, ♀, Aug. 29, 1933 (K. A. Salman) [USNM]; Mill Crk. Cyn., San Bernardino Co., ♀, Sept. 24, 1923 (E. P. Van Duzee) [CAS]; Mt. Shasta, ♀, June 29, 1935 (E. J. Beamer) [KU]; Needles, 2 ♀, Dec. 3, 1921 (J. A. Kutsche) [CAS, UM]; Pasadena, ♀, June 21, 1891 (R. W. Doane) [WSC]; Sacramento, 2 ♂, ♀, Sept. 27, 28, Oct. 6, 1916 (L. Bruner) [UN]; Santa Ana R., San Bernardino Mts., 2 ♂, June 14, Aug. 1, 1907 (J. Grinnell) [USNM, UM].

COLORADO: 3 ♀ [USNM, UN, CS]; ♀, May 27 [KSC]; ♂, ♀ [AES]; Boulder, ♂, June 18, 1933 (H. I. Gibbons) [UC]; Clear Creek, ♀ (Osler) [MCZ]; Colorado Springs, ♂, May 25, 1934 [CS]; Craig, ♂, June 30, 1931 (J. Nottingham) [KU]; Creede, ♀, Aug. 1914 (S. J. Hunter) [KU]; Delta, 5 ♂, June 26, July 3, 1938 (R. Bauer) (U.

Lanham) [UC, UM]; Denver, ♀, Oct. 5, 1901 [CS]; Ft. Collins, ♀, Sept. 12, 1934 [CS]; Massadona, ♂, 2 ♀, July 1, 1931 (R. H. Beamer) [KU, UM]; Poudre Canyon, W. of Ft. Collins, ♂, Aug. 8, 1934 (N. Dondelinger) [UC]; Powderhorn, ♂, June 23, 1926 (E. G. Anderson) [UM]; Pueblo, ♀, Aug. 9, 1920 [AMNH]; RM Boys Camp, RMNP, ♂, July 11, 1933 (Helen Rodeck) [UC]; Russell, ♂, July 12 (H. S. Smith) [UN]; Salida, ♀, Oct. 1898 [CS]; Ute Creek, 3 ♂, ♀, July 3, 17, Aug. 11 (L. Bruner) [UN]; Ute Creek, 7 ♂, ♀, June 28, July 1, 8, 30, Aug. 11 (R. W. Dawson) [UN]; Westeliff, ♂, June 19, 1926 (E. G. Anderson) [BM]; Westeliff, 2 ♀ (Ashmead) [USNM, UM]; White Rocks, Valmont, ♂, May 30, 1934 (M. & H. James) [CS].

IDAHO: Warren, Idaho Co., ♀ [MCZ].

ILLINOIS: Savanna, ♂, July 29, 1892 (Forbes & Shiga) [INHS].

MICHIGAN: South Haven, ♂, July 19, 1925 (E. G. Anderson) [UM]; Whitefish Pt., ♀, July 4, 1918 (A. W. Andrews) [USNM].

MONTANA: 5 ♀ [AES, UM]; Weeksville, ♂, Aug. 2, 1882 [MCZ].

NEBRASKA: Glen, Sioux Co., ♀, Aug. 12, 1906 (P. R. Jones) [UN]; Halsey, ♀, Aug. 29, 1912 (J. T. Zimmer) [UN]; Mitchell, ♀, Sept. 12, 1916 (R. W. Dawson) [UN]; Mitchell, ♀, Aug. 31, 1915 (E. M. Partridge) [UN]; Monroe Canon, Sioux Co., ♀, Aug. 13, 1912 (R. W. Dawson) [UN].

NEVADA: 3 ♂, ♀ [AES, UM]; Fallon, 3 ♂, May 25, June 10, 14, 1930 (E. L. Bell) [AMNH]; Reno, ♂, Sept. 1889 (F. H. Hillman) [USNM].

NORTH DAKOTA: Cannon Ball, ♂, 2 ♀, Aug. 20, 1922 (O. A. Stevens) [OS].

OREGON: Antelope Mt., Harney Co., ♂, Aug. 9, 1931 (D. K. Frewing) [OAC]; Arlington, ♂, July 15, 1931 (J. Nottingham) [KU]; Biggs, ♂, July 16, 1931 (J. Nottingham) [KU]; Boardman, 4 ♂, July 15, 1931 (J. Nottingham) [KU]; Chemult, ♀, Aug. 10, 1935 (H. A. Scullen) [OAC]; Cornucopia, Lookout Trail, ♀, July 24, 1936 (H. A. Scullen) [OAC]; Corvallis, ♀, Sept. 25, 1905 (Rickard) [OAC]; Corvallis, ♀, Aug. 23, 1932 (H. A. Scullen) [OAC, UM]; Crater Lake Pk., Je. Hwy. #97 & E. ent., ♂, Aug. 10, 1935 (Geo. Ferguson) [OAC, UM]; Dixie, 2 ♂, July 8, 1931 (J. Nottingham) [KU]; Island City, ♂, July 3, 1906 (Reynolds) [OAC]; Kooney Camp Springs, Sheep Mt., Grant Co., ♂, July 19, 1936 (H. A. Scullen) [OAC]; Prineville, ♂, Aug. 12, 1929 (H. A. Scullen) [OAC, UM]; Suttle Lake, ♂, Aug. 7, 1935 (H. A. Scullen) [OAC]; Umatilla, ♂, July 14, 1931 (J. Nottingham) [KU, UM].

SOUTH DAKOTA: Buffalo Vy., Stanley Co., ♀, Oct. 1-7, 1913 (W. H.

Over) [USNM]; Hot Springs, ♀, July 5, 1924 (H. C. Severin) [SD]; Hot Springs, ♀, Aug. 1, 1932 [SD]; Milesville, ♀, June 23, 1931 (H. C. Severin) [SD]; Pierre, 2 ♀ [SD, MCZ]; Pierre, ♂, ♀ [AES, UM]; Spearfish, ♂, July 28, 1924 (Severin) [MCZ].

UTAH: Cornish, ♂, Sept. 15, 1926 (G. F. Knowlton) [UM]; Jensen, ♂, July 27, 1930 (G. Fairchild) [RD]; Emery Co., 3 ♀, Sept. 6, 1921 (Grace O. Wiley) [UM]; Ft. Duchesne, ♂, Aug. 4, 1932 (F. K. Stoffers) [UAES]; Provo, ♂, July 29, Aug. 1, 1920 [AMNH]; Sand Dunes, ♂, July 13, 1923 (J. A. Harris, Jr.) [UM]; Trout Creek, ♂, July 23, 1933 (H. B. Stafford) [UAES].

WASHINGTON: Buena, ♀, July 1, 1923 (A. Spuler) [WSC]; N. Yakima, ♂, 2 ♀, July 15, Aug. 14, Sept. 26, 1903 (Eldred Jenne) [WSC]; Republic, ♂, Aug. 6, 1931 (L. D. Anderson) [KU]; Toppenish, ♀, July 24, 1924 (Spuler) [WSC]; Wawawai, ♀, June 9, 1908 (W. M. Mann) [MCZ]; Wawawai, ♀ (W. M. Mann) [CAS]; Wawawai, ♂, July 1898 [WSC]; Yakima River, ♂, July 4-5, 1882 (Nelson) [MCZ]; Yakima River, ♀ [MCZ].

WYOMING: Rawlins, 2 ♂, June 26, 1920 [AMNH].

ALBERTA: Edgerton, 4 ♀, Aug. 31, 1939 (E. H. Strickland) [UA, UM]; Manyberries, ♀, Aug. 11, 1939 (E. H. Strickland) [UA]; Medicine Hat, ♀, Aug. 9, 1939 (E. H. Strickland) [UA].

BRITISH COLUMBIA: Armstrong, ♀, July 4, 1931 (A. N. Gartrell) [CNM]; Copper Mtn., ♀, Aug. 7, 1928 (W. Stace Smith) [CNM]; Lytton, ♀, Aug. 2, 1931 (L. D. Anderson) [KU]; Merritt, 8 ♀, Aug. 3, 1931 (J. Nottingham) (R. H. Beamer) [KU, UM]; Okanagan Falls, ♀, July 24, 1917 (Sladen) [CNM]; Princeton, ♂, July 10, 1909 [MCZ]; Shingle Cr. Road, Keremeos, ♀, July 30, 1933 (A. N. Gartrell) [CNM].

MANITOBA: Aweme, ♂, ♀, Sept. 11, 1925 (R. D. Bird) [CNM].

SASKATCHEWAN: Radisson, ♀, July 30, 1907 (J. Fletcher) [CNM].

UNLABELED: 2 ♀ [CS, USNM]; ♂ (Snow) [KU]; ♂, June 8, 1901 [AES].

Variations.—Metapleuron sometimes wavy and with weak ridges over the entire surface; propodeal side sometimes definitely ridged everywhere. Male: length 10-16 mm.; rarely clypeal margin extending downwards and inwards a short distance, then bending sharply to run transversely to center without further bending or any central emargination; rarely frontal depression shallow and not well-marked; rarely clypeus with a few white pilose hairs; pilosity of cheeks rarely entirely white; all pilose hairs of thorax except on prothorax may be white; sometimes propodeum with a definite sericeous patch on each side of petiole attachment, and meso- and meta-

pleura occasionally rather sericeous; only very rarely that mesopleuron is not markedly sericeous, these cases apparently due mainly to rubbing; amount of red on abdomen occasionally reduced to second segment only; sometimes abdomen red and bright blue. Female: length 14–18 mm.; rarely mesopleuron without tiny punctures; fine brownish sericeous hairs sometimes conspicuous over entire meso- and metapleura and propodeal side; pilosity of posterior part of mesopleuron, and all of metapleuron and propodeum, white in several specimens; in several specimens abdomen entirely red.

This species is most closely related to *robusta* and *mickeli*. In the male *sericea*: frontal depression deep and well-marked, almost circular except where ocellus projects into it; mesopleuron with large punctures well-spaced, very many shallow tiny punctures from which white sericeous hairs arise, these hairs abundant up to rectangle; surface of mesopleuron glossy; metapleuron rather erinkly, ridges poorly marked and tiny punctures shallow, surface glossy and with white sericeous hairs; pilosity of thorax mostly white. In the male *robusta*: frontal depression moderately deep, elongated anteriorly, the limits not well-defined; usually only a few, and sometimes no sericeous hairs on meso- and metapleura; large punctures of mesopleuron numerous, surface of plate distinctly reticulate, therefore not as glossy as in *sericea*; metapleuron more or less distinctly ridged, surface reticulate; pilosity of thorax mostly white. In the female *sericea*: mesopleuron with a great many tiny punctures and a glossy surface, short brownish sericeous hairs more or less conspicuous. In *robusta* and also *mickeli*: mesopleuron with very few tiny punctures, surface reticulate and not highly glossy; brownish sericeous hairs occasionally present but not usually as conspicuous as in *sericea*. The notes under *mickeli* give the best characters for separating *mickeli* from *robusta*, and those notes on *mickeli* can be compared with these notes on *sericea* for separating *mickeli* from *sericea*.

19. *Podalonia robusta* (Cresson)

(Figures 18, 19, 25, 60)

1865. *Ammophila robusta* Cresson, Proc. Phila. Ent. Soc. 4: 461–462. Female (in part).  
 1865. *Ammophila communis* Cresson, Proc. Phila. Ent. Soc. 4: 462. Male (in part).  
 1882. *Ammophila communis* Provancher, Natural. Canad. 13: 13. Male, female (in part).

1883. *Ammophila communis* Provancher, Faun. Entom. Canad. Hym. 2: 614. Male, female (in part).
- ?1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40-42. Male, female (in part).
- ?1903. *Ammophila grossa* Melander, Psyche 10: 156-164. Male, female (in part).
1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male, female (in part).
1908. *Psammophila grossa* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Female (in part).
1908. *Psammophila violaceipennis* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Male (in part).
1917. *Psammophila grossa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).
1917. *Psammophila violaceipennis* Mickel, Univ. Nebr. Studies 17: 87-88. Male (in part).
1917. *Psammophila violaceipennis* Rohwer, Proc. U. S. Nat. Mus. 53: 241. Female.
1917. *Psammophila violaceipennis* Rohwer, Conn. Geol. & Nat. Hist. Surv. 22: 681. Male, female (in part).
- ?1925. *Psammophila grossa* Carter, Canad. Ent. 57: 132. Male, female.
1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37.
- ?1936. *Podalonia violaceipennis* Krombein, Ent. News 47: 93-99. Female.
1936. *Podalonia violaceipennis* Balduf, Canad. Ent. 68: 137-138. Female (in part).

Male.—(See figures 18 and 19 for genitalia.) Length 15 mm. Head: clypeal margin extending downwards and somewhat inwards for a distance, then bending and extending almost transversely but slightly downwards for an equal distance, then curving smoothly to run slightly upwards to center, forming a slight central emargination; frontal suture distinct to anterior ocellus; a rather long shallow frontal depression, its surface granulate; surface of frons with large rounded punctures and many tiny punctures, the latter especially noticeable along frontal suture and extending onto depression; pilosity of head moderately heavy, black. Thorax: collar broadly rounded; mesopleuron with very large round punctures, tiny punctures sparse on upper part but increasing in numbers below; surface of mesopleuron with very fine reticulation which cuts down

gloss; propodeal side and metapleuron with broken ridges and large punctures, surface reticulate and with very fine ridges; metanotal flange moderate in size; some pilose hairs of thorax all black, especially anteriorly, some all white, especially laterally, and some black basally and with white tips. Petiole: slender. Abdomen: first segment piceous, reddish laterally, second segment entirely red, third red at base ventrally, rest of abdomen dark blue.

Female.—Length 16 mm. Head: clypeus rather bulging, peak of bulge below middle of clypeus dorso-ventrally; clypeus with many large punctures and a reticulate surface throughout; upper edge of clypeus slightly curved; frontal depression not as evident as in male. Thorax: propodeal side and metapleuron more strongly ridged than in male; mesopleuron more conspicuously reticulate than in male; mesopleuron with almost no tiny punctures; pilosity of thorax entirely black. Petiole: slender, distinctly longer than hind coxa, proportion being 1.25 for petiole to 1 for coxa. Abdomen: first, second, and anterior half of third segments entirely red, rest of abdomen dark blue.

Redescribed from a male and a female, both having been compared with the holotype; male, Viking, Minnesota, Aug. 10, 1935 (D. G. Denning); female, Todd Co., Minnesota, Aug. 14, 1936 (D. Murray); both are located in the collection of the University of Minnesota, St. Paul, Minn.

*Holotype*.—Female, Colorado; located in the collection of the American Entomological Society, Philadelphia, Pa.

*Allotype*.—The male described herein is designated as the allotype.

Specimens examined: 296 ♂, 310 ♀; total specimens 606.

*Robusta* has been collected in the following states, provinces and countries: MAINE, NEW HAMPSHIRE (June 10–Sept. 18), VERMONT, MASSACHUSETTS, CONNECTICUT, NEW JERSEY, PENNSYLVANIA, MICHIGAN, WISCONSIN, ILLINOIS, MINNESOTA (June 10–Sept. 19), NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, TEXAS, MONTANA, WYOMING, COLORADO (May 18–Oct. 1), NEW MEXICO, UTAH, ARIZONA, IDAHO, WASHINGTON (May 25–Sept. 26), OREGON, CALIFORNIA, NOVA SCOTIA, NEW BRUNSWICK, QUEBEC, ONTARIO, MANITOBA, SASKATCHEWAN, ALBERTA, BRITISH COLUMBIA, MEXICO, COSTA RICA.

Variations.—Male: length 12–16 mm.; frontal suture occasionally obsolete in upper part of frontal depression; frontal depression sometimes scarcely evident; collar sometimes only moderately rounded; mesopleuron sometimes with many tiny punctures over



entire plate, and short ridges in front of the large punctures; white sericeous hairs sometimes arise from most of the tiny punctures of mesopleuron, these hairs not as long or as abundant as in *sericea*; rarely surface of anterior part of metapleuron glossy; rarely propodeal side and metapleuron with large round punctures and no ridges whatever; ridges of metapleuron and propodeal side sometimes strong and run across both segments; sometimes metanotal flange quite small; rarely dark part of abdomen black rather than dark blue; in western specimens dark part of abdomen usually more brilliantly blue than in eastern specimens; in one specimen abdomen entirely blue except for second segment, this being entirely red ventrally and with a narrow red band dorsally; pilosity of thorax varying from all white except on prothorax and mesonotum, where some hairs have black bases, to all black. Female: length 13–19 mm.; large punctures of frons occasionally irregular in size and shape, resembling those in *sericea*; occasionally ridges of metapleuron and propodeal side run strongly forwards; first four abdominal segments occasionally entirely red; pilosity of petiole, propodeum, meta- and mesopleura sometimes partly white, though the black hairs become more numerous anteriorly.

For distinctions between *robusta* and its most closely related species, see the notes following the descriptions of *sericea*, *violaceipennis*, *mickeli*, *occidentalis* and *parallela*.

## 20. *Podalonia parallela* new species

(Figure 61, male clypeus as in figure 25, genitalia as in figures 18 and 19)

1927. *Podalonia argentifrons* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 26–30. Male, female (in part).

Male.—(For genitalia see figures 18 and 19.) Length 13 mm. Head: clypeal margin extending downwards and somewhat inwards for a distance, then bending and extending almost transversely but slightly downwards for an equal distance, then curving smoothly to run slightly upwards to center, forming a slight central emargination; frontal suture distinct to anterior ocellus; frontal depression moderate, with a great many tiny punctures, giving a granulated appearance; rest of frons with a few well-spaced large punctures and a great many tiny punctures, surface rather glossy; pilosity of head black. Thorax: collar moderately rounded; mesopleuron with a moderate number of large round punctures, and a large number of tiny punctures from which short white sericeous hairs arise,

thus when held at proper angle entire plate except rectangle appearing thinly sericeous; these tiny punctures vary in size to the very minute punctures which produce the surface reticulation; large punctures of metapleuron tending to elongate posteriorly; surface of metapleuron ridged so as to give a slightly crinkly appearance, sparsely covered with sericeous hairs which become more numerous along metapleural-propodeal suture; propodeal side with large punctures arranged in rows which are separated by ridges, appearance of plate similar to metapleuron; propodeal side posteriorly and propodeal end sparsely sericeous; metanotal flange small; pilosity of thorax entirely black. Abdomen: steel blue.

Female.—Length 15 mm. Head: clypeus rather bulging, peak of bulge below center of clypeus dorso-ventrally; clypeus with scattered large and tiny punctures, surface reticulate; frons with fewer tiny punctures than in male, surface reticulate. Thorax: mesopleuron with a moderate number of large punctures, almost no tiny punctures, surface distinctly reticulate; metapleuron and propodeal side with distinct ridges running forwards and downwards; no sericeous hairs on pleura as in male.

*Holotype*.—Male, Big Bear Lake, San Bernardino Mts., California, July 16, 1934 (E. G. Anderson), deposited in the collection of the University of Minnesota, St. Paul, Minn.

*Allotype*.—Female, Auburn, California, Oct. 20, 1918 (L. Bruner), located in the collection of the University of Nebraska, Lincoln, Nebr.

Specimens examined: 19 ♂, 11 ♀; total specimens 30.

*Paratypes*.—

CALIFORNIA: Auburn, 5 ♂, 4 ♀, Sept. 20, 1916, Aug. 24, 1918 (L. Bruner) [UN]; Big Bear Lake, San Bernardino Mts., 2 ♂, July 16, 1934 (E. G. Anderson) [UM]; Bradley, ♂, April 27, 1919 (E. P. Van Duzee) [CAS]; Burbank, ♂, Nov. 15, 1935 (C. H. Hicks) [CH]; Mts. nr. Claremont, ♂ (Baker) [CU]; Crystal Lake, San Gabriel Mt., ♂, July 7, 1934 (E. G. Anderson) [UM]; Cr. Sp., ♂, Sept. 3, 1871 (Beckrus) [MCZ]; Mill Cr. Cn., San Bernardino Co., 2 ♂, Sept. 24, 1923 (E. P. Van Duzee) [CAS, UM]; Pacific Grove, Monterey Co., ♀, Sept. 20 (F. E. Blaisdell) [CAS]; Pasadena, ♂, Aug. 13 (Hayes) [OAC]; Pyramiol Pk., El Dorado Co., ♂, Aug. 8, 1912 (E. C. Van Dyke) [CAS]; Redlands, ♀, July 3, 1918 (H. A. Scullen) [OAC]; San Francisco, ♀, Sept. 8, 1920 (E. P. Van Duzee) [CAS]; San Jacinto Mts., ♂, July 21, 1929 (L. D. Anderson) [KU];

San Jacinto Mts., Tahquitz Valley, ♀, July 17, 1912 (J. C. Bridwell) [USNM]; Santa Monica, ♂, June 1892 (C. E. Hutchinson) [USNM]; So. California, ♀, Summer 1934 (A. C. Browne) [KS]; Stone Cn., Monterey Co., ♀, April 21, 1919 (E. P. Van Duzee) [UM].

Variations.—Rarely frontal suture obsolescent. Male: clypeal margin somewhat variable; sericeous hairs on mesopleuron more conspicuous in some specimens than in others; in one specimen extreme anterior part of metapleuron with one or two large punctures and a highly glossy surface; ridges of metapleuron and propodeal side sometimes rather strong and regular; a tendency for bluish color to show on places other than on abdomen: petiole, costa of wings, proximal segments of legs, and even some surface of head and thorax may show a more or less distinct bluish color.

Superficially *parallela* appears to be most closely related to the *argentifrons* group because of the entirely blue abdomen. Actually, however, it is extremely closely related to *robusta*, the only reliable separation being based on the color of the abdomen. The genitalia are apparently identical. The metanotal flange is smaller in *parallela* than in the typical *robusta*, the pilosity in the male is entirely black, while in *robusta* the pilosity is usually white on at least part of the thorax in the western part of the United States.

The best characters for separating the males and females of *parallela* from *mexicana* are given in the key to the species.

One may well doubt whether this should be considered as a distinct species or as a subspecies of *robusta*. *Parallela* does not offer the variation found in *robusta*, but appears to be quite uniform in many characters, as in the punctuation of the head and thorax, sericeous hairs on pleura, color of thoracic pilosity, size and shape of the metanotal flange, and in the size of the insect as a whole. Considering the present evidence, it is believed best to give *parallela* the rank of a distinct species.

## 21. *Podalonia caerulea* new species

(Figures 8, 44, 58)

Male.—(For genitalia see figure 8.) Length 13 mm. Head: clypeal margin extending downwards and slightly inwards for a considerable distance, then bending inwards slightly and extending a short distance, then bending inwards to extend transversely to center, a faint indentation in center; clypeus almost flat; frontal suture distinct to anterior ocellus; frontal depression shallow and not well-defined, surface granulate and without punctures; frons with a moderate number of large punctures,

with many tiny punctures, surface faintly reticulate and rather glossy; pilosity of head black. Thorax: collar narrowly rounded; mesopleuron with many large round punctures which become smaller and more separated posteriorly; surface of mesopleuron faintly reticulate and inclined to be crinkly; metapleuron and propodeal side with large punctures so close together as to give a coarsely reticulated appearance to these plates; metanotal flange very small; pilosity of thorax black. Head and thorax metallic blue, abdomen purplish blue.

Female.—Unknown.

*Holotype*.—Siskiyou Co., California, June 2, 1911 (F. W. Nune-macher), located in the collection of the United States National Museum at Washington, D. C.

Distinct from all known *Podalonia* by the metallic blue head and thorax, and also by the male genitalia. On the basis of color and certain other characters, *caerulea* appears to be most closely related to *parallela*. These resemblances may be entirely superficial, however.

This is the rarest species of the genus *Podalonia* in North America, being known only from the holotype, and an effort should be made by collectors to obtain more specimens. It is probable that this species is very limited in distribution.

22. *Podalonia mickeli* new species

(Figures 17, 21, 65)

1865. *Ammophila robusta* Cresson, Proc. Phila. Ent. Soc. 4: 461-462. Male, female (in part).  
 ?1891. *Ammophila robusta* Aldrich, Canad. Ent. 23: 136-137. Female.  
 ?1902. *Psammophila communis* Melander & Brues, Biol. Bul. 3: 40-42. Male, female (in part).  
 ?1903. *Ammophila grossa* Melander, Psyche 10: 156-164. Female (in part).  
 ?1903. *Ammophila violaceipennis* Melander, Psyche 10: 156-164. Male, female (in part).  
 1908. *Psammophila grossa* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Female (in part).  
 1908. *Psammophila violaceipennis* H. S. Smith, Univ. Nebr. Studies 8: 330-331. Male (in part).  
 1917. *Psammophila grossa* Mickel, Univ. Nebr. Studies 17: 87-88. Female (in part).  
 1917. *Psammophila violaceipennis* Mickel, Univ. Nebr. Studies 17: 87-88. Male (in part).

?1925. *Psammophila grossa* Carter, Canad. Ent. 57: 132. Male, female.

1927. *Podalonia violaceipennis* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, pp. 30-37. Male, female (in part).

Male.—(See figure 17 for genitalia.) Length 16 mm. Head: clypeal margin extending downwards and somewhat inwards for a short distance, then bending and extending slightly more inwards for an equal distance, then rounding smoothly and running slightly upwards to center, forming a rather broad and shallow central emargination; frontal suture distinct to anterior ocellus; frontal depression almost round except where the ocellus cuts into it; frontal depression reticulate, frons and vertex with many large punctures, and many tiny punctures except along frontal suture; pilosity of head very dense, black. Thorax: collar narrowly rounded at top; mesopleuron with many round large punctures, surface weakly reticulate with no ridges except ventrally; metapleuron with very many large elongated punctures, surface between punctures with weak reticulations; propodeal side with many large punctures which have short ridges in front of and behind them and tending to form rows; metanotal flange moderately large, slightly emarginate; pilosity of thorax entirely black. Petiole: black, heavier in middle below, giving the ventral side a curved appearance; about as long as or slightly longer than hind coxa and trochanter together. Abdomen: first, second, and anterior half of third segments red, rest of abdomen black.

Female.—16 mm. Head: clypeus strongly bulging, with many large punctures and a reticulate surface except between peak of bulge and anterior margin, this latter region highly glossy and with a few moderate-sized punctures; peak of bulge almost in middle of clypeus dorso-ventrally; upper edge of clypeus broadly V-shaped; frontal suture quite distinct, surface on each side finely reticulate; frontal depression shallow and more elongate than in male. Thorax: surface of mesopleuron distinctly reticulate, with large but almost no tiny punctures; metapleuron except anteriorly, and propodeal side with ridges between punctures. Petiole: stout, only very slightly longer than hind coxa, proportion being 1.1 for petiole to 1 for coxa; slightly bulging in middle below. Abdomen: first, second, and all but dorsal tip of third segments red, rest of abdomen black.

*Holotype*.—Male, Euclid, Polk Co., Minnesota, July 13, 1936 (D. G. Denning); it is deposited in the collection of the University of Minnesota, St. Paul, Minn.

*Allotype*.—Female, Itasca Park, Minnesota, July 1, 1936; it is deposited in the collection of the University of Minnesota.

Specimens examined: 69 ♂, 110 ♀; total specimens 179.

*Paratypes*.—

ARIZONA: Flagstaff, ♀, July 17, 1930 (T. F. Winburn, R. H. Painter) [KSC].

CALIFORNIA: Lake Tahoe, ♀, Aug. 22, 1916 (L. Bruner) [UN].

COLORADO: 4 ♂, ♀ [AES, USNM, UM]; Bennet Crk., ♂, Sept. 7, 1933 [CS]; Creede, 6 ♀, Aug. 1914 (S. J. Hunter) [KU, UM]; Cumbres, ♂, July 22–23, 1902 (H. H. Newcomb) [MCZ]; Lump Gulch nr. Gilpin, ♀, Aug. 8, 1934 (H. G. Rodeck) [UC]; Monte Vista, ♀, June 16, 1919 [AMNH]; Moraine Park, RMNP, June 29, 1933 (Helen Rodeck) [UC]; Pikes Peak, ♀, June 22, 1932 (M. J. Oosthuizen) [UM]; Pingree Park, Larimer Co., Aug. 17–22, 1925 (F. C. Hottes) [UM]; Pingree Park, Larimer Co., ♀, Aug. 15, 1934 (C. H. Hicks) [CH]; Pingree Park, Larimer Co., ♂, July 7, 1932 (S. C. McCampbell) [CS]; Pingree Park, Larimer Co., 2 ♀, Aug. 17, 1932, Aug. 14–19, 1933 (M. & H. James) [CS, UM]; Summit Vega Pass, ♀, July 28, 1877 [USNM]; Ute Creek, 2 ♀, July 3, 31 (L. Bruner) [UN]; Ute Creek, ♂, ♀, July 6, Aug. 15 (R. W. Dawson) [UN].

GEORGIA: ♀ (A. L. Melander) [WSC]. (Considerable doubt must be placed on this record.)

IOWA: Ames, 2 ♂ (E. D. Ball) [AES, UM]; Dickinson Co., ♀, June 23, 1934 (H. E. Jaques) [IWC]; Sioux City, ♀ (C. N. Ainslie) [UM].

KANSAS: ♀ [AES]; Cimmaron, ♂, June 6, 1926 (E. G. Anderson) [UM]; Riley Co., 2 ♀, Oct. (Marlatt) [USNM, UM]; Trego Co., ♀, Nov. 14 [KSC].

MINNESOTA: Ashby, ♀, Aug. 28, 1911 [UM]; Big Stone Co., ♀, June 22, 1910 [UM]; Big Stone Co., Artichoke twnp., ♀, Sept. 5, 1937 (W. Stehr) [WS]; Crookston, 2 ♀, Sept. 5, 1936, June 18, 1937 (D. G. Denning) [UM]; Detroit, ♀, Aug. 26, 1924 (O. A. Stevens) [UM]; Detroit, ♂, June 17, 1911 (C. H. Waldron) [OS]; Fergus Falls, ♂, ♀, Aug. 11, 25, 1911 (Stoner) [UM]; Fergus Falls, 2 ♀, July 17, 1911 (Zetek) [UM]; Ft. Snelling, ♀, July 3, 1923 (A. T. Hertig) [UM]; Itasca Park, ♀, July 6, 1936 (A. C. Hodson) [UM]; Itasca Park, ♂, 7 ♀, June 18, 19, 20, 21, 25, 28, July 11, 14, 1936 [UM, BM]; Kittson, 2 ♀, Aug. 20, 28, 1936 (D. G. Denning) [UM]; Lake Benton, ♂, Sept. 12, 1935 (C. E. Mickel) [UM]; Lancaster, ♂, 2 ♀, Aug. 26, 1935, Aug. 7, 1936 (D. G. Denning) [UM]; Laporte, ♀, Aug. 6, 1930 (D. G. Denning) [UM]; Marshall Co., ♀, July 28, 1911 [UM]; Norman Co., ♀, Sept. 7, 1937 (D. G. Denning) [UM]; Polk Co., ♂,

2 ♀, July 18, 29, 1936, July 5, 1937 (D. G. Denning) [UM]; St. Anthony Park, ♀, [UM]; Sedan, ♀, Sept. 19, 1929 (D. G. Denning) [UM]; Sherburne Co., sandbank, ♀, Sept. 25, 1924 (W. Carter) [UM]; Strandquist, ♂, Aug. 9, 1935 (O. Pearson) [UM]; Wall Lake, 2 ♀, Aug. 30, 1911, 1913 [UM].

MONTANA: ♂, 2 ♀ [AES, USNM]; Big Fork, ♂, June 22, 1904 [MSC, UM]; Moccasin, ♀, Aug. 1-15, 1915 (LeR. Moomaw) [USNM]; Rapelje, ♂, Sept. 11, 1928 [MSC].

NEBRASKA: Crawford, ♂, June 10, 1910 (L. Bruner) [UN]; Harvard, ♀, June 8, 1932 (Lyle Selko) [UN]; Holt Co., ♀ [UN]; Lincoln, ♂, 2 ♀, June, July [UN]; Mitchell, ♀, Sept. 12, 1916 (R. W. Dawson) [UN]; So. Sioux City, ♀, July 3, 1912 (L. T. Williams) [UN]; West Point, ♀, Sept. 20 [UN].

NEW MEXICO: Alto, ♂, June 24, 1932 (K. C. Doering) [KU].

NORTH DAKOTA: Beach, 7 ♂, 3 ♀, Aug. 17, Sept. 3, 5, 1921, Sept. 16, 1922, May 20, 1926 (C. N. Ainslie) [UM, BM]; Binford, ♂ ♀ in copulation, Aug. 25, 1919 (O. A. Stevens) [UM]; Bottineau, ♀, Aug. 25, 1919 (C. N. Ainslie) [UM]; Fargo, 2 ♂, 2 ♀, July 31, Aug. 10, 1910, Sept. 15, 1911 [OS, UM]; Gascoyne, 2 ♂, June 16, 1918 (O. A. Stevens) [OS]; Monango, ♀, July 3, 1913 (O. A. Stevens) [OS]; Sheldon, ♀, June 12, 1934 (O. A. Stevens) [OS]; Turtle Mts., ♂, July 8, 1917 (O. A. Stevens) [OS].

OREGON: Camp Umatilla, ♂, June 26, 1882 [MCZ]; Drake Peak, Lake Co., ♀, July 26, 1930 (H. A. Scullen) [OAC].

SOUTH DAKOTA: Brookings, ♂, 4 ♀ [MCZ]; Brookings, 3 ♂, ♀, May 26, 1891 [MCZ]; Buffalo, ♀, Sept. 9, 1927 (H. C. Severin) [SD]; Custer, 2 ♂ [MCZ, UN]; Elmira, ♀ [SD]; Hecla, ♀, June 19, 1933 (H. C. Severin) [SD]; Hot Springs, ♂ [AES]; Martin, 2 ♀, Aug. 25, 1929, Sept. 15, 1931 (H. C. Severin) [SD]; Rapid City, 2 ♀ [AES, UM, SD]; Sylvan Lake, ♀, Sept. 1, 1924 (H. C. Severin) [SD]; White River, Stanley Co., ♀, Sept. 1-5, 1913 (W. H. Over) [USNM].

WASHINGTON: Gulf of Georgia, ♀ (A. Agassiz) [MCZ]; Ilwaco, ♀, July 1918 (O. E. Miner) [WSC]; Little Spokane, ♂, July 26, 1882 [MCZ]; Pullman, ♂ [WSC]; Seaview, ♀, Sept. 12, 1918 (H. K. Plank) [USNM].

WASHINGTON TERRITORY: 10 ♂, 2 ♀ [AES, UM].

WYOMING: Bridge Basin, ♀ (S. Garman) [MCZ]; New Castle, ♂, July 1, 1911 (F. C. Bishopp) [USNM]; Yellowstone N. Park, ♀, July 23, 1930 [AMNH].

ALBERTA: Beaverlodge, ♀, July 19, 1931 (E. H. Strickland) [UM]; Gleichen, ♂, July 30, 1929 (H. L. Seamans) [CNM]; Lethbridge, ♂, ♀, July 7, 1909 (J. B. Wallis) [MCZ].

BRITISH COLUMBIA: Peachland, ♂, July 21, 1909 (J. B. Wallis) [MCZ]; Victoria, ♀ [AES].

MANITOBA: Aweme, ♀, July 3, 1917 (N. Criddle) [CNM]; Aweme, ♂, June 10, 1926 (R. M. White) [CNM].

SASKATCHEWAN: Regina, ♀, Aug. 8, 1886 (J. Fletcher) [CNM]; Rudy, ♀, July 19, 1907 (J. Fletcher) [CNM].

MEXICO: Escuinapa, Sinaloa (State), ♀ (J. H. Batty) [AMNH]; Meadow Vy., 2 ♀ (Townsend) [USNM, UM].

UNLABELED: ♂, 2 ♀ [UM].

Variations.—Male: length 10–16 mm.; margin of clypeus variable, sometimes appearing broadly transverse with a central emargination, sometimes appearing broadly rounded without any bending; frontal suture sometimes obsolescent in depression; some specimens with an obsolescent episternal suture below rectangle, and in one specimen this suture completely absent between rectangle and ventral side of thorax; fine sericeous hairs occasionally present on lower side of mesothorax; propodeal side and metapleuron sometimes with long distinct ridges; these plates occasionally heavily punctured giving them a very coarsely reticulated appearance; occasionally metanotal flange quite small; in a few specimens pilose hairs of meso- and metapleura and propodeum black basally and white apically, and very rarely pilosity entirely white on these plates. Female: length 12–18 mm.; very rarely clypeus slightly reticulate on lower part of bulge, in these cases not as glossy as typically; upper edge of clypeus sometimes scarcely marked.

This is one of the most difficult species to identify, due to its variations over its wide range. Only careful attention to a number of minute characters will separate *mickeli* from several closely related species in this genus. This is especially true in the males. The most closely related species are *compacta*, *robusta*, *sericea* and *occidentalis*. In the male *mickeli*: pilosity of head, and especially of clypeus, very dense; frontal depression short and crescent-shaped, otherwise frontal suture not depressed below rest of frons; metapleuron and propodeal side very heavily punctured, ridges not well-defined due to this punctation; metanotal flange moderate to large; petiole stout, heavier in middle below, thus with ventral side curving upwards posteriorly; dark part of abdomen always black; pilosity of thorax almost always entirely black. In the male *robusta*: pilosity of head only moderately dense; frontal depression elongated anteriorly, frontal suture depressed below rest of frons; ridges on metapleuron and propodeal side fairly distinct, large punctures not so abundant on these plates; metanotal flange moderate to small;



pilosity of thorax almost always white in specimens taken in the distribution range of *mickeli*; petiole slender, not distinctly bulging below; dark part of abdomen almost always a bluish-black or sometimes even a bright blue. In the female *mickeli*: clypeus very bulging, peak of bulge at about center of clypeus dorso-ventrally, area between peak of bulge and anterior margin glossy and without reticulation; area above bulge with a great many large punctures and many long black pilose hairs arising from them; petiole only slightly longer than hind coxa, stout, especially in middle below. In the female *robusta*: clypeus moderately bulging, peak of bulge being normally below center of clypeus dorso-ventrally, area between peak and anterior margin reticulate and not glossy; upper part of clypeus with only a few large punctures and only a few black pilose hairs; petiole distinctly longer than hind coxa, slender.

See also the notes following the descriptions of *compacta* and *occidentalis*.

### 23. *Podalonia compacta* Fernald

(Figures 20, 67, genitalia as in 17)

1927. *Podalonia violaceipennis* var. *compacta* Fernald, Proc. U. S. Nat. Mus. 71, Art. 9, p. 33. Male, female.

Male.—(Genitalia as in figure 17.) Head: clypeal margin extending downwards and inwards for a short distance, then bending and extending inwards but slightly downwards for the same distance, then curving upwards to center, forming a slight central emargination; lower part of clypeus with a slight suggestion of a reflexed condition; frontal suture distinct to anterior ocellus; a moderately long crescent-shaped frontal depression, surface granular and with no large punctures; except in frontal depression, frontal suture not depressed below level of frons; frons with many large and tiny punctures and a reticulate surface; pilosity of head moderately heavy, black. Thorax: collar narrowly rounded at top; episternal suture tending to become obsolescent below rectangle; mesopleuron with many large punctures, almost no tiny punctures, surface reticulate; metapleuron with prominent ridges which slant downwards and considerably forwards; propodeal side with prominent ridges, those on anterior part running forwards, remainder running forwards and downwards; metanotal flange quite small; pilosity of thorax black. Petiole: distinctly shorter than hind coxa and trochanter together, though longer than hind coxa alone; stout, and almost straight. Abdomen: first and second segments red,

third red with black markings dorsally and laterally; rest of abdomen black.

Female.—Length 15 mm. Head: clypeus moderately bulging, with many large punctures, some tiny punctures, and a smooth glossy surface; upper edge of clypeus scarcely marked. Thorax: metapleuron with ridges running almost due forwards. Petiole: stout, distinctly shorter than hind coxa, proportionate lengths being .91 for petiole to 1 for coxa. Abdomen: first, second, and third segments red, rest of abdomen black.

Redescribed from a male and a female deposited in the collection of Cornell University, Ithaca, New York; ♂, ♀, Harris, Humboldt Co., California, June 29, 1907 (J. C. Bradley).

*Holotype*.—Female, Sausalito, California; it is deposited in the collection of the American Museum of Natural History, New York.

*Allotype*.—Male, Sausalito, California; it is deposited in the collection of the American Museum of Natural History, New York.

Specimens examined: 5 ♂, 9 ♀; total specimens 14.

CALIFORNIA: 3 ♂, 4 ♀ [AES, UM]; ♀ [MCZ]; Harris, Humboldt Co., ♂, June 29, 1907 (Bradley) [CU].

OREGON: Corvallis, 2 ♀, July 1, 1910 (J. C. Bridwell) [USNM].

UNLABELED: ♀ [HF].

Variations.—Male: length 12–15 mm. Female: in one specimen first five abdominal segments red.

This species is most closely related to *mickeli*. The best characters to use in separating these two species are as follows. In the male *compacta*: metanotal flange small; petiole distinctly shorter than hind coxa and trochanter together. In the male *mickeli*: flange moderately large (in some specimens it is small); petiole about equal in length to coxa and trochanter, or slightly longer. In the female *compacta*: clypeus moderately bulging; proportion of petiole to hind coxa .91 to 1. In the female *mickeli*: clypeus strongly bulging; proportion of petiole to hind coxa 1.1 to 1. The male genitalia of these two species appear to be identical.

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## EXPLANATION OF PLATES I-V

Figures 1 through 18. Male genitalia, ventral view.

Figure 14. Drawing of genitalia of *valida* enlarged three-fifths as much as drawings of the other species.

Figure 19. Tip of aedeagus or penis valve of *robusta*, ventral view.

Figures 20 through 27, 31 through 39, and 42 through 48. Outline of clypeal margin.

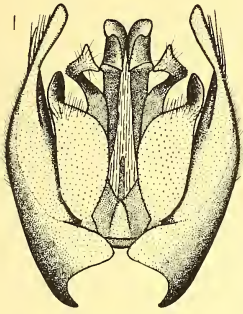
Figures 28 through 30. Arolium and tarsal claws.

Figures 40 and 41. Lateral view of clypeus, showing a reflexed condition in *melaena* and a slightly bulging condition in *mexicana*.

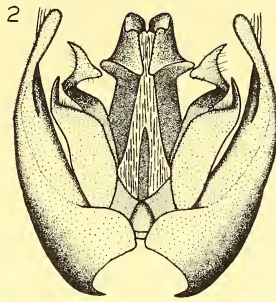
Figures 49 through 67. Maps showing distribution of species.

Figure 53. For *sonorensis nigra* read *sonorensis differentia*.

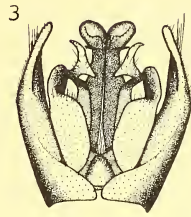




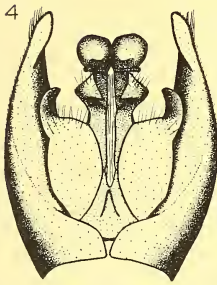
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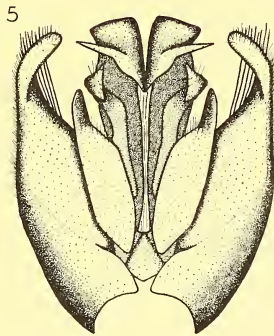
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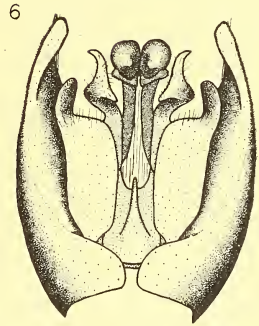
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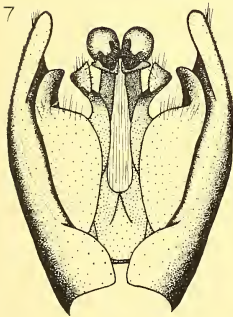
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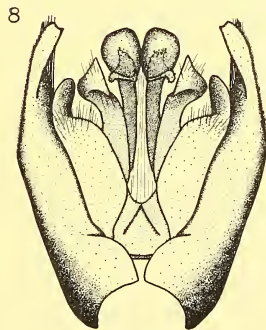
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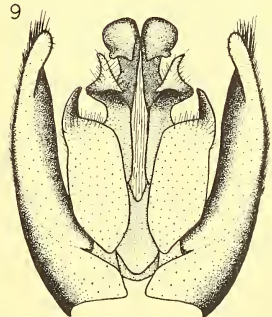
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ARGENTIFRONS

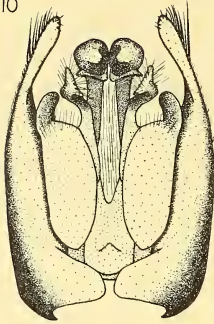


CAERULEA



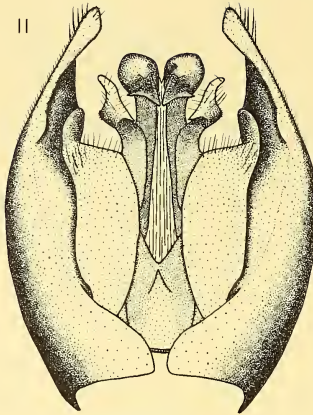
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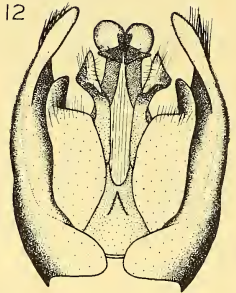
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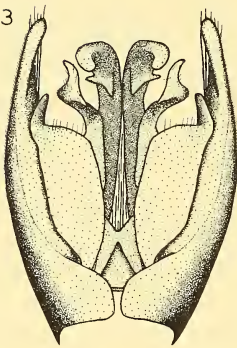
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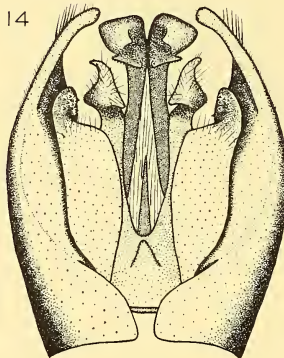
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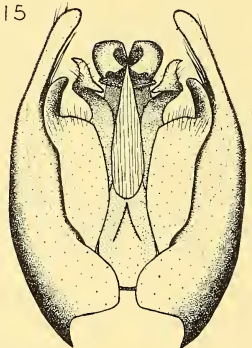
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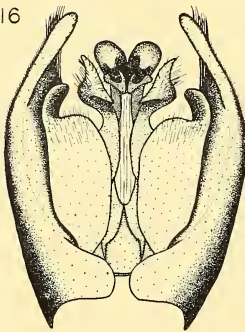
VALIDA

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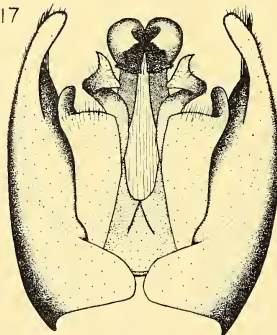
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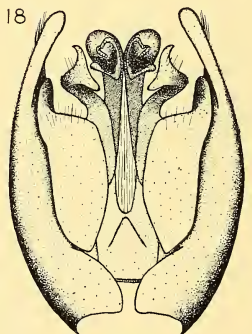
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17



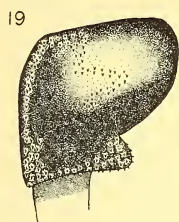
MICKELI

18



ROBUSTA

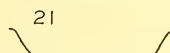




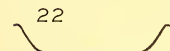
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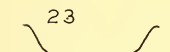
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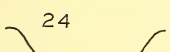
MICKEI ♂



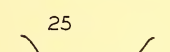
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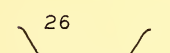
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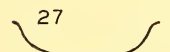
OCCIDENTALIS ♂



ROBUSTA ♂



MEXICANA ♂



CLYPEATA ♂



LUCTUOSA ♀



COMMUNIS ♀



ALPESTRIS ♀



MELAENA ♂



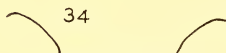
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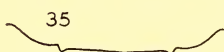
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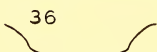
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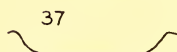
MORRISONI ♀



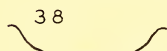
SONORENSIS ♀



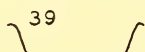
PUNCTA ♂



MELAENA ♂



ARGENTIFRONS ♂



MORRISONI ♂



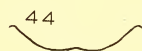
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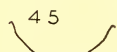
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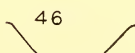
VALIDA ♂



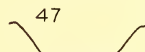
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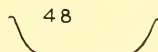
SONORENSIS ♂



ALPESTRIS ♂



COMMUNIS ♂



LUCTUOSA ♂

49



VIOLACEIPENNIS

54



CLYPEATA

50



OCCIDENTALIS

55



PUBESCENS

51



MELAENA

56



PUNCTA

52



ARGENTIFRONS

57



MORRISONI

53



• SONORENSIS  
▲ SONORENSIS NIGRA

58



CAERULEA



•• VALIDA  
 ▲• MONTANA



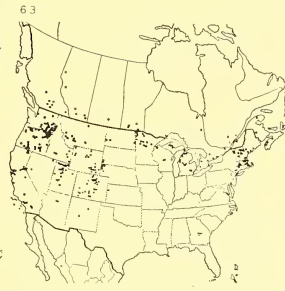
•• COMMUNIS  
 ▲• COMMUNIS ALPESTRIS  
 +• COMMUNIS INTERMEDIA



MICKELI



ROBUSTA



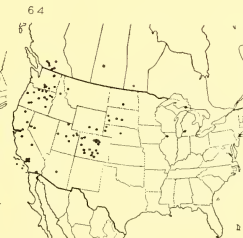
LUCTUOSA



MEXICANA



PARALLELA



SERICEA



COMPACTA



VOL. XX (New Series) JULY, 1940

No. 3

(Sec. of Entom.)

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# ENTOMOLOGICA AMERICANA

VOL. XX

JULY, 1940

No. 3

A REVISION OF THE GRASSHOPPERS OF THE GENUS  
*ORPHULELLA* GIGLIO-TOS, FROM AMERICA  
NORTH OF MEXICO (ORTHOPTERA;  
ACRIDIDAE)<sup>1</sup>

BY ASHLEY BUELL GURNEY

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE  
U. S. DEPARTMENT OF AGRICULTURE

## INTRODUCTION

For many years the genus *Orphulella* Giglio-Tos was considered to be more numerous in species than any other genus of Acridinae (the slant-faced grasshoppers, formerly the Truxalinae of authors) in the United States, and 21 different specific names have been assigned to the genus from America north of Mexico. Two species, *speciosa* (Scudd.) and *pelidna* (Burm.), are widely distributed and sometimes sufficiently numerous in grassland to be injurious. It has been well known that certain of the described species are synonyms and that various distribution records are incorrect, but there have been many unsolved problems in *Orphulella* and there has been no recent attempt to revise the genus. The present work attempts to provide a means of identifying the valid species and to bring

<sup>1</sup> Thesis submitted to the Graduate School of the Massachusetts State College, Amherst, Massachusetts, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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together information on their synonymy, distribution, biology, and importance.

This study has included the examination of more than 6,000 specimens of *Orphulella*. Material in such abundance was made available through the generous cooperation of others. The principal collections studied, and the institutions to which they belong, are indicated on succeeding pages. For the loan of specimens and for encouragement the writer is indebted to the following individuals: Morgan Hebard, J. A. G. Rehn, and H. Radclyffe Roberts, of the Academy of Natural Sciences of Philadelphia; T. H. Hubbell, of the Universities of Florida and Michigan, and Irving Cantrall of the latter institution; C. E. Mickel and Donald G. Denning, of the University of Minnesota; C. P. Alexander, of the Massachusetts State College; E. S. Thomas, of the Ohio State Museum; Philip J. G. Rock, of the Canadian Entomological Laboratory, Lethbridge, Alberta. Mr. Hebard and Mr. Rehn cordially extended the full privileges of the Academy during several visits to Philadelphia, and gave advice on various difficult problems; Mr. Roberts kindly made several helpful suggestions, and has permitted the use in this paper of several new terms to be treated by him in a forthcoming work on the terminology of male acridid genitalia; Mr. Denning made a special effort to collect mating pairs of *Orphulella*; Mr. Thomas has contributed notes on *Orphulella* as found in Ohio, drawn from his wide acquaintance with the Orthoptera of that State. Through the kindness of Nathan Banks, of the Museum of Comparative Zoology, Harvard College, it was possible to examine at Cambridge the types of Scudder's species. Lastly, the writer would express his appreciation to Dr. Alexander in particular for reviewing the manuscript.

The synonymy has been brought up to date, and, where the different named segregates have been based on cotype specimens, lectotypes have been selected. Perhaps the most important single result of the study has been the discovery that the aedeagus of the male genitalia is useful in distinguishing species. Since 1932, when T. H. Hubbell published a paper calling attention to the taxonomic value of the concealed genitalia of Cyrtacanthacrinae (spine-throated grasshoppers), these features have been widely used in *Melanoplus* and certain allied genera, but the genitalic characters of *Orphulella* are much less apparent than those of many species of *Melanoplus* and no previous attempts to utilize genitalia of *Orphulella* have been successful. External characters will permit the identification of most specimens of *Orphulella*, but the data accumulated on variation show that most external characters are unreliable



in some instances, and then the genitalia are of great value. Genera allied to *Orphulella*, especially those inhabiting the United States, have been considered. The author has proceeded on the assumption that the great majority of Nearctic grasshoppers have already been described, and that the important taxonomic work of the future will primarily be concerned with establishing the limits of genera, studying variation, and placing the species on a recognizable basis.

As a result of this investigation, only four species of *Orphulella*, two of which are composed of two subspecies each, are recognized as inhabiting the United States and Canada. During recent years the occurrence of subspecies in grasshoppers has been recognized, and the variation occurring within species of *Orphulella* is now sufficiently well known to justify the adoption of subspecific names in two instances where such adoption appears to be the logical interpretation of the species as they occur in nature. As an example of analytical work of this sort, Rehn (1923) has discussed and mapped the distribution of *Ligurotettix*, with an indication of the specimens intermediate between subspecies.

*Subspecific categories in Orthoptera.*—Early in the study of *Orphulella*, specimens were encountered from Montana and Wyoming which were not readily identifiable either as *desereta* Scudd. or *pelidna*, and the question was thus raised as to the distinctness of *desereta* as a species. Material fully typical of each form, such as that of *desereta* from Utah and that of *pelidna* from east of the Mississippi River, suggested so strongly the existence of populations worthy of different names that the placing of the more recent name, *desereta*, in synonymy appeared unwise. The comparison of specimens from many localities demonstrated that intergradation between *pelidna* and *desereta* (see fig. 2) occurs, and that they had best be treated as subspecies. The occurrence of specimens which are intermediate between the two in structural characteristics shows the impossibility of recognizing two distinct species and is evidence of the intergradation that is usually sought in support of the subspecific status of populations. The problem of *Orphulella halophila* R. & H. and *olivacea* (Morse) of the Atlantic and Gulf Coasts was even more perplexing than that of *pelidna*, and is not yet fully understood, though considerable evidence of intergradation is available and the two forms are provisionally treated as subspecies.

In recent years both European and American orthopterists have frequently recognized the existence of geographic races; in Orthoptera these are generally considered the equivalent of subspecies. The use of subspecific categories has been developed to such an

undesirable extent in certain orders of insects that some taxonomists are opposed to the use of any trinomials. A similar confusion could easily exist in Orthoptera by the indiscriminate naming of forms occurring in the same area based on color variation and wing length. However, in North American Orthoptera most such forms unworthy of names have already been placed in synonymy. The collection and study of large series indicates that, in many genera, the recognition of races of a given species is the only sound interpretation of the species as it occurs in nature. Geographic races are units of a species which intergrade where their respective areas of distribution meet, but are well demarked in the remainder of their respective ranges.

Ginsburg (1937, 1938, 1939, 1940), working mainly with fishes, has studied subspecific categories from the standpoint of structural variation, and he has attempted to record the variation on mathematical and graphic bases. He has emphasized the overlapping in subspecies of characters that ordinarily distinguish species when overlapping is absent.

In certain other orders species are known of which subspecies of a different nature, often based upon host relationships, occur. As the food habits of Orthoptera become better known, such types of physiological subspecies may be more generally recognized; Fulton (1926) has already pointed out the significance of food plants in the case of the subspecies of *Oecanthus nigricornis* Walk.

McClung (1908) called attention to the value of cytology in taxonomy, and he has subsequently shown that chromosomal characters are useful in recognizing the limits of certain species and higher categories in Orthoptera. Rehn (1919) described *Mermiria maculipennis macclungi* as a subspecies partly because of the differences in genetic makeup which had been demonstrated by McClung. Dobzhansky (1937) and others are now working with genetics in conjunction with taxonomy, and their work supports the belief that subspecies are steps in the natural evolution of species.

Species are not static units in nature, and a conservative use of the geographic race in North American Orthoptera seems justified by the data now available, which are more extensive in many genera than those available in most other orders of insects. Hebard (1929a) has discussed subspecific categories as related to Orthoptera. He has stressed the point that a species composed of subspecies is not the same as a species that has extremes which vary gradually and evenly from one to the other. Subspecies are characterized by "virtually constant differences," and each occupies an area that is

“almost always very extensive.” While the distinguishing features are “virtually constant over considerable areas, there are intervening (usually much more restricted) areas showing every intermediate gradation.”

The Genus *Orphulella* Giglio-Tos

*Orphulella* Giglio-Tos, Bol. di Zool. Anat. Comp., Vol. 9, No. 184, p. 10, 1894; Morse, Psyche, Vol. 7, p. 407, 1896; Scudder, Canad. Ent., Vol. 31, p. 177, 1899; Scudder, Proc. Dav. Acad. Nat. Sci., Vol. 8, p. 23, 1899; Bruner, Biol. Cent.-Amer., Orth., Vol. 2, pp. 31, 74, 1902, 1904; Rehn, Proc. Acad. Nat. Sci. Phila., Vol. 56, p. 518, 1904; Kirby, Syn. Cat. Orth., Vol. 3, p. 119, 1910; Bruner, Ann. Carn. Mus., Vol. 8, No. 1, p. 9, 1911; Hebard, Trans. Amer. Ent. Soc., Vol. 52, p. 54, 1926; Rehn and Hebard, Ibid., Vol. 64, p. 203, 1938. (Genotype, *Acrydium punctatum* Degeer, designated by Rehn, 1904.)

*Generic Description*

(Based primarily upon the genotype and the species north of Mexico; exceptions in certain features may occur in some Neotropical species now assigned to *Orphulella*.)

Form typically truxaline, rather slender, brachypterous to fully winged. Face retreating considerably; fastigium produced, acute to obtuse in dorsal view, lateral carinae well developed, median carina lacking or rarely indicated mainly by color, impression broad and varying in extent from an area near apex to one as long as width of fastigium; lateral foveolae triangular or obsolete, rarely slightly visible from above; frontal costa feebly sulcate to slightly swollen, diverging toward clypeus, narrowest at fastigio-facial angle, not widened between antennae; compound eyes moderately conspicuous, axis dorso-anterior to ventro-posterior; antennae filiform, sometimes feebly depressed.

Pronotum elongate; median carina not arched, rarely subobsolete on part of prozona, otherwise distinct, cut only by principal sulcus; lateral carinae distinct, sometimes obsolete between sulci of prozona, diverging posteriorly on metazona, usually angulate or curved on prozona, rarely parallel on prozona, cut by principal sulcus and usually by two incomplete sulci on prozona; supplementary carinae absent; surface of disk weakly convex between carinae, smooth to punctate; anterior margin of dorsal surface entire, truncate to gently rounded;

posterior margin broadly rounded to obtusely angulate; lateral lobes curving to meet dorsal surface, supplementary carinae absent, anterior margin usually gently retreating, ventral margin broadly irregular, unarmed, posterior margin straight or concave; prosternum simple; mesosternal lobes well separated, interspace quadrate to longitudinal; metasternal lobes attinent (males) to well separated (females); tegmina usually fully developed, rarely short, apices rounded; intercalary area (between median and anterior ulnar veins) without intercalary vein, a spurious vein often present; ulnar area (between anterior ulnar and posterior ulnar veins) with or without spurious vein; reticulation at apex regular; wings usually well developed and capable of producing flight, rarely short, degree of fenestration of ulnar area variable; spines on external dorsal margin of hind tibia rarely exceeding 12 in number; internal apical spurs equal; fine stridulatory teeth (not pegs) on inner surface of basal half of hind femur well marked (male) to obsolete (female).

Cerci simple, tapering, often conical; scoop of dorsal valve of ovipositor carinate on lateral margin, untoothed, apex up-curved, acute; ventral valves unarmed excepting subapical ventro-lateral lobe; female subgenital plate (see figs. 14, 15) with median projection (including egg guide) and lateral specialization; male subgenital plate (apical sclerite of ninth sternite in male Acrididae) bluntly conical; valves of aedeagus well sclerotized.

Although color alone is of questionable merit as a generic character, the structural characters of many genera are accompanied by color patterns that are typical and helpful in sorting material rapidly by habitus. In *Orphulella* the general coloration varies from green to black, but is usually of a green or brown shade. The body and tegmina may be of rather uniform color, or there may be one of many diversified color patterns. Morse (1920, p. 434) has noted the various color combinations. The lateral pronotal carinae are sometimes conspicuously pale. Dusky lateral stripes may extend backward from each eye to the tegmina, which may be uniformly colored or divided into two or three well defined color areas. The tegmina often have dark elongate maculations in the discoidal field. The wings are sometimes slightly fuscous along their outer margins. Pale episternal stripes may mark the sides of the thorax, and the hind femora may be uniform light brown or have dark spots and

bars. The hind tibia is most often weak fuscous to brown, sometimes with a pale annulus near the base.

#### *Position of Genus*

The classification of acridine genera has changed considerably since Brunner (1893, pp. 118-123) presented a key to the principal genera and indicated generic groups in his classic *Système des Orthoptères*. In his group Orphulæ were 5 genera, including *Chlocaltis* Harris. Although McNeill (1897), in his Revision of the Truxalinae of North America, made certain errors that now appear serious, as the wide separation of *Napaia* McNeill and *Chlocaltis*, he did treat *Dichromorpha* Morse, *Clinocephalus* Morse, *Orphula* Stål, and *Alpha* Brunner in that order, and this arrangement is largely preserved in our current classification. Except for *Neopodismopsis* Bey-Bienko, *Napaia* and *Chlocaltis* are the only American genera of the group Chrysochraontes. McNeill placed species now referred to *Orphulella* in *Orphula*. *Alpha* was later renamed *Cordillacris* Rehn. Scudder (1899b) included *Chlocaltis* in the Orphulæ and placed *Alpha* and *Phlibostroma* Scudder in his group Phlibostromæ. This last group has been retained, and *Cordillacris* is included therein, instead of with *Orphulella*. However, the distinguishing characters of *Cordillacris* and *Orphulella* are compared later for the sake of completeness.

In recent American literature the supergeneric group containing *Orphulella*, separated from the group Orphulæ, has been known as the Orphulellæ. There are numerous Neotropical genera falling within this group; among these *Orphulina* Giglio-Tos and *Parachlocobata* Bruner are particularly suggestive of *Orphulella*. The nomenclature involving *Orphula* has been confused by the misapplication of Stål's name by most authors preceding Rehn (1916, p. 275; 1917, p. 344), who showed that the insect identified as *Orphula pagana* (Stål) by Giglio-Tos, Bruner, and others is really *Paratruxalis filatus* (Walk.). Rehn used topotypes of the true *pagana* from Pará, State of Pará, Brazil, as evidence of the previous misidentification.

The position of *Orphulella* among allied genera found within the United States is indicated by the following linear sequence of a portion of our native genera taken from Hebard (1926), who published a key to the genera of Acridinae occurring north of Mexico, namely, *Mesochloa* Scudder, *Phlibostroma* Scudder, *Esselenia* Hebard, *Cordillacris* Rehn, *Orphulella* Giglio-Tos, *Clinocephalus* Morse, *Dichromorpha* Morse, *Chlocaltis* Harris, *Napaia* McNeill. Of these, only

*Cordillacris*, *Clinocephalus*, and *Dichromorpha* are closely related to *Orphulella*, and the last is easily distinguished from them.

Students who may use Hebard's 1926 paper as a guide are reminded of the following important generic changes that have occurred since its publication: Rehn (1927) described *Zapata salvator* from Arizona, the genus *Zapata* Bruner not having been previously recorded from north of Mexico; Rehn (1927) described the genus *Drepanopterna*, based upon *Aulocara femoratum* Scudder; Rehn, in Hebard (1928, p. 231), placed *Stirapleura* Scudder as a synonym of *Psoloessa* Scudder; Bey-Bienko (1932) described the genus *Neopodismopsis*, based upon *Chrysochraon abdominalis* Thomas, which had previously been removed from *Chloea* to its original genus by Rehn (1928); Hebard (1935) described *Aeropedellus*, based upon *Gomphocerus clavatus* Thomas, the genus *Gomphocerus* Thunberg in the present restricted sense not occurring in America; Hebard (1937), under the name *Metalepta brevicornis* (Johannson), called attention to the generic transfer of the species, which had been referred to *Truxalis* for many years.<sup>2</sup>

In reviewing the generic relationships of *Orphulella*, the male genitalia of the following American genera were examined: *Mesochloa*, *Phlibostroma*, *Cordillacris*, *Orphulina*, *Parorphula*, *Clinocephalus*, *Dichromorpha*, *Parachloebata*, *Sisantum* Bruner,<sup>3</sup> *Para-*

<sup>2</sup> The genus *Metaleptea* was proposed by Brunner (1893) without species being mentioned by name, but in a sense that is unquestionably binary, thereby giving the genus validity. The spelling *Metalepta* was given, probably in error, by Sharp in the Zoological Record for 1893, but this spelling is preoccupied by *Metalepta* Baly, 1861, in Coleoptera. Latreille designated the genotype of *Truxalis* as "*nasutus*, Fab." in 1810; this is the *nasutus* of Linnaeus and is generically distinct from *brevicornis* (Joh.), which under Opinion 46 of the International Commission on Zoological Nomenclature is genotype of *Metaleptea*. Bruner (1895) used the name "*Metalepta (Tryxalis) notochloris* Pal. Beauv.," a synonym of *brevicornis*, and Giglio-Tos (1897a) associated the name *brevicornis* of Linnaeus and Stål with *Metaleptea*. The latter usage certainly, and probably the former also, satisfies the requirements for type designation outlined in category 5 of Opinion 46. *Truxalis* is restricted to the Old World, but falls as a synonym of *Acrida* L. The combination *Metaleptea brevicornis* (Joh.) is therefore to be followed.

<sup>3</sup> Hebard (1922, p. 103) placed *Sisantum* as a synonym of *Thyriptilon* Bruner, but later (1932, p. 236) treated the name

*truxalis* Rehn and *Metaleptea* Brunner. In all except two genera the genotypic species were studied, the exceptions being *Orphulina balloui* (Rehn) and *Parachloebata scudderi* (Bolivar).

This brief examination of genitalia suggests that in natural genera the epiphallus and aedeagus each conforms to a rather uniform pattern and that in most cases the generic relationships indicated by genitalia conform to those already based upon external structures. For instance, *Sisantum* is found to possess genitalia close to those of *Orphulella*, but decidedly different from those of *Metaleptea*. External features, such as the oblique apex of the tegmina, suggest the relationship of *Orphula* and *Sisantum* to each other and to *Metaleptea*; the latter is a member of the group Hya-lopteryges, but Hebard (1922, p. 103) has pointed out that *Orphula* is really an aberrant member of the Orphulellae, and the genitalia would probably support that view.

The genitalia of *Parachloebata* and *Dichromorpha* are of a type similar to each other and somewhat different from those of *Orphulella*; the last is approached more nearly by *Clinocephalus*, *Orphulina*, and *Parorphula*. The aedeagus of *Phlibostroma* is not particularly unlike that of the type found in *Orphulella*, but the posterior lobes of the epiphallus are distinct from any examined, this wide difference being in keeping with important external features.

The generic arrangement of *Orphulella* and its allies in the "Biologia" (Bruner, 1904) and Kirby's Catalogue (1910) is naturally somewhat out of date, owing to nomenclatorial changes or faulty associations of genera.

The following key is intended to be used for the included genera only as they occur north of Mexico. The genitalic characters used will be found helpful in cases of doubtful identity, but habitus and the form of the pronotum will usually place a specimen in its proper genus. North of Mexico, *Clinocephalus* and *Dichromorpha* each contains a single species. The other species of *Cordillacris* differ somewhat in the structure of the epiphallus from that of *Cordillacris occipitalis* (Thos.) (fig. 67), and the same is true of species of *Sisantum* as valid. In recent correspondence (August 24, 1939), H. Radclyffe Roberts, of the Academy of Natural Sciences of Philadelphia, has reported on an examination of *Sisantum*, *Thyripton*, and *Cumarala* Hebard, each of which contains a single species, and suggests that, while arbitrarily they may be considered distinct genera, they are so closely related that little seems to be gained by such separation.

*Dichromorpha* occurring south of the United States when compared with *Dichromorpha viridis* (Scudder) (fig. 66).

KEY TO THE GENUS *ORPHULELLA* AND CLOSELY ALLIED GENERA  
FROM AMERICA NORTH OF MEXICO

1. Lateral carinae of pronotum well indicated in color, but structurally obsolete on prozona and subobsolete on metazona; antennae subsensiform; metasternal lobes of male separated; marginal field of tegmen moderately fenestrate; lower ovipositor valve of female with first ventral basivalvular sclerite about as broad as long (fig. 60), giving the lower valve a shortened appearance; valves of aedeagus sharply and evenly acute (fig. 54). (In area north of Mexico, not known east of Mississippi River) ..... *Cordillacris* Rehn.

Lateral carinae of pronotum well indicated structurally, occasionally subobsolete on prozona; antennae filiform; metasternal lobes of male contiguous; marginal field of tegmen not fenestrate; first ventral basivalvular sclerite elongate, giving the lower valve of the ovipositor a more exerted appearance; aedeagus not as above ..... 2

2. Lateral carinae of metazona diverging posteriorly, or, if nearly parallel (certain specimens of *Orphutella speciosa* like those upon which the synonym *O. decora* (McNeill) was based), with the metazona and prozona subequal in length; epiphallus of male with posterior lobes as in fig. 65 in lateral view. (Occurs throughout the United States and southern Canada).

*Orphulella* Giglio-Tos.

Lateral carinae of metazona parallel, or, if diverging feebly (some specimens of *Clinocephalus*), with prozona considerably longer than metazona; epiphallus of male with posterior lobes (figs. 64, 66) not grouped as above ..... 3

3. Lateral carinae of metazona parallel; lateral lobes nearly vertical and forming a right angle with the deplanate dorsal surface; posterior and median lobes of male epiphallus as in fig. 66; female subgenital plate (fig. 58) with rather broad truncate projection at base of egg guide. (In area north of Mexico inhabiting eastern half of country, not known west of Great Plains.) ..... *Dichromorpha* Morse.

Lateral carinae of metazona often diverging weakly; lateral lobes decidedly rounded at junction with dorsal surface, the latter less deplanate than above; posterior and median lobes of male epiphallus grouped as in fig. 64; female subgenital



plate (fig. 61) with projection at base of egg guide narrower than above and less regularly truncate. (Atlantic and Gulf Coasts, New Jersey to Texas, inland only in Southern States.)

*Clinocephalus* Morse.

#### HISTORY OF WORK ON THE SPECIES OF *ORPHULELLA*

Previous to the proposal of *Orphulella* in 1894, numerous species, now assignable to that genus, had been described. Of the 21 specific names which have been referred to the fauna north of Mexico, 12 were originally assigned to other genera. The first species was *pelidna* Burm. 1838, described in *Gomphocerus*. Saussure's *Oxy-coryphus toltecus* 1861 has been recorded only indirectly, through Hebard's placing (1932) of *Orphulella orizabae* (McNeill) 1897 in the synonymy of *Orphulella tolteca* (Sauss.). As will be pointed out later, *Stenobothrus tepanecus* Sauss. 1861, now referred to *Orphulella*, is a Mexican species which was recorded from the United States (probably incorrectly) by McNeill (1897) and Scudder (1899a).

In his "Materials for a monograph of the North American Orthoptera," 1862, S. H. Scudder described 5 species, *aequalis*, *bilineatus*, *maculipennis*, *propinquans*, and *speciosa*. These were described in *Stenobothrus* and all except *speciosa* have now fallen into synonymy. The species *gracilis* Scudd. (1872) and *olivacea* Morse (1893) were also described in *Stenobothrus*.

The publication of Brunner's "Système" (1893) called the genus *Orphula* Stål to the attention of American workers, and, though *Orphulella* was proposed the following year, the distinctions between the two were not entirely clear (see Morse 1896, p. 407), and McNeill (1897) described *decora* and *orizabae* in *Orphula*. *Orphulella* was first recognized as a Nearctic genus by Scudder (1899a) in his revision of the North American species, and 7 species were described from north of Mexico, *affinis*, *compta*, *desereta*, *obliquata*, *picturata*, *pratorum*, and *salina*. The only species since described are *graminea* Bruner (1904) and *halophila* R. & H. (1916).

While it was the need of revisionary study that prompted the present work on the genus as known from north of Mexico, and while the species occurring south of the United States are still badly in need of revision, several papers have been published which assemble data on the species of various faunas. Besides Scudder's revision (1899a), the most comprehensive work is that of Bruner (1904) in the *Biologia Centrali-Americana*. The limitations of the two latter

works, due to changes in nomenclature and in our concepts of variable species, are shown by the fact that of 15 species mentioned by Scudder 10 are now in synonymy or have an otherwise different status from that accorded them by Scudder; of 25 species treated by Bruner at least 17 are known to have a different status.

In his "Guide," Scudder (1897) retained the genus *Orphula*, but later in the "Catalogue" (1899b) and "Index" (1901) adopted *Orphulella*. In recent years the species of the United States have gradually become better known, owing mainly to the individual and joint work of Hebard and Rehn in the numerous papers cited. Their extensive collections have permitted a much more thorough study of variation than was possible for most earlier students. A. P. Morse, long a special student of New England Orthoptera, gave careful attention to *Orphulella*, and helpful notes by him appeared in several papers, culminating in his "Manual of the Orthoptera of New England" (1920). Like Hebard and Rehn, Morse appreciated the advantages of large series in the study of variation, and his extensive collecting throughout New England, as well as in southern and western States, gave him a broad knowledge of the genus. The treatment of *Orphulella* by Blatchley (1920) is valuable when one is studying the species occurring east of the Mississippi River, and, since the nomenclature of the species of that area requires little modification, his work will remain helpful to eastern students.

While the Neotropical species of *Orphulella* are not covered by the present paper, attention may be called to certain of the more important sources of information regarding them. Kirby (1910) listed the species and synonymy known to him, and followed Rehn's designation (1904) of *punctata* (Degeer) as genotype. In addition to his treatment in the "Biologia" (1904), Bruner (1906) gave a key to the species of Paraguay, and later (1911) gave a synopsis of the South American species. In important faunistic studies of the Orthoptera of Colombia, Panama, Ecuador, and Mexico, Hebard (1923, 1924a, 1924b, 1932) has contributed materially to our knowledge of distribution and synonymy, and Rehn and Hebard (1938) discuss several species occurring in the West Indies.

The 21 specific names found in the literature of the United States fauna are in the following alphabetical list, with an indication of the present status of the species or a note explaining distribution records. The genus in which each was originally described is in parentheses. Full discussion of synonymy follows in the detailed treatment of species.

STATUS OF SPECIFIC NAMES TO WHICH MATERIAL OF *ORPHULELLA*  
FROM AMERICA NORTH OF MEXICO HAS BEEN REFERRED

- aequalis* Scudder 1862 (*Stenobothrus*). Synonym of *speciosa*.  
*affinis* Scudder 1899 (*Orphulella*). Synonym of *compta*.  
*bilineatus* Scudder 1862 (*Stenobothrus*). Synonym of *speciosa*.  
*compta* Scudder 1899 (*Orphulella*). Valid species.  
*decora* McNeill 1897 (*Orphula*). Synonym of *speciosa*.  
*desereta* Scudder 1899 (*Orphulella*). Subspecies of *pelidna*.  
*gracilis* Scudder 1872 (*Stenobothrus*). Synonym of *speciosa*.  
*graminea* Bruner 1904 (*Orphulella*). Synonym of *compta*.  
*halophila* Rehn and Hebard 1916 (*Orphulella*). Subspecies of  
*olivacea*.  
*maculipennis* Scudder 1862 (*Stenobothrus*). Synonym of *pelidna*.  
*obliquata* Scudder 1899 (*Orphulella*). Synonym of *speciosa*.  
*olivacea* Morse 1893 (*Stenobothrus*). Valid species.  
*orizabae* McNeill 1897 (*Orphula*). The male cotype from Texas  
probably was a specimen of *speciosa*; it probably was not con-  
specific with the original Mexican material of *orizabae*. On the  
basis of Mexican topotypes of *orizabae*, *orizabae* is a synonym  
of *tolteca* (see Hebard, 1932, p. 237).  
*pelidna* Burmeister 1838 (*Gomphocerus*). Valid species.  
*picturata* Scudder 1899 (*Orphulella*). Synonym of *speciosa*.  
*pratorum* Scudder 1899 (*Orphulella*). Synonym of *pelidna*.  
*propinquans* Scudder 1862 (*Stenobothrus*). Synonym of *pelidna*.  
*salina* Scudder 1899 (*Orphulella*). Synonym of *desereta*.  
*speciosa* Scudder 1862 (*Stenobothrus*). Valid species.  
*tepaneca* Saussure 1861 (*Stenobothrus*). A Mexican species. Cali-  
fornian material doubtfully identified by McNeill (1897)  
included material of *compta* and *desereta*; Texan material  
recorded by Scudder (1899a) probably represented *halophila*.  
*tolteca* Saussure 1861 (*Oxycoryphus*). A Mexican species. See  
under *orizabae*.

*Natural groups of species.*—The species now assigned to *Orphulella* comprise at least two distinct species groups. Early in the study H. Radclyffe Roberts called the writer's attention to the fact that the genotype, *punctata*, differs from the species found in the United States with respect to the male supraanal plate. In *punctata* the lateral margins of the plate are entire and there is no conspicuous transverse ridge on the dorsal surface. A transverse ridge which arises from an emargination of the lateral margin at each extremity of the ridge occurs in the species found north of Mexico and in many of the Neotropical species. Corkins (1925) has noted the value of

the apical abdominal segments in identifying the males of Acridinae; although contrary to his belief, the differences mentioned between *pelidna* and *salina* (synonym of *pelidna descreta*) are not sufficiently distinct to separate the two forms, the importance of examining these structures thoroughly in any study of acridine genera remains. That *punctata* belongs to a species group distinct from that of the species here treated is also shown by the female subgenital plate. In *punctata* (fig. 14) there are prominent latero-apical lobes and sub-lateral teeth, while in *pelidna* (fig. 15) and its allies the apex is less specialized. *O. obscura* Bruner<sup>4</sup> and probably other Neotropical species are included in the group with *punctata*. The female of *O. concinnula* (Walk.) of Panamá is different from either of the above, the apex of the subgenital plate being much like that of *Clinocephalus* (fig. 61).

*Distribution*.—The accompanying maps (figs. 1–3) show the known distribution of the species of *Orphulella* in America north of Mexico, and it does not seem necessary to discuss life zones in detail. *O. compta* is characteristic of the Lower Austral (Lower Sonoran in arid belt) Zone of California, Arizona, Nevada, and Utah. *O. speciosa* is mainly a species of the Transition and upper portions of the Upper Austral (Carolinian) Zones east of the Rocky Mountains except for a Great Plains extension into the Lower Austral (Austro-riparian in moist belt) Zone. *O. pelidna* is present in favorable situations throughout the United States, with the exception of the extreme Southwest and certain upland regions in the Northeast. *O. olivacea* is an Atlantic and Gulf Coast species limited to the Upper Austral Zone in its northward spread. The southern border of the Canadian Zone apparently marks the northern limit in the distribution of the genus.

South of the United States, *Orphulella* extends far southward, at least as far as central Argentina (see Hebard, 1926, p. 54). The origin of the species occurring in the United States is not clearly established. It would seem that *compta*, at least, may be related to Mexican species, but *olivacea halophila* has an unmistakable resemblance to *brachyptera* R. & H. of Cuba, and the West Indian influence on the races of *olivacea*, if not on other species, is very likely.

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<sup>4</sup> Described by Bruner (1906, p. 627) from one male and two females collected at Sapucay, Paraguay, by W. T. Foster. The male is herein designated as the lectotype. The type and one female of *Orphulella obscura* are in the United States National Museum.

*Material examined.*—The following table summarizes the principal collections of material that have been studied. The material in the United States National Museum (U. S. N. M.) served as the original basis for this study. The Philadelphia collections include those belonging to the Academy of Natural Sciences (A.N.S.P.), as well as those in the Hebard Collection located at the same institution.

|                                 | A.N.S.P.<br>and Heb. Coll. | U.S.N.M.   | U. of<br>Mich. | U. of<br>Minn. |              |
|---------------------------------|----------------------------|------------|----------------|----------------|--------------|
| <i>pelidna pelidna</i> .....    | 723                        | 243        | 1,134          | 55             | 2,155        |
| <i>pelidna desereta</i> .....   | 68                         | 44         | 53             |                | 165          |
| <i>pelidna</i> (intermediates)  | 108                        | 32         | 22             |                | 162          |
| <i>olivacea olivacea</i> .....  | 310                        | 40         | 237            | 6              | 593          |
| <i>olivacea halophila</i> ..... | 78                         | 9          | 5              |                | 92           |
| <i>olivacea</i> (intermediates) | 8                          |            |                |                | 8            |
| <i>compta</i> .....             | 363                        | 66         | 40             |                | 469          |
| <i>speciosa</i> .....           | 668                        | 469        | 661            | 441            | 2,239        |
|                                 | <u>2,326</u>               | <u>903</u> | <u>2,152</u>   | <u>502</u>     | <u>5,883</u> |

The following material was examined, but not included in the above table: The holotypes and lectotypes of Scudder's species located at the Museum of Comparative Zoology; several hundred specimens from the United States, in the Philadelphia collections, which were reviewed hastily because of lack of time and which probably would have contributed little further information to this report because most of the localities were represented by material already studied; a few specimens, mostly from New England, in the Massachusetts State College Collection; 8 specimens of *speciosa*, from Augusta and Brunswick, Maine, belonging to the Ohio State Museum; 34 specimens of *pelidna pelidna* and *speciosa*, from Manitoba and Alberta, belonging to the Canadian Entomological Laboratory, Lethbridge, Alberta; all material, excepting specimens of *olivacea* from Bermuda, occurring outside the borders of the United States and Canada, and that belonging to genera other than *Orphulella* studied during the preparation of this paper.

*Wing venation as a diagnostic character.*—The venation of both tegmina and wings is important in the taxonomy of higher acridid groups, and in many cases provides specific characters. In the species of *Orphulella* here treated the venation of the tegmina is

valuable in distinguishing the males of certain species, and to a less extent the females. Characters of the wing are helpful when extralimital species are considered, but the writer has failed to find the wing of service in the present study.

The venational terms employed by most orthopterists are those used by Saussure (1884) in his classic "Prodromus Oedipodiorum," or modifications of them. A few workers (McNeill, Karny, and others) have made use of the Comstock-Needham System, and most morphologists apply the later system in naming the veins of grasshopper wings. Although the general use of the Comstock-Needham System is perhaps to be desired, the writer has decided to follow the older system at least for the present. The fact that the venational nomenclature in the current literature of American Blattidae is firmly established is one reason for retaining the older system for Orthoptera, at least until there is convincing evidence that the Comstock-Needham System could be used to advantage.

Figs. 30 and 31 illustrate the tegmen of *Orphulella* and the terms applied to the veins which have been used in this paper. It should be noted that a well developed intercalary vein, such as occurs in many Oedipodinae, is absent from the Nearctic species of *Orphulella*. The tegmina illustrated by Blatchley (1920, fig. 8) and Morse (1920, fig. 13) are both from Saussure's figure (1884, pl. 1, fig. 1) of *Pachytylus* (now considered a synonym of *Locusta*), an Old World oedipodine with a strongly developed intercalary vein. Morse (1920, pp. 434-435) has applied the term "discoidal area" to what is usually called the median area. "Discoidal area" is usually applied to the whole area of the tegmen between the marginal and anal fields.

One of the errors of several previous students of *Orphulella* was the placing of too much reliance upon the venation of the tegmen in the separation of species. Variation is such that the venation cannot always be trusted, but it is frequently helpful when certain features occur in a condition of maximum development or when used in conjunction with other characters. The amount of variation occurring in several species has been determined by gathering data on certain tegminal characters, and is discussed under the individual species.

*Genitalia and their value.*—The use, by American orthopterists, of those parts of the male acridid genitalia which are ordinarily concealed has been developed only since Hubbell (1932) called attention to their great value, particularly in the genus *Melanoplus*. Hebard has more recently utilized the details of the aedeagus and epiphallus

in a series of studies dealing with *Melanoplus* and its allies. Although many species may be readily identified by the usual external characters, it is now essential to examine the concealed genitalia in certain groups of *Melanoplus* before identification can be made. This is notably true in the case of *M. packardii* Scudd., a species of economic importance, and its near relatives. Unfortunately, all subfamilies of Acrididae, or even all genera of Cyrtacanthacrinae, do not exhibit such striking genitalic differences between species as are found in most groups of *Melanoplus*, and in Nearctic Acridinae the concealed genitalia have not been used for taxonomic purposes. The writer has now discovered that the aedeagus is of value in *Orphulella* and believes that this or others structures will eventually prove to be helpful in several other genera of Acridinae. It is encouraging to note that a few students of the Old World Acrididae (Chang, Jannone) have used the concealed genitalia in taxonomic works, and it is to be hoped that these will come into more general use.

Illustrated discussions of the principal parts of the male acridid genitalia have been given by Walker (1922), Hubbell (1932), Snodgrass (1935, 1937), and others, and only a brief review will be made here. The writer has recently consulted with H. Radelyffe Roberts, who plans to publish a general treatment of the terminology of male acridid genitalia within a short time, and he has tried to use terms in agreement with those of Mr. Roberts. The genitalia of *Orphulella* are of a type similar to those of *Chorthippus* and *Mermiria* which are figured by Snodgrass (1935, figs. 28, 29). The concealed genitalia lie beneath and slightly anterior to the pallium or dorsal membrane covering the apical sternite of the abdomen. During copulation the genitalia are protruded from beneath this covering, and in the study of dried material relaxation allows the pallium to be slipped back posteriorly so that the tip of the aedeagus is exposed. Buried in the muscles of the genital mass, and leading to the base of the aedeagus, are the large, paired, supporting arms of the endophallus (fig. 12). Dorsad of the endophallus are the aedeagal apodemes (not illustrated here), which resemble a yoke, the free ends of which are directed anteriorly. The epiphallus (fig. 13) is a transverse sclerite, characterized by various folds and hooks, and is attached to the upper surface of the genital mass.

When examined in lateral view (fig. 12), the apex of the aedeagus is seen to be made up of anterior and posterior processes, which may be more correctly called dorsal and ventral valves. Viewed along the longitudinal axis, both dorsal and ventral valves are revealed

as paired structures, the left and right dorsal valves being rather closely fused, while the two ventral ones are separate at their tips, so that a cleft is formed between them. The spermatophores, containing spermatozoa, are formed in the spermatophore sac ventrad of and anterior to the base of the aedeagus. During copulation the spermatophores pass through the groove which is formed by the space between the dorsal and ventral valves and the cleft between the two ventral valves.

The aedeagus and epiphallus are equivalent to the penis and pseudosternite, respectively, of Walker, Hubbell, and Hebard. It is believed, in agreement with Snodgrass, that the former terms are more indicative of the true morphological nature of the structures, and, if so, a change is justified, as the other terms have been in general use by orthopterists only a few years.

In separating the species of *Orphulella* found north of Mexico, the writer has failed to find constant differences in the epiphallus, but the structure of the dorsal valves of the aedeagus has proved very helpful. The outline of the apex of the dorsal valves, when seen in lateral view (fig. 12), is characteristic of each species, and, after a little practice with the species involved, it is possible to identify doubtful specimens by this character. Variation in the dorsal valve occurs in *O. pelidna* as an accompaniment of the division of that species into subspecies; in at least one area in the wide distribution of *pelidna*, and in one area in the distribution of *compta*, variation in the dorsal valve occurs which is apparently the result of incipient raiation not yet worthy of nominal recognition. With these exceptions, to be discussed in detail later, the dorsal valve is found to be remarkably constant.

When specimens of *Orphulella* are collected it is a simple matter to slip back the pallium of a few individuals of each series at the time of mounting, thus making the apex of the aedeagus available for later study without further relaxation, unless the whole genital mass is to be removed. Dry material may be relaxed by dipping the tip of the abdomen in water that is boiling or nearly boiling. The author has followed a method of removing the entire genital mass, including epiphallus, and placing it in alcohol. The dorsal valve then is examined carefully. It was found that with a little removal of torn and loose muscle the dorsal valve was available for minute examination without treatment with caustic potash. Since the latter treatment may injure structures which sometime later will prove to be of value, though not so recognized at present, the author prefers to keep the genital mass in its natural condition, and, after study, it



is placed in a micro-vial of glycerine attached to the pin below the grasshopper from which it was taken. During this study the male genitalia of 270 specimens of *Orphulella* were examined in alcohol and preserved in glycerine; others were studied without removal from the specimen.

With the exception of color differences in the lateral basivalvular sclerite of the ovipositor of *pelidna* and *speciosa*, to be considered later, no female genitalic characters for the separation of species north of Mexico have been found. The relation of genitalia of both sexes to natural groups of species has already been mentioned, but this involved Neotropical species.

The characters of *Orphulella* are so variable that the author realizes the limitations of the following key. With a little experience on the part of the user, however, it should aid in identification, particularly since no more than two species occur in any one part of the United States, except rarely within the range of *olivacea*.

KEY TO THE SPECIES AND SUBSPECIES OF *ORPHULELLA* FROM  
AMERICA NORTH OF MEXICO

1. Lateral view of dorsal valve of aedeagus as in fig. 28, in specimens from southeastern Arizona varying as in fig. 43; pronotum (figs. 23, 25) usually noticeably elongate, with lateral carinae parallel on the prozona, carinae frequently somewhat incurved (fig. 26) in specimens from southwestern California, rarely so farther east, ulnar area of male tegmen without well developed spurious vein, rarely present for 2-3 cells (see figs. 31, 51 for terminology); fastigium of male vertex (fig. 23) acute, dorsal depression with posterior margin far removed from apex of fastigium; fastigium of female variable (figs. 4, 26, 27, 49), usually well produced anteriorly. (Arizona and southern parts of California, Nevada, and Utah. Fig. 1.)

*compta* Seudder.

Aedeagus not as above (figs. 20, 32, 35-42); other features variable. (Area of distribution not adjoining that of *compta* except in *pelidna desereta*.) ..... 2

2. Aedeagus as in fig. 20; fastigium usually blunt, with dorsal depression little developed and near apex of fastigium (figs. 16, 19), occasionally, particularly in western specimens, more acute and depression more developed (figs. 17, 18); tegmen of male rarely with well developed spurious vein in ulnar area, most often absent (fig. 31); tegmen of female with anterior ulnar vein usually noticeably curving anteriorly (fig. 30);

pronotum (figs. 16, 19) usually relatively short and with lateral carinae little incurved, but these features variable (figs. 21, 22, 24). (Western margin of Great Plains to Atlantic Ocean, in Southeast found only in highlands. Fig. 1.)

*speciosa* (Scudder).

Aedeagus not as in fig. 20; fastigium rarely as blunt or depression as little developed as in usual condition in above category (figs. 5-6, 8-11); tegmina variable, but usually opposite from above in specimens from within range of *speciosa* (figs. 50, 51); pronotum usually more elongate (figs. 5-11), carinae variable ..... 3

3. Aedeagus as in figs. 37-42; fastigium rectangular to acute (figs. 5-6, 45) ..... *pelidna* (Burmeister). 4

Aedeagus never with distinct anterior "lip," not as above (figs. 32-36); fastigium rectangular to very acute (figs. 9-11, 48). (Coasts of Atlantic and Gulf States. .... *olivacea* (Morse). 5

4. Tegmina usually extending clearly beyond hind femora; lateral carinae of pronotum (figs. 6, 46) distinctly incurved on prozona except rarely; aedeagus usually with noticeable anterior "lip," except in certain material west of the Mississippi River. (Atlantic Ocean to western margin of Great Plains. Fig. 2.)

*pelidna pelidna* (Burmeister).

Tegmina less elongate, usually little exceeding hind femora; lateral carinae never markedly incurved, often parallel on prozona or nearly so (fig. 45); aedeagus very rarely with anterior "lip." (West of the Great Plains.)

*pelidna desereta* Scudder.

5. Tegmina usually extending well beyond hind femora; pronotum more elongate and lateral carinae but little incurved. (More northern in distribution. Fig. 3.)

*olivacea olivacea* (Morse).

Tegmina extending little if any beyond hind femora; pronotum usually less elongate and lateral carinae more noticeably incurved lateral carinae often interrupted on prozona (fig. 48)). (More southern in distribution.)

*olivacea halophila* Rehn and Hebard.

*Orphulella compta* Scudder

Figs. 1, 4, 23, 25-29, 43, 49

*Orphulella compta* Scudder, *Canad. Ent.*, Vol. 31, pp. 178, 180, 1899.

*Orphulella affinis* Scudder, *Ibid.*, pp. 178, 183, 1899. (New synonymy.)

*Orphulella graminea* Bruner, *Biol. Cent.-Amer.*, Orth., Vol. 2, pp. 75, 78, 1904.

*Type material examined and its location*

Lectotype of *compta*, here designated: Male labeled "Palm Springs, Calif., July 10, 1897. Orph. *compta*. Scudder's type, 1899. M. C. Z. type 15223." M. C. Z.

Lectotype of *affinis*, here designated: Male labeled "Coronado, Calif., July 24, 1897. Orph. *affinis* Scudder's type 1899. M. C. Z. type 15222." M. C. Z.

Lectotype of *graminea*, designated by Rehn and Hebard (1912a, p. 112): Male labeled "Phoenix, Ariz. R. E. Kunze." Heb. Coll.

Paratypes of *compta*: 7, Palm Springs, Calif.; 6, Yuma, Ariz. U. S. N. M., Heb. Coll. and U. of Mich.

Paratypes of *affinis*: 3, Coronado, Calif.; 2, Kern City, Calif.; 2, San Diego, Calif.; 1, Tulare, Calif. U. S. N. M. and U. of Mich.

Paratypes of *graminea*: 4, Phoenix, Ariz. Heb. Coll.

*Descriptive notes.*—The most characteristic external feature of *compta* is the lateral carinae of the pronotum. Figs. 4, 23, 25-27 illustrate the variation that occurs; the incurving carinae are especially typical in specimens taken near the California coast. The fastigium (figs. 4, 23, 27, 49) is usually elongate and more acute than in typical *desereta*, but in certain cases male genitalia are necessary to distinguish species. No males have been examined which have an entire spurious vein in the ulnar area of the tegmen. Very rarely one is present for 2-3 cells, and the absence of a spurious vein is probably more constant than in *speciosa*.

A very puzzling problem in the study of *compta* has been a series of 49 specimens from Cochise County, Ariz. This includes the material reported as *compta* by Rehn (1907) and Rehn and Hebard (1908). The dorsal valve of the aedeagus (fig. 43) is not typical of *compta*, though showing relationship to the dorsal valve of typical specimens (fig. 28). External structures agree essentially with specimens from the remainder of the range of *compta* and apparently the Cochise County material represents no more than incipient racial development in this southwestern species. From what is known of life zones, the affinities of this material would more naturally be with *compta* than with *desereta*, and Rehn and Hebard

(1908) suggest that *compta* may have reached this area by way of the valley of the Rio Yaqui.

The color of *compta* varies from a uniform pale green to brown, and the tegmina may be maculate or not. Frequently the tegmina are slate-colored in the discoidal area, while the anal and marginal fields are green or pale brown. A narrow dark stripe often extends caudad from each compound eye, narrowly bordering the pale lateral carinae on the lateral lobes of the prozona and continuing on the disk of the metazona. In material from southwestern California the brown color predominates, though green specimens occur. Farther east, green specimens are much more common than brown. Apparently the percentage of green individuals is highest in areas of luxuriant vegetation.

In the following table measurements in millimeters of representative specimens from various localities are given.

| Locality                         | Body Length | Pro-notum | Tegmen | Hind Femur |
|----------------------------------|-------------|-----------|--------|------------|
| <i>Females</i>                   |             |           |        |            |
| Coronado, Calif.                 |             |           |        |            |
| Paratype of <i>affinis</i> ..... | 21.         | 3.7       | 13.3   | 12.4       |
| Tulare, Calif.                   |             |           |        |            |
| Paratype of <i>affinis</i> ..... | 23.2        | 4.3       | 15.5   | 12.1       |
| Beaver Dam, Ariz. ....           | 24.5        | 4.6       | 19.7   | 13.8       |
| Yuma, Ariz. ....                 | 22.5        | 4.4       | 20.5   | 13.5       |
| Ft. Yuma, Calif. ....            | 25.5        | 5.        | 24.5   | 15.3       |
| <i>Males</i>                     |             |           |        |            |
| Coronado Beach, Calif.           | 16.         | 2.8       | 11.9   | 9.5        |
| Kern City, Calif.                |             |           |        |            |
| Paratype of <i>affinis</i> ..... | 15.         | 3.        | 11.4   |            |
| St. George, Utah .....           | 18.         | 3.6       | 15.    | 11.3       |
| Yuma, Ariz.                      |             |           |        |            |
| Paratype of <i>compta</i> ...    | 16.6        | 3.2       | 14.7   | 10.        |
| Heber, Calif. ....               |             | 3.6       | 16.5   | 11.3       |

*Synonymy.*—Hebard (1935b, p. 282) placed *graminea* in synonymy, and this synonymy has been verified by the present study. The lectotype and paratypes of *graminea* are perfectly typical of

*compta*. Because of the variation of *compta*, as found near the coast, the synonymy of *affinis* has required more study, but is likewise evident. Practically the only differences between *affinis* and *compta* recognized by Scudder (1899a) were that the tegmina of *affinis* were shorter than those of *compta*, and that the lateral carinae of *affinis* were divergent on the prozona instead of parallel or faintly arcuate as in *compta*. Specimens from several series, which in these cases are surely composed of only one species, illustrate the variability of the characters in question. Series from Nevada include specimens collected at the same time and place which show the perfectly parallel carinae frequent in *compta* and the arcuate carinae of *affinis*. Specimens from coastal localities from Los Angeles to San Diego exhibit sufficient variation in the shape of the carinae and the length of the tegmina to include the morphological features of specimens occurring in the Imperial Valley where *compta* is especially abundant. Although there are fairly regular tendencies shown by this variation, there is no evidence of well marked subspecies, and *affinis* is accordingly placed in synonymy. The distinctive male aedeagus supports this conclusion.

*Distribution* (fig. 1).—Scudder's record (1899a, p. 187) of *pelidna* from Los Angeles was based upon material of *compta*. Specimens from Los Angeles identified by McNeill (1897) as "*tepanica* (?) Sauss." prove, upon examination, to be *compta*. This species replaces *desereta* in the Lower Austral Life Zone of Arizona, Nevada, and California, and penetrates extreme southwestern Utah. The only species likely to be confused with *compta* is *desereta*, and the aedeagus is helpful in specimens which lack distinctive external features.

*Biological notes on compta*.—This is the species which Essig (1926, p. 75) has called the "green desert grasshopper." As that name implies, it is a species of the arid Southwest. The optimum development is found in moist areas, often rather local, which are frequently surrounded by desert or at the edges of foothills. Essig reports having taken *compta* in fields of alfalfa, barley, and grasses in the Imperial Valley of California, and specimens are available which indicate that it often occurs in fairly large numbers in alfalfa and grasses.

Like *Dichromorpha viridis* (Scudd.) in the East, *compta* often takes advantage of green vegetation along streams. Irrigated lands often serve as a habitat, and Rehn and Hebard (1908, p. 378) mention the great abundance of *compta* on irrigated ground at Yuma, Ariz. At Mesquite, Nev., it was taken in a creek bed with tornillo.

salt cedar, and tall grasses, and at Las Vegas, Nev., Rehn and Hebard (1910, p. 427) found it "well distributed in grass beside a stream." Along the coast of southern California the habitat is somewhat different, and the latter authors found it "common among the scant grasses of the beach dunes" at Alamitos Bay and "among low salt marsh plants" at South Coronado Beach.

The vertical distribution of *compta* is indicated by the following data taken from labels: Indio, Salton Depression, Calif., 26 ft. below sea level, irrigated land, July 29, '07; Beaver Dam, Ariz., 1450 ft., Sept. 7, 1926; Las Vegas, Nev., 2050 ft., Aug. 10, '07; Ash Meadows, Nev., 2300 ft.

Adults of *compta* occur during a large part of the year, apparently owing to a long open season. Specimens from Yuma, Ariz., range from June 9 to November 2. Material from Brawley, Calif., is dated May 28, and a considerable series from Ft. Yuma, Calif., Sept. 9. Among the northern localities are August 8 at St. George, Utah, and September 7 at Beaver Dam, Ariz.

In his paper on Orthoptera attracted to lights, Tinkham (1938) says that *compta* is fairly common. His records are Las Vegas, Nev., and Wellton, Ariz. In addition to Tinkham's records, a male and two females collected at electric lights at Yuma, Ariz., June 18, 1915, by Harold Morrison are here recorded.

#### *Distribution of material examined*

Utah: St. George, Santa Clara Creek above Santa Clara.

Arizona: San Bernardino Ranch (Cochise County), Douglas, Tucson, Phoenix, Congress Junction, Beaver Dam, Topock, Wellton, Yuma.

Nevada: Mesquite, Bunkerville, Logandale, Las Vegas, Ash Meadows.

California: Shoshone, Needles, Blythe, Bard, Fort Yuma, Kane Spring, Brawley, Imperial, Holtsville, El Centro, Heber, Calexico, Mountain Spring, Tulare, Kern City, Bakersfield, Newberry, San Bernardino, Riverside, Palm Springs, Indio, Alamitos Bay (Los Angeles), Huntington Beach, Del Mar, San Diego, Coronado, Coronado Beach, Tia Juana, Dulzura.

#### *Orphulella olivacea olivacea* (Morse)

Figs. 3, 9-11, 32-34

*Stenobothrus olivaceus* Morse, Psyche, Vol. 6, p. 477, figs. 5, 6, 1893.

*Type material examined and its location*

Lectotype of *olivacea*, designated by Morse and Hebard (1915):

Female labeled "Stamford, Connecticut, Aug. 13-17, 1891, A. P. Morse, Coll." M. C. Z.

Paratypes of *olivacea*: 6, Stamford, Conn.; 47, Greenwich, Conn., U. S. N. M., A. N. S. P., Heb. Coll., U. of Minn., and U. of Mich.

This species was based upon one of the largest type series of any American grasshopper, there being 180 males and 167 females in the original series.

*Descriptive notes.*—This is the northern and typical subspecies of *olivacea*. Because of the variation and the development of a southern subspecies, *halophila*, the two subspecies will be discussed in some detail. The following descriptive notes based upon paratypes of *olivacea*, which were taken near the known northern limit of the species, precedes the discussion of variation.

Fastigium acute, more acute and sides often concave in male. Foveolae distinct, shallow, narrowly triangular. Depression far removed from apex (figs. 10, 11). Lateral carinae of pronotum usually little incurved, but gradually diverging from near base of prozona to posterior margin of metazona; carinae more distant at posterior margin than in front. Tegmina exceeding hind femora; ulnar area of male usually with incomplete spurious vein, sometimes absent; anterior ulnar vein of female not incurved or only slightly so. Dorsal valve of male aedeagus with apex as illustrated (fig. 32) in lateral outline. General color usually olivaceous brown, occasionally pale green. Markings as usual in the genus, seldom strongly contrasting.

Along the Atlantic Coast there are certain progressive changes in *olivacea*. From the narrow, acute fastigium of northern specimens there is a gradation to the broader, more obtuse fastigium of the southern form, accompanied by an increase in size. These features were noted by Rehn and Hebard (1916, p. 164). Light-green specimens occur more frequently farther south than in the North.

Rehn and Hebard described *halophila* as differing from *olivacea* "in the more robust form, the never strongly elongate tegmina, the shorter pronotum, the more arcuate lateral carinae of the pronotum and more inflated caudal femora." The lateral carinae of the prozona of *halophila* are frequently interrupted, at least in color, but this feature is not constant. After puzzling a great deal over the available material, the writer has decided that there is evidence of intergradation in series from the Texan and Floridian coasts,

and from Bermuda, and *halophila* and *olivacea* are consequently treated as subspecies. Although each subspecies varies within its range, and, as has already been pointed out, in the case of *olivacea* there are progressive changes, each subspecies is essentially distinct except in the areas of intergradation. The differences mentioned in the original description of *halophila* are well marked in typical specimens. This situation fulfills the requirements of subspecies as outlined by Hebard (1929a), referred to earlier in the general discussion of subspecies.

There is variation in the robustness of *halophila*, as shown by series from Iona, Fla., and in this respect *halophila* females grade into *olivacea* females from Cedar Keys, Fla.

The tegmina of *halophila* vary in length, but do not equal the macropterous specimens of *olivacea*. On the other hand, there is much variation in *olivacea*. Series of the latter from Tybee Island, Ga., vary from tegmina equal to the hind femora to exceeding the femora by 4.5 mm. Tegmina of series from Cedar Keys exceed the hind femora by 2 to 4 mm. and those from Virginia Point, Tex., by 2.8 to 5 mm. The same is true of series from certain other localities, and it is evident that the length of tegmina cannot be used as a constant character to distinguish two species.

A female from Yankeetown, Fla., has a shorter pronotum than most specimens of *olivacea*, but series of the latter from Cedar Keys and Virginia Point include specimens having the same condition. Measurements show that the proportions of metazona and prozona vary in males, but the extent of intergradation is not so marked as in the females. It is nevertheless indicated in material from Dune-din and Cedar Keys, Fla.

Variation in the arcuation of the lateral carinae of the pronotum is strikingly demonstrated by specimens of *halophila* from Katherine and Padre Island, Tex., with greatly incurved carinae as compared with specimens from Corpus Christi, Tex., which have the carinae nearly parallel on the prozona. Small series from Katherine and Lake Lomalta, Tex., show a great deal of arcuation, and have a color pattern of ashy hues suggestive of *Cordillacris*. The Katherine specimens were taken "in short grass in salty flat," and the condition of the specimens is perhaps the response to a rather dry inland saline area as opposed to a coastwise salt marsh. The carinae of certain specimens appear more arcuate than those of others because of more contrasting colors.

In its bearing on intergradation, a series of 3 males and 5 females from Bermuda is of unusual interest. With the exception of a male



from Elba Beach, this is the material recorded by Rehn (1910) from Warwick Parish as *olivacea*. The females are very similar to females from the New Jersey Coast, while the males are very like paratypes of *halophila* from Key West, Fla., and other males from Dunedin, Fla. There is no evidence that the opposite sexes of the Bermuda series represent different species. Rehn (1910) says that notes with the specimens state that the species is not rare on the south shores of Warwick Beach. It would not seem that if *olivacea* and *halophila* were distinct species, and both occurred on the island, the collecting would have resulted in one sex alone of each species being taken. There is little choice but to believe that a peculiar type of intergradation occurs there, with the result that the two sexes most closely resemble different subspecies of one species.

Representative specimens of *olivacea olivacea* have been measured in millimeters as follows:

| Locality                        | Body Length | Pronotum | Tegmen | Hind Femur |
|---------------------------------|-------------|----------|--------|------------|
| <i>Females</i>                  |             |          |        |            |
| Greenwich, Conn. ....           | 19.5        | 3.7      | 16.7   | 11.5       |
| Paratype of <i>olivacea</i> ... |             |          |        |            |
| Same as above .....             | 20.5        | 3.7      | 18.0   | 11.6       |
| Same as above .....             | 23.0        | 4.0      | 21.0   | 13.3       |
| Buras, La. ....                 | 24.3        | 4.3      | 20.0   | 14.5       |
| Biloxi, Miss. ....              | 27.5        | 5.2      | 24.5   | 16.0       |
| Cedar Keys, Fla. ....           | 27.5        | 5.2      | 23.5   | 16.5       |
| Ware's Wharf, Va. ....          | 26.0        | 4.0      | 21.5   | 13.8       |
| Cedar Keys, Fla. ....           | 29.5        | 5.3      | 23.0   | 15.5       |
| Margate City, N. J. ....        | 25.5        | 4.6      | 22.8   | 14.5       |
| Virginia Point, Tex. ....       | 27.0        | 5.1      | 23.5   | 16.5       |
| <i>Males</i>                    |             |          |        |            |
| Greenwich Conn. ....            | 15.3        | 2.6      | 13.2   | 9.3        |
| Paratype of <i>olivacea</i> ... |             |          |        |            |
| Buras, La. ....                 | 20.5        | 4.0      | 17.7   | 12.3       |
| Cedar Keys, Fla. ....           | 22.0        | 4.2      | 19.0   | 13.5       |
| Tybee Island, Ga. ....          | 19.5        | 3.6      | 17.0   | 11.7       |
| Virginia Point, Tex. ....       | 21.7        | 4.0      | 18.0   | 11.8       |

The writer is unable to separate two subspecies from the material

recorded from Corpus Christi, Tex., as both *olivacea* and *halophila* by Rehn and Hebard (1916), and it is all assigned to *olivacea halophila*.

*Distribution* (fig. 3).—In addition to the distribution indicated by material examined, *olivacea* has been recorded from the Bahamas by Morse (1905) and was perhaps the species doubtfully recorded as *pelidna* by Rehn (1906b). In both cases the subspecies *halophila*, or material intermediate between the two races, very likely was involved.

There have been several misidentifications involving *olivacea* recorded. Rehn (1910, p. 6) suggests that a number of records of other species from Bermuda probably refer to *olivacea*. A male "Gulf Coast of Texas, Aaron 1884" recorded by Scudder (1899a) as *pratorum* is actually *olivacea*. The male recorded from Pablo Beach, Fla., by Rehn and Hebard (1916) as *olivacea* is shown by examination of the aedeagus to be *pelidna pelidna*. Giglio-Tos (1897a) recorded *olivacea* from Panamá and Venezuela, and (1898) from Ecuador. Hebard (1924a, p. 97) considers the 1897 records to be based upon either *concinnulla* or *punctata*, and states that *olivacea* "does not occur in the American tropics." He also says (1924b, p. 172) that Ecuadorean specimens received from Giglio-Tos from the series reported in 1898 are *concinnulla*. The Giglio-Tos specimens were previously mentioned by Rehn (1906a, p. 27; 1916, p. 278).

*Biological notes on olivacea olivacea and olivacea halophila*.—This species is well known as an inhabitant of coastwise marshes and nearby saline or brackish places. Typical *olivacea* is found in the tall vegetation of salt marshes, but, as pointed out by Rehn and Hebard (1916), it occasionally occurs among beach dunes. On the other hand, *olivacea halophila* has been taken more often on saline flats with low halophytic vegetation, or even on almost bare coral rock, rather than in actual salt marsh. This distinction does not always hold, however, as shown by specimens of *halophila* taken in salt marsh grass at Iona, Fla.

Collections indicate that *halophila* occurs in the adult condition over a much longer period than does *olivacea olivacea*. This is to be expected because of the tropical and subtropical habitat of *halophila*. Adults of *halophila* have been studied which were taken during each month of the year except January and June, and these months are represented among intergrades from Bermuda. Nymphs have been collected during February, March, July, August, and September.

July, August, and September are the months in which *olivacea olivacea* has been taken most frequently. July 5 at Smith Island, Va., and October 3 at Ware's Wharf, Va., are seasonal limits at that latitude. July 24 is an early date at Margate City, N. J. Large series from Cedar Keys, Fla., were collected July 12, 13, September 29, and October 18. Nymphs were taken there July 13.

*Distribution of material of olivacea olivacea examined*

Connecticut: Stamford, Greenwich.

New Jersey: Little Beach, North of Brigantine Inlet, Atlantic City, Ventnor, Margate City, Ocean City, Cedar Springs, Sea Isle Turnpike, Ocean View, Avalon, Clermont, Anglesea, Wildwood Junction, Cold Spring, Cape May, Dennisville, Cape May Court House, Erma.

Virginia: Franklin City, Smith Island, Ocean View, Tappahannock, Ware's Wharf, Millenbeck, White Stone, Revel's Island.

North Carolina: Beaufort, Wrightsville, Southport.

South Carolina: Isle of Palms, Charleston, Bluffton.

Georgia: Tybee Island, Sandfly.

Florida: Cedar Keys, Yankeetown, Carrabelle, Pensacola, Ft. Barrancas.

Mississippi: Biloxi, Gulfport, Ship Island, Cat Island, Pass Christian.

Louisiana: Buras.

Texas: Sabine, Galveston, Virginia Point.

*Specimens examined intermediate between olivacea olivacea and olivacea halophila*

Bermuda: Warwick Parish, Dec. 11, 1909, 1 female; Dec. 14, 1909, 1 female; Dec. 17, 1909, 1 female; Dec. 19, 1909, 1 male; Jan. 12, 1909, 1 female; April 18, 1909, 1 male, 1 female. All collected by F. M. Jones.

Elba Beach, June 30, 1931, H. H. Whetzel, 1 male.

(All above Bermuda material in Philadelphia collections.)

*Orphulella olivacea halophila* Rehn and Hebard

Figs. 3, 8, 35, 36, 47, 48

*Orphulella halophila* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., Vol. 68, p. 166, pl. 12, figs. 6-8, 1916.

*Type material examined and its location*

Holotype of *halophila*: Female "Key West, Monroe Co., Fla., July 3-7, 1912, R. & H." Heb. Coll.

Allotype and paratypes of *halophila*: 8 males, 17 females, same data as type; 1 male, 4 females, "Key West, Fla., March 15-16, 1910, Hebard." A. N. S. P. and Heb. Coll.

*Descriptive notes.*—The important descriptive features of *halophila* are here noted, based upon typical specimens of this subspecies.

Fastigium (figs. 8, 48) narrowly rounded (female) to slightly acute (male); foveolae about as in *olivacea*; dorsal depression of male considerably removed from apex, less so in female. Lateral carinae of pronotum distinctly incurved on prozona, diverging on metazona, usually weak or interrupted on prozona. Tegmina extending to or slightly surpassing tips of hind femora; ulnar area of male with incomplete spurious vein usually present. Hind femora often rather swollen. Aedeagus practically identical with that of *olivacea*. Color, especially in females, more variable than in *olivacea*; general color green or brown, occasionally pale gray; lateral carinae of pronotum often brilliant pale yellow, usually interrupted and somewhat accompanied by structural interruption, sometimes immaculate; pronotal disk immaculate or marked with black or purple; tegmina usually with large maculations in discoidal area, often with small brown spots in anal field, sometimes marked with purple; hind femora often barred and dotted with color ranging from brown to purple.

Apparently *halophila* varies considerably in color with local ecological conditions. Females from Key West and Corpus Christi are of a greenish-yellow-brown color for the most part, with purple conspicuous on the pronotum and posterior portions of the tegmina in a few specimens. Boot Key and Dunedin specimens are of a somber, grayish-brown shade, similar to certain of the paratypes. Rehn and Hebard noted the various color combinations and that the males, which are predominantly of a brownish shade, are more uniform in color.

Two females in the Philadelphia collections, labeled Loma, Tex., July 7, 1908, agree closely with those from Lake Lomalta, Tex. The only "Loma" known to the writer is located in Walker County, about 70 miles inland and at a latitude north of Galveston. No further information about the source of the specimens is available. If they are not accidentally mislabeled, which is barely possible, they demonstrate that the subspecies of *olivacea* are very plastic under ecological conditions and that a colony, established farther inland than had previously been suggested, has taken on the appearance of an extreme condition of the southern race. At least in southern

Texas, there has been considerable fluctuation of the coast line during recent geological time. This has resulted in a number of old sea beaches several miles inland, and in such situations *halophila* probably occurs. Rehn and Hebard (1916, pp. 164-165, 170) have discussed the effect which beaches, saline flats, and marshes apparently have on *olivacea* and *halophila*.

Under *olivacea olivacea* the variation and intergradation of the two subspecies have been treated. In Florida, material south to and including Yankeetown on the Gulf Coast is considered to be *olivacea olivacea*. Material from the Atlantic Coast of Florida is not sufficient to give the limits of the subspecies. Specimens from Texan localities north to and including Corpus Christi are regarded as *halophila*. The material from Bermuda is considered to represent an intergrading condition. The assignment of certain specimens near the zone of intergradation is somewhat arbitrary. However, the series from Corpus Christi, Cedar Keys, and the area about Dunedin indicate that those from Cedar Keys lean sufficiently on the *olivacea* side and the others on the *halophila* side to permit racial identification. Further field work may make possible the plotting of more definite areas of intergradation.

Representative specimens of *olivacea halophila* have been measured in millimeters as follows:

| Locality                         | Body Length | Pronotum | Tegmen | Hind Femur |
|----------------------------------|-------------|----------|--------|------------|
| <i>Females</i>                   |             |          |        |            |
| Katherine, Tex. ....             | 20.5        | 3.5      | 14.5   | 11.7       |
| Iona, Fla. ....                  | 21.4        | 3.8      | 17.0   | 12.8       |
| Key West, Fla. ....              | 22.8        | 4.2      | 17.0   | 12.5       |
| Paratype of <i>halophila</i> ... |             |          |        |            |
| Same as above ....               | 25.5        | 4.4      | 19.7   | 14.0       |
| Corpus Christi, Tex. ....        | 26.5        | 5.0      | 20.7   | 15.5       |
| <i>Males</i>                     |             |          |        |            |
| Dunedin, Fla. ....               | 16.0        | 3.2      | 13.4   | 10.3       |
| Key West, Fla. ....              | 17.6        | 3.2      | 14.3   | 10.0       |
| Paratype of <i>halophila</i> ... |             |          |        |            |
| Same as above ....               | 18.5        | 3.3      | 15.5   | 10.8       |
| S. end Padre Island, Tex.        | 14.5        | 2.7      | 12.3   | 9.4        |
| Corpus Christi, Tex. ....        | 19.0        | 3.5      | 15.5   | 11.0       |
| Same as above ....               | 18.0        | 3.5      | 14.5   | 11.5       |

*Distribution* (fig. 3).—In addition to the localities shown, records from Tampico, Tamaulipas, Mex., have been published by Rehn and Hebard (1916, p. 169) and also by Hebard (1932, p. 237). Material of *halophila* was recorded as *pelidna* by Rehn and Hebard (1912b) before it was treated as a distinct species. The habitat, as discussed in 1916 by the latter authors, and by Blatchley (1920), is mainly among halophytic plants in the mangrove region. It may be on almost bare coral rock, or on sandy areas often covered by water at high tide. "At Corpus Christi and Point Isabel the species frequented saline adobe flats with low halophytic vegetation" (Rehn and Hebard, 1916, p. 170).

Because *halophila* is least known of the species and subspecies treated, full data on the specimens examined are given. The specimens are in the Philadelphia collections unless otherwise noted. Type material, already listed, is omitted here.

*Distribution of material of olivacea halophila examined*

- Florida: Tampa, Feb. 23, 1924, 1 female, 2 juv. (U. of Mich.); July 20, 1934, R. H. Beamer, 1 female.  
 Dunedin, Dec. 12, 1917, W. S. B., 1 male (U. of Mich.); Feb. 12, 1918, 1 male, 1 female (U. of Mich. and U. S. N. M.).  
 Hog Island, Dec. 12, 1917, W. S. Blatchley, 1 male, 1 female (U. S. N. M.).  
 Punta Rassa, May 12, 1910, J. C. Bradley, 1 male.  
 Iona, Lee County, near Ft. Myers, found in salt marsh grass, Sept. 13, 1917, R. & H., 10 males, 4 females, 1 juv.  
 Marco, April 20, 1912, W. T. Davis, 2 females.  
 Key Vaca, Mar. 14, 1910, H., 2 males, 1 juv.  
 Boot Key, Mar. 14, 1910, H., 1 male.  
 Big Pine Key, July 6, 1912, R. & H., 1 male.  
 Key West, March, Dyar and Caudell, 1 male, 2 females (U. S. N. M.); Feb. 15, 1917, Harold Morrison, 1 female, 1 juv. (U. S. N. M.).
- Texas: Corpus Christi, Oct. 3, 1929, A. A. Mathewson, 1 female (U. S. N. M.); July 29, 1912, H., 7 males, 14 females, 1 juv.  
 Katherine, Dec. 3, 1911, in salt grass in salty flat, 2 males, 2 females.  
 Lake Lomalta, Cameron County, Nov. 27, 1910, 1 female.  
 S. end Padre Island, Dec. 12, 1910, 1 male.  
 Point Isabel, Aug. 2, 1912, H., 3 males, 2 juv.  
 Questionable record, Loma, July 7, 1908, 2 females.

*Orphulella pelidna pelidna* (Burmeister)

Figs. 2, 6, 7, 12, 13, 15, 38-41,  
46, 50, 51, 53, 65

*Gomphocerus pelidnus* Burmeister, Handb. Ent., Bd. 2, Abth. 2, pt. 1, p. 650, 1838.

*Stenobothrus maculipennis* Scudder, Bost. Journ. Nat. Hist., Vol. 7, p. 458, 1862.

*Stenobothrus propinquans* Scudder, *Ibid.*, p. 461, 1862.

*Orphulella pratorum* Scudder, Canad. Ent., Vol. 31, pp. 179, 186, 1899.

*Type material examined and its location*

Lectotype of *maculipennis*, here designated: Female labeled "S. maculipennis Scudd. Mass.; *Stenobothrus maculipennis* Scudd. Cab. S. H. Scudder; Type 15230." M. C. Z.

Lectotype of *propinquans*, here designated: Female labeled: "53; S. propinquans Scudd.; = *Gomph. pelidnus* Burm., *Gomph. pelidnus* Cab. S. H. Scudder; Type 15229"; also a pink circle; M. C. Z.

Lectotype of *pratorum*, here designated: Male labeled "Dallas, Tex. Boll's No. 38; Det. Mar. 1875 by S. H. Scudder for J. Boll; *Stenobothrus maculipennis* Scudd. Cab. S. H. Scudder; Type 15224." M. C. Z.

Paratypes of *pratorum*: 4, Dallas, Tex.; 4, Texas; 2, Georgia. U. S. N. M., A. N. S. P., Heb. Coll. and U. of Mich.

*Descriptive notes.*—Throughout most of the range of this subspecies the angle of the fastigium (figs. 6, 46) is fairly constant, being more blunt near the area of intergradation with *pelidna desereta*. The dorsal depression usually differentiates *pelidna pelidna* from *speciosa*, being more distinct and farther removed from the apex than in *speciosa* (figs. 16, 19). However, some *speciosa* males (fig. 18) are very suggestive of *pelidna* in this respect, and the differences shown by females are not always clear cut. The lateral foveolae are about as in *olivacea*, on the average more distinct than in *speciosa*, but not sufficient to serve as a single separating character.

The lateral carinae of the pronotum are very distinctly arcuate in specimens from the Eastern States (figs. 6, 7, 46, 53), but are exceedingly variable. The carinae of specimens ranging from Minnesota and Texas to the western border of the Great Plains are, on the average, less incurved than those of specimens from east of the

Mississippi River, but extremes typical of eastern specimens occur. Rarely, as in a male from Salem, N. J., the carinae are interrupted on the prozona.

Specimens were measured to determine the relative lengths of prozona and metazona. Of 33 Floridian males the metazona was the longer in 24, and only 1 had a distinctly longer prozona. The average ratio of prozona to metazona was as 1:1.1. Of 33 males from Texas and middle-western States, 18 had a longer metazona, 8 had a longer prozona, and the average ratio of prozona to metazona was as 1:1.02. Measurements showed that 18 of 33 Floridian females had a longer metazona and in 7 the prozona was the longer; the ratio of prozona to metazona was as 1:1.04.

Ordinarily the tegmina of *pelidna* clearly surpass the tips of the hind femora. Seventy-three Minnesota specimens were measured; in 22 the tegmina exceeded the femora by 2 mm. or more, and in 9 by 1 mm. or less. In none did the femora exceed the tegmina. In the large specimens occurring in Florida and the southern half of the Plains States the long tegmina are often conspicuous and permit little chance of confusion with *speciosa*. Along the western limits of the range of typical *pelidna* a decrease in tegminal length occurs.

The rather regular occurrence of a spurious vein in the ulnar area of the male tegmen (fig. 51) is indicated by an examination of 592 males, mostly from Florida and other southeastern States. Of this number all except 12 (or 2.6 percent) (2 of which were from Michigan and 4 from North Dakota) possessed a well-developed spurious vein on one or both tegmina. A spurious vein appears somewhat less regularly in middle-western than in eastern specimens. The anterior ulnar vein of the female is seldom curved anteriorly as in *speciosa*.

The illustrations (figs. 38-41) show the variation in the dorsal valve of the aedeagus. In specimens from the extreme eastern States there is almost always a projecting "cap" or "lip" at the antero-dorsal margin of the dorsal valve. This lip is well developed in the many Floridian specimens examined. In material from Louisiana westward, along the Gulf Coast, a lip does not appear regularly, and there are noticeable average differences between specimens from eastern and western Texas, the latter being much like most Minnesota males (fig. 41). A few males from Ohio and Illinois are transitional between Middle Atlantic and Minnesota specimens. Several specimens from Presidio, Tex., show a peculiar type of variation. The aedeagus is broadly convex along the vertical anterior margin of the dorsal valve. In this variant the lateral



carinae are parallel on the prozona, diverging gradually on the metazona in a manner suggestive of northern specimens of *olivacea olivacea* (fig. 10). The aedeagus has not been used as a prime character for separating the two subspecies of *pelidna*, as on this basis a well-defined restricted area of intergradation has not thus far been evident, but there is a very noticeable change from the aedeagus characteristic of extreme eastern *pelidna* to that of *pelidna desereta*.

The coloration of *pelidna pelidna* runs through the whole gamut of color forms occurring in *Orphulella*, but specimens with green ground color are less common than in *speciosa*. Velvet-like black markings often appear on the disk of the metazona and along the lateral carinae on the lateral lobes of the prozona. The tegmina vary from heavily maculate to unmarked and areas of the tegmen frequently are reddish purple. The abdomen is more often blotched with black than in *speciosa*, and the dark color of the lateral basivalvular sclerite of the lower ovipositor valve is fairly constant, though not always present.

Study of variation in *pelidna*, particularly along the Rocky Mountains and the western margin of the Great Plains, leads to the conclusion that *desereta* is a western subspecies. In spite of the very many specimens of *pelidna* available, the localities represented in the area where the two subspecies meet (fig. 2) are too few to permit plotting this area of intergradation satisfactorily. A single specimen from a given locality near the zone of intergradation cannot always be placed to subspecies with certainty, but in a series a more satisfactory analysis of characters can be made and an exceptional specimen varying in the direction of the other subspecies will be recognized only as such. The area of intergradation is roughly outlined (fig. 2) by the symbols for intermediates, but the change from *pelidna* to *desereta* is sufficiently gradual so that sometimes the decision is arbitrary as to whether certain specimens are intermediates or atypical specimens of one subspecies. Specimens from Cereal, Alberta, are suggestive of *desereta*, but a series from Finigan, Alberta, is practically typical of *pelidna pelidna*, and, owing to the Great Plains character of that section of Alberta, such a northwestern extension of the range of *pelidna pelidna* seems natural.

The following are measurements in millimeters of representative specimens of *pelidna pelidna* (see p. 120).

*Synonymy*.—The synonymy of *maculipennis* and *propinquans* was recognized by McNeill (1897) and followed by Scudder (1899a).

| Locality                          | Body Length | Pronotum | Tegmen | Hind Femur |
|-----------------------------------|-------------|----------|--------|------------|
| <i>Females</i>                    |             |          |        |            |
| Kittson County, Minn. ....        | 18.0        | 3.3      | 14.8   | 10.3       |
| Noyes, Minn. ....                 | 20.0        | 3.5      | 17.7   | 11.3       |
| Thomasville, Ga. ....             | 18.5        | 3.2      | 15.0   | 10.4       |
| Norman, Okla. ....                | 26.5        | 4.5      | 23.0   | 15.0       |
| Kansas ....                       | 26.0        | 4.5      | 24.0   | 15.5       |
| Fairbanks, Fla. ....              | 25.0        | 4.0      | 21.5   | 14.0       |
| <i>Males</i>                      |             |          |        |            |
| Willow Branch, Saskatchewan ..... | 15.5        | 2.7      | 12.5   | 9.3        |
| Kittson County, Minn. ....        | .....       | 2.6      | 12.5   | 8.5        |
| Plummer, Minn. ....               | 16.5        | 2.9      | 15.5   | 9.5        |
| Elkhart, Tex. ....                | 18.6        | 3.1      | 18.5   | 11.0       |
| Atlantic Beach, Fla. ....         | 14.7        | 2.8      | 14.3   | 9.1        |
| Same as above .....               | 14.5        | 2.5      | 13.5   | 9.0        |
| Galveston, Tex. ....              | 18.5        | 3.5      | 18.5   | 11.5       |
| Cushing, Okla. ....               | 20.8        | 3.5      | 18.5   | 12.5       |
| Handley, Tex. ....                | 21.0        | 3.8      | 18.0   | 12.5       |

The former name was proposed for specimens from Massachusetts and the latter was based on material from Connecticut and Minnesota. Type examinations show the correctness of the synonymy in both instances, but from the data now borne by the specimen the writer does not know whether the lectotype of *propinquans* is from Connecticut or Minnesota.

Rehn and Hebard (1906, p. 366; 1910, p. 627) suggested the difficulty of distinguishing *pratorum* from *pelidna*, and (1916, p. 163) placed *pratorum* in synonymy. There is no doubt that *pratorum* is the species which American authors have called *pelidna*, and this interpretation had best be followed unless *pelidna* can be shown to be based upon another species. Rehn (1906b, p. 115) suggested that the status of *pelidna* was open to question. The writer has seen Pennsylvania specimens of *Orphulella* only from near Philadelphia, except for *speciosa*, and the exact source of Burmeister's material is not known, the original locality simply being given as Pennsylvania. McNeill's statement (1897, p. 238) that Scudder examined

the type of *pelidna* and found *propinquans* to be a synonym is of uncertain value.

*Distribution* (fig. 2).—Within the United States there are few records extending the distribution significantly beyond that indicated. Davis (1928, p. 29) records *pelidna* from Ithaca and Rochester, N. Y., Blatchley (1920) gives Indiana records, and Morse (1920) suggests that it may occur in southern Maine and New Hampshire but gives no New England records north of Massachusetts.

There are several records of *pelidna* from beyond the borders of the United States. Rehn (1909) gives records from Cuba and the Isle of Pines, and Hebard (1932) from Tamaulipas, Mexico. Bruner (1919) has identified *pelidna* from the Isle of Pines and Colombia; the latter record is almost surely incorrect. A small series from the island of New Providence, Bahamas, belonging to the Hebard Collection, has been examined. Of three males studied, the characters of one are typical of *pelidna pelidna*, but the aedeagus of each of the others is uniformly different, and, coupled with certain external differences, suggests that further investigation of the Bahaman fauna might be of interest. The specimen typical of *pelidna* was not collected with the other two males mentioned.

*Biological notes on pelidna pelidna and pelidna desertata*.—The preferred habitat of *pelidna* is rather varied, and, over its wide range from Atlantic to Pacific, there are many large areas in which *pelidna* occurs only in restricted localities. Moisture is an important factor, and in the Southeastern Coast States *pelidna* is much more generally distributed than in the Northern States. East of the Mississippi River *pelidna* occurs on poor soil which varies from the areas just back of beaches to waste areas overgrown with weeds and grasses in upland regions, the latter sometimes covered by open woods. Shotwell's reports (1938, 1939) on species and distribution of grasshoppers important in 1937 and 1938, based upon survey collections from different habitats, show that in Kansas grassland in 1937 *pelidna* constituted 13.98 percent of the grasshopper population, being exceeded in abundance only by *Opeia obscura* (Thos.) and *Ageneotettix deorum* (Scudd.). The same year *pelidna* constituted 3.09 percent of the total in Iowa pasture land and 4.91 percent on range. In 1938 3.96 percent of the Colorado range population was *pelidna*. These surveys include counts of thousands of specimens, and, while certain limitations in their value exist, they indicate rather well the general trends of species abundance. Woodruff (1937) examined the following four types of habitats at Lawrence, Kans., during 1936: Alfalfa, corn, prairie, and weed patch. Collections were made

three times each week from July 1 to August 21. Of the total number of grasshoppers taken, *pelidna* (4 percent) and *speciosa* (3.7 percent) were much less numerous than four species of *Melanoplus*. On prairie, however, *pelidna* (21.3 percent) and *speciosa* (15.2 percent) were exceeded or approached in abundance only by *Melanoplus differentialis* (Thos.) (15.5 percent) and *Mermiria bivittata* (Serv.) (18.5 percent).

Blatchley (1920) states that *pelidna* occurs everywhere in Florida, but that he took it only twice in Indiana, once near a small lake and again in some low meadows. His Indiana experience is much like that of E. S. Thomas, who writes (in litt.) of his contact with *pelidna* in Ohio: "Found as yet at only four stations, three in the prairie oak openings of Lucas and Fulton Counties and one in a limestone-tufa dry prairie north of Castalia, Erie County. The insects were found in or around damp depressions, for the most part; rather sparsely vegetated spots, characterized by fringed gentian (*Gentiana crinita*), *Aster azureus*, and other plants of damp, alkaline soils. They were also found in prairie grasses, such as *Andropogon scoparius*, around the borders of the low ground. Earliest date, July 18; latest, Sept. 22."

At Plummer, Minn., D. G. Denning has taken specimens along a river bank, in a meadow, and in wooded areas. Of its occurrence on Staten Island, N. Y., Davis (1928, p. 29) says: "Occurs in both dry and moist situations, and is often common along the edge of the salt meadows." In northeastern Texas it is common locally in open, sandy, oak woods (Isely, 1935; 1937, p. 331) and is classed among the grasshoppers of the light-sandy-soil group. Hebard (1925; 1928) believes that *pelidna* is restricted to local areas over the Great Plains, where it apparently occurs only in swales or along river valleys. This localized occurrence seems to hold true for the western race, *pelidna desereta*; and moist areas where vegetation grows more luxuriantly than elsewhere are the preferred habitats. Near Bonita, Oreg., Rehn and Hebard collected it on an alkali flat, and material is at hand from a "boggy alkaline meadow" at Milford, Utah. A series of specimens intergrading between the two races was taken by Rehn and Hebard at La Junta, Colo., "in high grass on banks of Arkansas River." Buckell (1920, p. 55) says *pelidna* was first found near Fairview, British Columbia, August 7, 1919, and occurred during August "fairly commonly near the edges of ponds, and along the banks of the Okanagan River. They were only seen where the grass was still green and were never observed out on the

dry ranges. They are strong jumpers but do not use their wings much."

Except in semitropical areas *pelidna* is generally most abundant from July to October. Adults have been taken in Florida during every month of the year and in the region about Brownsville, Tex., during December, June, and August. The species belongs to the August-October succession in northeastern Texas (Isely, 1937), and extreme dates for North Dakota (Hebard, 1936) and Minnesota (material examined) are July 24 to September 16 and July 6 (Ada) to September 6 (Polk County), respectively. October 18, at Coddys-shore, is a late Virginia record. July 8 at Toppenish, Wash., September 4 at Gazelle, Calif., and September 5 at Milford, Utah, are extreme dates among the northwestern material studied.

The altitudinal range of *pelidna* is from sea level to over 7,000 ft. In Maryland and Virginia this form is common near the coast, and H. A. Allard found it at 5,500 ft. on Whitetop Mt., Va. T. H. Hubbell has taken large series of *pelidna* at the following localities: Crestmont, N. C., 3,500 ft.; Roan Mt., Tenn., 2,800 ft.; Grassy Cove, Tenn., 2,600 ft.; Allardt, Tenn., 1,600 ft. In the Northwest, series have been taken at elevations of 7,100 to 7,200 ft. at Laramie, Wyo., and 7,200 ft. at Springerville, Ariz.

Tinkham (1938) states that males of *pelidna* occasionally come to lights. His records are from Presidio, Tex. Davis (1928, p. 29) has recorded a female at light on Staten Island, N. Y.

A female of *pelidna* was taken in copulation with a male of *Dichromorpha viridis* at Gainesville, Fla., July 8, 1930, by T. H. Hubbell, while Uvarov (1928, p. 55) points out that different grasshopper species have often been observed mating. There are several types of abnormal sexuality recorded, and Hayes (1927) has discussed some aspects of the phenomenon, with special reference to Coleoptera.

#### *Distribution of material of pelidna pelidna examined*

Massachusetts: Nauset Light, Revere, Plymouth, Marion, Nantucket, Cuttyhunk Is., Woods Hole.

Rhode Island: Wesquage Beach, Saunderstown.

Connecticut: Westville, Stratford.

New York: Bellport, Staten Is.

New Jersey: Material examined from 26 localities.

Pennsylvania: Mt. Airy, Philadelphia, Newton Square.

Delaware: Concord.

- Maryland: Somerset Heights, Plummer's Island, Glen Echo, St. Leonard, Kenwood Beach.
- Virginia: Material examined from 21 localities, the most western of which are Whitetop Mt. and the base of Mt. Rogers.
- North Carolina: Weldon, Ellis Lake, Wrightsville, Winter Park, Raleigh, Fayetteville, Lake Waccamaw, Greensboro, Southern Pines, Charlotte, Mt. Mitchell, Swannanoa, Crestmont.
- South Carolina: Florence, Manning, Isle of Palms, Ashley Jet., Yemassee, Columbia, Spartanburg, Calhoun, Clemson College.
- Georgia: Material examined from 46 localities. The more northern records are from Currahee Mt. (Habersham County), George Mt., Toccoa, Dalton, Jasper, Thompson's Mills, Stone Mt.
- Florida: Material examined from 111 localities distributed throughout Florida.
- Michigan: Port Austin, Sand Point, Point Lookout, Austin Lake (Muskegon County), Crystal Lake (Muskegon County).
- Ohio: Columbus.
- Kentucky: 5 mi. S. Danville.
- Tennessee: Roan Mt., Johnson City, Big South Fork Cumberland River, Scott Co., Allardt, Clark Range (Fentress County), Brushy Mts. near Petros, Crab Orchard, Grassy Cove, Dorton, Crossville, Chattanooga, Camden.
- Alabama: Camp MacClellan, Choccolocco Mt. (Calhoun County), Montgomery, Selma, Greenville, Dothan, Evergreen, Flomaton, Mobile, Springhill, Irvington, St. Elmo.
- Mississippi: Meridian, Laurel, Hattiesburg, Perkinston, Ocean Springs, Pascagoula, Pass Christian, Bay St. Louis, Winona, Jackson, Brookhaven, Natchez.
- Wisconsin: Sawyer County, Jackson County.
- Manitoba: Marquette, Arnaud, Baldur, Good Land, Lyleton.
- Minnesota: Anoka, Howard Lake, Roseau County, Noyes, Lancaster, Plummer, Huot, Crookston, Ada, Fergus Falls, Foxhome, Tenney, Brown's Valley, Graceville, Heron Lake.
- Iowa: Moulton, Woodbury County.
- Illinois: Beach, Waukegan, Chicago, Meredosia.
- Missouri: Willard.
- Arkansas: Polk County, Hope.
- Louisiana: Material examined from 17 localities.
- Saskatchewan: Willow Branch, Gull Lake.
- North Dakota: Devil's Lake, Stump Lake, Hillsboro, Fargo, Hankinson, Nicholson, Bottineau, Ashley, Mott, Beach.
- South Dakota: Sisseton, Bigstone, Waubay, Elk Point, Hecla,

Wessington Springs, Springfield, Lakeview, Martin, Buffalo, Newell.

Nebraska: West Point, Cedar Bluffs, Lincoln, Burnham, North Platte, Keith County, Dundy County, Benkelman, Haigler, Dawson County, Box Butte, Pine Ridge near Prairie Dog Canyon (Sioux County).

Kansas: Crawford County, Cherokee County, Medora, St. John, Barber County, Seward County, Grant County.

Oklahoma: Catale, Keystone, 6 mi. E. Cushing, Henryetta, Halden-ville, Oklahoma City, Norman, Ft. Sill Mil. Res., 20 mi. S.E. Buffalo, Elmer, Gate, Guymon, Kenton.

Texas: Material examined from 47 localities, mainly in the eastern half of the State and along the coast, as indicated in fig. 2. The more western specimens are from Canadian, Happy Crossing, Pecos, and Presidio.

Alberta: Cereal, Finnigan, Irvine.

Montana: Glendive.

New Mexico: Roosevelt County, Artesia, Avalon, Carlsbad.

*Material examined intermediate between pelidna pelidna  
and pelidna desereta*

Montana: Harlem, Custer, Billings, Columbus.

Wyoming: Pine Bluffs, Goshen County, Platte County, Laramie, Big Horn County.

Colorado: Julesburg, Logan County, Livermore, Ft. Collins, Adams County, Poudre River, Colorado Springs, El Paso County, Olney, Lamar, La Junta, Walsenburg.

New Mexico: Springer, Wagon Mound, Otowi, Cowles, Sandia Mts., Albuquerque, Bernalillo County, Torraine County, Belen, Melena, Roswell, Sacramento Mts.

*Orphulella pelidna desereta* Scudder

Figs. 2, 5, 42, 44-45

*Orphulella desereta* Scudder, Canad. Ent., Vol. 31, pp. 178, 184, 1899.

*Orphulella salina* Scudder, *Ibid.*, pp. 179, 185, 1899.

*Type material examined and its location*

Lectotype of *desereta*, here designated: Male labeled "Salt Lake Vall. Utah, 4,300 ft., Aug. 1-4, 1877; Orph. desereta Scudder's Type, 1899; Type 15220." M. C. Z.

Lectotype of *salina*, here designated: Male labeled "White R., Col.,

Jul. 24–Aug. 13; Orph. salina, Scudder's Type. 1899. A. P. Morse, Collector." M. C. Z.

Paratypes of *desereta*: 10, Salt Lake Valley, Utah, U.S.N.M., A.N.S.P., Heb. Coll., and U. of Mich.

Paratypes of *salina*: 3, White River, Colo.; 2, Spring Lake Villa, Utah; 2, Salt Lake, Utah; 1, Provo, Utah. U.S.N.M., A.N.S.P., Heb. Coll., and U. of Mich.

*Descriptive notes.*—The principal characters distinguishing *desereta* from *pelidna pelidna* are given in the key. The tegmina of *desereta* usually extend to the tips of the hind femora; they may be slightly shorter but seldom surpass the femora by more than 1 mm. The lateral carinae usually are slightly incurved on the prozona (figs. 5, 44), and no specimens with the greatly incurved carinae frequent in *pelidna pelidna* have been seen. The fastigium is usually slightly blunter and the dorsal depression less distinct than that of *pelidna pelidna*. Though the aedeagus differs from that of far eastern specimens of *pelidna pelidna*, as previously stated, there is no sharply demarked distinction between it and aedeagi of specimens of the latter subspecies occurring on the Great Plains. The spurious vein in the ulnar area of the male tegmen is not sufficiently constant in its occurrence to be a dependable key character. Of 138 males of *desereta* 11 specimens, or 8 percent, showed no spurious vein on either tegmen. Many others had one tegmen with the vein poorly developed or absent. The pronotal proportions of *desereta* were determined by measuring 33 individuals of each sex. Eleven of the males had a longer prozona and in 4 the metazona was slightly the longer, the ratio of metazona to prozona being as 1:1.01. Among the females 22 showed a longer prozona, 5 a longer metazona and the ratio of metazona to prozona was as 1:1.04.

The coloration of *desereta* includes various combinations based on green or brown but usually is more somber than in *pelidna pelidna*. The color of the lateral basivalvular sclerite of the lower ovipositor valve is not sufficient to constitute a specific character.

The following are measurements in millimeters of representative specimens of *pelidna desereta* (see p. 127).

*Synonymy.*—Hebard (1929b) placed *salina* as a synonym of *desereta*. The variability of the separating characters given by Scudder (1899a) is now well known, and type material shows the two to be synonymous. Scudder's record of *pelidna* from Gazelle, Calif., was based on material of *desereta*. Certain records of *salina* and *desereta*, as those of Scudder and Cockerell (1902) from near



| Locality                    | Body Length | Pronotum | Tegmen | Hind Femur |
|-----------------------------|-------------|----------|--------|------------|
| <i>Females</i>              |             |          |        |            |
| Springerville, Ariz. ....   | 25.5        | 4.5      | 20.3   | 14.4       |
| Gazelle, Calif. ....        | 20.0        | 3.5      | 14.7   | 11.5       |
| Salt L. Vall., Utah ....    | 24.0        | 4.2      | 19.0   | 13.5       |
| Paratype of <i>desereta</i> |             |          |        |            |
| Oliver, British Columbia    | 18.5        | 3.4      | 15.5   | 12.0       |
| <i>Males</i>                |             |          |        |            |
| St. Johns, Ariz. ....       | 15.6        | 2.8      | 13.7   | 9.0        |
| Springerville, Ariz. ....   | 17.5        | 3.2      | 15.5   | 10.5       |
| Salt Lake Vall., Utah ....  | 17.2        | 3.0      | 13.0   | 9.5        |
| Paratype of <i>desereta</i> |             |          |        |            |
| Gazelle, Calif. ....        | 14.5        | 2.8      | 12.5   | 9.5        |
| Republic, Wash. ....        | 16.7        | 3.0      | 13.2   | 10.0       |

Tularosa, N. Mex., were probably based upon specimens intermediate between the two subspecies.

Mention of the principal known facts in the biology of *desereta* is made under *pelidna pelidna*.

*Distribution*.—Fig. 2 shows the distribution of *desereta* and the area of intergradation between the subspecies. The variation in *pelidna pelidna* and the intergradation with *desereta* have been discussed under the former.

*Distribution of material of pelidna desereta examined*

Montana: Bozeman, Gallatin County.

Colorado: White River, Delta, Montrose, Grand Junction.

New Mexico: Farmington, Jemez Mts.

Idaho: Eagle, Emmett, Montpelier, Bannock County, Burley.

Utah: Uintah County, Logan, Ft. Duchesne (Wasatch County), Salt

Lake Valley, Spring Lake Villa (Utah County), Salt Lake City,

Utah Lake (east side), Sompete County, Glenwood, Milford

(Beaver County), Marysvale, Box Elder County, Tooele

County, Juab County, Millard County.

Arizona: St. Johns, Holbrook, Springerville (Apache County).

British Columbia: Fairview, Penticton, Oliver.

Washington: La Chapples (Yakima River), Wallula, Toppenish, Beuna, Walla Walla.

- Oregon : Divide (Douglas County), 6 mi. E. of Vale, alkalie flat E. of Bonita.  
 Nevada : Darroughs Hot Springs (Big Smoky Valley, Nye County), Clover Valley (Elko County).  
 California : Gazelle, Amedee (Lassen County).

*Orphulella speciosa* (Scudder)

Figs. 1, 16-22, 24, 30, 31

- Stenobothrus speciosus* Scudder, Bost. Journ. Nat. Hist., Vol. 7, No. 3, p. 458, 1862.  
*Stenobothrus aequalis* Scudder, *Ibid.*, p. 459, 1862.  
*Stenobothrus bilineatus* Scudder, *Ibid.*, p. 460, 1862.  
*Stenobothrus gracilis* Scudder, Final Rept. U. S. Geol. Surv. Nebr., p. 250, 1872.  
*Orphula decora* McNeill, Proc. Dav. Acad. Nat. Sci., Vol. 6, pp. 235, 239, fig. 17d, 1897.  
*Orphulella obliquata* Scudder, Canad. Ent., Vol. 31, pp. 178, 181, 1899.  
*Orphulella picturata* Scudder, *Ibid.*, pp. 178, 182, 1899.

*Type material examined and its location*

- Holotype of *speciosa*: Male labeled "36, *Stenobothrus speciosus* Scudd. Cab. S. H. Scudder, *S. speciosus* Scudd. Type 15227." The unique male was described from St. Paul, Minn. M. C. Z.  
 Lectotype of *aequalis*, here designated: Female labeled "Mass. Sanborn; *Stenobothrus aequalis* Scudd. Cab. S. H. Scudder; Type 15226." M. C. Z.  
 Lectotype of *bilineatus*, here designated: Male labeled "S. *bilineatus* Scudd. Mass.; *Stenobothrus bilineatus* Cab. S. H. Scudder; Type 15225." M. C. Z.  
 Holotype of *gracilis*: Male labeled "Platte; Hayden; *Stenobothrus gracilis* Scudd. Cab. S. H. Scudder; *S. gracilis* Scudd.; Type 15228." M. C. Z.  
 Lectotype of *obliquata*, designated by Hebard (1929b, p. 328): Male labeled "Dallas Tex. Boll; *Orph. obliquata*. Scudder's Type, 1899; type 15218." M. C. Z.  
 Lectotype of *picturata*, designated by Hebard (1929b, p. 328): Male labeled "Dallas Tex. Boll; *Orph. picturata*. Scudder's Type, 1899; Type 15219." M. C. Z.  
 Paratypes of *obliquata*: 1, Dallas, Tex. U. S. N. M.  
 Paratypes of *picturata*: 3, Dallas, Tex.; 12, Texas. U. S. N. M., A. N. S. P., Heb. Coll., and U. of Mich.

*Descriptive notes.*—Over the more eastern part of the range of *speciosa* the fastigium is rather uniformly blunt, with the dorsal depression little developed and far forward (figs. 16, 19). That of the female is more broadly rounded than that of the male. There is a great deal of variation, and in neither sex can the fastigium alone be utilized to separate *speciosa* from *pelidna*. Specimens with the fastigium more acute and the depression much more developed are especially frequent in Texas (figs. 17, 18). The lateral carinae of the pronotum vary from virtually parallel to decidedly incurved (fig. 22) but usually are only slightly incurved (fig. 16). In most areas at least a few specimens occur with noticeably incurved carinae, but E. S. Thomas writes that series of Ohio specimens are very constant. The synonymous *decora* was based upon a specimen with parallel carinae and very obtuse, broadly-rounded fastigium.

It has often been stated that in *speciosa* the prozona is longer than the metazona. Thirty-three males from Texas were measured for pronotal proportions. The prozona of only one specimen exceeded the metazona in length; in 19 the metazona was longer. The ratio of prozona to metazona was as 1:1.05. Of 33 males from Michigan 25 had a longer prozona and only 4 a longer metazona; the ratio of metazona to prozona was as 1:1.05. Of 33 Texas females 2 had the prozona longer, 22 had a longer metazona, and the average ratio of prozona to metazona was as 1:1.04. The prozona was longer in 27 of 33 Michigan females, only 1 had a longer metazona, and the ratio of metazona to prozona was as 1:1.1. These measurements demonstrate that slight average differences occur in different areas.

The tegmina of 236 males from Minnesota were examined for the presence of a spurious vein in the ulnar area. The two tegmina of the same specimen often showed some variation. In 171 specimens neither tegmen showed any spurious vein, and in only 7 was an entire one developed. Ten others each possessed a nearly entire spurious vein on at least one tegmen; the remaining specimens had the spurious vein restricted to a few cells of the ulnar area. Material from other States indicates that similar variation occurs throughout the range of *speciosa*. In previous keys the spurious vein has often been used, but while very helpful it cannot be trusted as a single character for separating *speciosa* from its congeners. Fig. 30 shows the characteristic shape of the anterior ulnar vein of the female tegmen; though usually curving anteriorly, the vein is occasionally straight.

Because the tegmina of *speciosa* are usually shorter than those

of *pelidna pelidna* and because the reliability of this character was unknown, 200 females and 223 males of *speciosa* from Minnesota were measured to determine the length of tegmina with respect to the apices of the hind femora. The tegmina of 180 females and 190 males either did not surpass the hind femora or exceeded them by less than 0.5 mm. Of the remaining specimens, the tegmina of 4 exceeded the hind femora from 1 to 2.5 mm. and the others exceeded them by less than 1 mm. The data presented elsewhere for *pelidna pelidna* show that the length of tegmina does afford a helpful character for separating the two species.

The aedeagus of *speciosa* shows no significant variation. Occasional specimens vary slightly from fig. 20, but there is no confusion with *pelidna* in this respect, and separation of *speciosa* from *halophila* and *olivacea* may be made on external characters.

The species most likely to be confused with *speciosa*, in fact the only species whose range is similar (except along the coast where *olivacea* occurs), is *pelidna*. After a little practice the student will have little difficulty separating *speciosa* from *pelidna* for the great majority of specimens, but in some cases the examination of genitalia will be necessary. A series of 4 males and 1 female of *speciosa* and 2 males and 2 females of *pelidna pelidna* from North Platte, Nebr., demonstrates the value of characters of the aedeagus. Males were distinguished at a glance following genitalic examination. In this series the color of the lateral basivalvular sclerites of the females was well differentiated. The external characters obviously separated the two species in both sexes, but this separation could not confidently have been made previous to the genitalic examination.

Almost every color combination of the many that are familiar to all students who know *Orphulella* occurs in *speciosa*. Of 225 Minnesota specimens which were tabulated with respect to color, 124 were predominantly light, pale brown, 59 were dark brown, and 42 were of some shade of green. Within these 3 groups the tegmina varied as to the color of the principal fields, and varied from unmarked to conspicuously maculate. The pronotal disk may be immaculate or brilliantly marked with pale lateral carinae bordered with black. In series from Texas and Louisiana there are some specimens that have markings brighter and more contrasting than is usual for the Northeastern States; Hebard (1929b, p. 328) noted this at the time *obliquata* and *picturata* were placed in synonymy. The hind tibia sometimes has an imperfect, pale, basal annulation, but this is usually absent.

In searching for characters to separate females of *speciosa* from

those of *pelidna pelidna*, it has been found that the base of the lateral basivalvular sclerite of the lower valve of the ovipositor is almost always colorless in *speciosa* and cloudy or dark fuscous in *pelidna pelidna*. Frequently it is possible to utilize the color as a supporting character by simple examination, but in other cases relaxation of the end of the abdomen and removal of one lower valve are helpful. The valve may be cleaned of loose attached muscle in water or alcohol and then mounted on a point below the specimen from which it was removed. With the exception of these two species, this color character has thus far not been found sufficiently constant to be valuable, but with a little practice it is rather helpful in distinguishing doubtful females of *speciosa* from *pelidna pelidna*.

The largest specimens of *speciosa* examined are those from Oklahoma, which represent the synonymous *decora*. Measurements in millimeters of representative specimens of *speciosa* are as follows:

| Locality                | Body Length | Pronotum | Tegmen | Hind Femur |
|-------------------------|-------------|----------|--------|------------|
| <i>Females</i>          |             |          |        |            |
| Toronto, Ontario .....  | 17.0        | 3.0      | 11.0   | 10.0       |
| Massachusetts .....     | 15.0        | 2.8      | 11.5   | 10.5       |
| Big Bald Knob, Va. .... | 22.0        | 3.8      | 17.8   | 12.5       |
| Rumford, R. I. ....     | 15.6        | 3.2      | 11.0   | 10.6       |
| Kadoka, S. Dak. ....    | 20.5        | 3.4      | 18.0   | 12.0       |
| Cache, Okla. ....       | 24.0        | 4.5      | 15.7   | 14.0       |
| Fargo, N. Dak. ....     | 18.0        | 2.7      | 12.0   | 10.0       |
| <i>Males</i>            |             |          |        |            |
| Cumington, Mass. ....   | 14.5        | 3.0      | 10.8   | 10.0       |
| Same as above .....     | 13.7        | 2.5      | 10.7   | 9.5        |
| Minneapolis, Minn. .... | 13.3        | 2.3      | 10.0   | .....      |
| Rumford, R. I. ....     | 12.5        | 2.5      | 9.3    | 9.0        |
| Magazine Mt., Ark. .... | 19.2        | 3.8      | 14.0   | 11.7       |
| Wilburton, Okla. ....   | 20.0        | 4.0      | 14.0   | 12.0       |

*Synonymy*.—Three of Scudder's species, *aequalis*, *bilineatus*, and *gracilis*, were placed in synonymy by McNeill (1897), and the synonymy was followed by Scudder (1899a) and subsequent authors. Morse (1893, p. 479) had already united *bilineatus* with *aequalis*. Scudder's *gracilis* 1872 should not be confused with

*Orphulella gracilis* Giglio-Tos (1894) from Paraguay.<sup>5</sup> Three additional names, *decora*, *obliquata*, and *picturata*, were synonymized by Hebard (1929b, p. 328). The present writer has examined the types of all except *decora* and finds the above synonymy correct and explainable on the basis of variation. McNeill's *decora* was described from Fayetteville, Ark., and was of the variation common in Arkansas and adjoining States, being large with unusually obtuse fastigium and parallel pronotal carinae. The single type female has presumably been lost.

The synonymy of *aequalis* and *bilineatus* was indicated in 1868 by S. I. Smith in his paper on the Orthoptera of Maine. However, he placed them under *maculipennis* instead of *speciosa*, misidentifying the common Maine species, *speciosa*, as *maculipennis*. The latter is actually a synonym of *pelidna pelidna*, and Smith's misidentification was followed by several later authors. Morse (1893, p. 479) has noted Smith's misapplication of the name *maculipennis*.

*Biological notes on speciosa*.—This widespread species is characteristic of short-grass country and has been called the pasture locust, probably because it often swarms in dry upland pastures and semi-waste fields in the Northeastern States. It has frequently been stated that *speciosa* outranks *pelidna* in numbers on areas of short grass, in States where both species are abundant in favorable habitats. This fact is borne out by surveys which have been reported by Shotwell (1938). During field studies of the grasshoppers important in 1937 it was found that on Iowa range land *speciosa* comprised 4.91 percent of the total grasshoppers taken as compared with 0.85 percent for *pelidna*. On the other hand, in a pasture of longer grass *pelidna* was the fourth most numerous species, being exceeded only by *Melanoplus femur-rubrum femur-rubrum* (Degeer), *M. mexicanus mexicanus* (Sauss.), and *Ageneotettix deorum deorum* (Scudd.). In Kansas the same survey showed that *speciosa* was next in relative abundance to *mexicanus* and *deorum* on short-grass pasture, while in taller grassland *pelidna* followed *Opeia obscura*

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<sup>5</sup> *O. gracilis* G.-T. is a secondary homonym, and, since the International Commission on Zoological Nomenclature does not distinguish between secondary and primary homonyms, a new name is required. Accordingly, *Orphulella neogea*, new name, is here proposed for the South American species. Giglio-Tos (1897b) placed his *gracilis* as a synonym of *maculipennis*, and plainly was confused regarding identities. Rehn (1906a) and Bruner (1906; 1911; 1919) have treated *gracilis* G.-T.

(Thos.) and *decorum*. A report by Shotwell (1939) on species important in 1938 shows that in Illinois *speciosa* was the fourth most numerous species on pasture grassland, comprising 3.2 percent of survey collections. In Iowa it was the fifth species but represented 5.59 percent of collections on pasture grassland; in Texas it was fourth and included 4.22 percent of the grasshoppers taken on bottom sandy areas. Wolcott (1937) collected insects on 100 sq. ft. of ground in northern New York and found that *speciosa* exceeded in numbers all other Orthoptera except *Tettigidea* and *Conocephalus*; only 5 specimens of *speciosa* were taken, however, so that his results are of limited significance.

That the variation in *speciosa* is partly a response to environment is suggested by Morse's statement (1907, p. 31) that *decora* was found in the "denser growths of grass in the damper parts of fields in the territory inhabited by it, while *picturata* prefers the shorter growths of drier soils."

Hebard (1925, p. 60) characterizes the South Dakota habitat of *speciosa* as "dry, though not very dry, grasslands . . .," and Isely (1937) concurs for northeastern Texas by finding *speciosa* typical of deep soil areas rather than those of light sandy soil. In Massachusetts its habitat varies from rather bare hilly pastures to moist pastures or hay fields of low growth.

The following notes on the occurrence of *speciosa* in Ohio have very kindly been supplied by E. S. Thomas: "In the Appalachian Plateau counties (the southeastern half of the State, roughly) *speciosa* is distributed rather generally, though locally. It is a characteristic and common species in our relatively few 'dry prairies,' but occurs also, sometimes commonly, in sandy pastures and old fields. In the latter situations, it is almost invariably associated with sandy soils with 'artificial dry prairie' aspects. West of the Appalachian Plateau (roughly, the northwestern half of the State), I have specimens from but 9 localities (out of some 120 localities investigated). Of these, 4 are original dry prairies, 3 are sand ridges or fossil sand dunes, and the remaining 2 I have not personally seen. These data lead to the decided inference that *speciosa* in this State is an important element of the dry prairie fauna and that originally, under primary conditions, it was undoubtedly restricted to dry prairie. *Speciosa* matures very consistently about July 4. The average date for first adults over a period of 11 years is July 5; the latest September 15. My earliest record over that period is June 27; latest, October 12."

The seasonal distribution varies with the region involved. Adults from Brownsville, Tex., bear the dates January 24, May 23, July 10, August 3, and December 20, and perhaps they occur there throughout the year. Considering northeastern Texas, however, Isely (1937) places *speciosa* in the June–August succession and reports juvenile specimens but no adults during May, the largest number of adults during August–October, and only occasional adults in December. Morse (1920) gives seasonal distribution as July–October in New England, and the author has taken adults at Cummington, in the Berkshire Hills of Massachusetts, from July 12 to October 1, and has found nymphs abundant July 22. At Norway, Maine, Smith (1868) found *speciosa* “very abundant, especially in hilly pasture land, late July to the last of September.” Adults are known to occur in Kansas from June 27 to September 24, and in South Dakota from July 10 to October 4. Extreme dates of Minnesota specimens examined are July 8 at Fergus Falls and September 30 at St. Anthony Park. D. G. Denning collected the following mating pairs of *speciosa* in Minnesota: Plummer, August 18, 1; Crookston, August 30, 9; Crookston, September 5, 5; Crookston, September 11, 1. Specimens from White Lake, Ontario, July 18, and Toronto, October 3, have been seen.

The species occurs practically at sea level in parts of New England, as for instance on Mt. Desert Island, Maine. Morse (1920, p. 436) recorded it from Speckled Mt., Maine, 2,800 ft., and Mt. Greylock, Mass., 3,500 ft. The writer took it at 5,000 ft. on the slope of Mt. Rogers in southwestern Virginia, September 18, 1938. Other records of interest, from specimens at hand, are as follows: Allardt, Tenn., August 14, 1,650 ft. (a large series); Cheaha Mt., Ala., July 13, 2,400 ft.; Magazine Mt., Ark., August 29, 2,600 ft.; North Platte, Nebr., July 28, 2,800 ft.

Bromley (1914) gives six recorded instances of *speciosa* being the prey of the robber fly *Proctacanthus philadelphicus* Macq.

*Distribution* (fig. 1).—There are relatively few records of *speciosa* from beyond the limits of the material examined. Scudder (1899a) recorded it from Nova Scotia, but Piers (1918) questioned the record. Rehn (1910) believes that certain early Bermuda records refer to *olivacea*. Linnville, in Mitchell County, N. C., is the most southern locality in the Appalachian Range known to Hebard (1925) and the only North Carolina locality listed by Brimley (1938). Hebard (1932) recorded *speciosa* from Tamaulipas, this being the first Mexican record.



*Distribution of material of speciosa examined*

- Maine: Orono, Northeast Harbor (Mt. Desert Is.), Rockport, Augusta, Norway, Brunswick.
- New Hampshire: Rye Beach, Jaffrey.
- Vermont: Woodstock.
- Massachusetts: Townsend, North Saugus, Lexington, Dover, Wellesley, Cambridge, Forest Hills, Quincy, Marion, Mattapoissett, Nantucket, Oxford, Amherst, Northampton, Cummington.
- Rhode Island: Rumford, Providence, Saunderstown, Watch Hill.
- Connecticut: New Haven, Milford, Stamford.
- Ontario: White Lake, Toronto, DeGrassi Point, Bay Point.
- New York: Lake George, West Fort Ann, West Point, Van Cortlandt Park, Ithaca, Otto.
- New Jersey: Riverton, Gibbsboro, Parkdale, Margate City, Stafford's Forge, Salem.
- Pennsylvania: Tobyhanna, Yardley, Overbrook, Mt. Airy, Black Moshannon Lake (Centre County).
- Delaware: Wilmington.
- Maryland: Bel Air, Bowie, Glen Echo, Blue Ridge Mts., Garrett County.
- Virginia: Paris, Hopewell Gap (Bull Run Mts.), Manassas, Rosslyn, Fredericksburg, Stony Man Mt., White Oak Canyon (Blue Ridge Mts.), Charlottesville, Sounding Knob, Hard Scrabble Mt., Monterey (Highland County), Big Bald Knob (Augusta County), Flag Rock Pass, Warm Springs Mt. (Bath County), Hot Springs, Wytheville, Elk Ridge (Mt. Rogers), White Top Mt.
- Michigan: Montmorency County, Roscommon, Oscoda (Iosco County), Boardman Plains (Grand Traverse County), Lake George (Clare County), E. S. George Reserve (Livingston County), Milford (Oakland County), Ann Arbor, Irish Hills (Jackson County), Warren Woods, Lakeside, Three Oaks, Berrien County.
- Ohio: Wooster, Columbus, Athens, Carbondale, Byer, Mendon.
- Indiana: Pine, Lafayette.
- Tennessee: Allardt (Fentress County), Dorton, Grassy Cove (Cumberland County), Memphis.
- Alabama: Cheaha Mt.
- Mississippi: Vicksburg, Natchez.
- Wisconsin: Marathon County, Wood County, Jackson County, Monroe County, Dunn County, Madison, Lone Rock.

- Manitoba: Arnaud, Carlowrie, Brandon, Aweme, Wawanesa, Turtle Mts., Lyleton.
- Minnesota: Material examined from 44 localities, distributed as shown in fig. 1.
- Iowa: Muscatine County, Louisa County, Lee County, Mt. Pleasant, Bloomfield, Moulton, Osceola, Kossuth County, Lyon County, Sioux County, Sioux City, Creston.
- Illinois: Material examined from 19 localities.
- Missouri: Willard, Howard County, Grundy County, Morgan County, Nodaway County, DeKalb County, Clinton County, Jackson County, Bates County, Newton County.
- Arkansas: Winslow, Van Buren, Magazine Mt., Blue Mt. Sta., Dardanelle, Centerville, Polk County, Hope, Ashdown.
- Louisiana: Delta, Laurel Hill, Port Hudson, Baton Rouge, Magnolia, St. Rose, West Monroe, Alaha, Shreveport, Natchitoches.
- North Dakota: Devil's Lake, Cheyenne River (Eddy County), Stump Lake, Hillsboro, Fargo, Hankinson, Linton, Ashley, Killdeer Mts., Medora, Sentinel Butte, Beach, Amidon.
- South Dakota: Material examined from 24 localities, of which the most western are Buffalo, Newell, Spearfish, and Hot Springs.
- Nebraska: West Point, Nance County, Lincoln, Burnham, Valentine, Kearney, North Platte, Ft. Robinson, Keith County, Glen.
- Kansas: Material examined from 26 localities, the most western of which are Lane and Seward Counties.
- Oklahoma: Catale, Haileyville, Wilburton, Howe, Osage County, Cushing, Perkins, Shawnee, Norman, McClain County, Chickasha, Caddo, Alfalfa County, Canadian County, Cache, Mountain Park, Guymon.
- Texas: Material examined from 49 localities, mainly in the eastern half of the State. The most westerly localities are Clarendon and Midland.
- Montana: Carter County, Custer National Forest.
- Colorado: Julesburg, Ft. Collins, Elbert County.

## SUMMARY

*Orphulella* is a genus of acridine grasshoppers found in the New World from Canada to Argentina; this paper covers those occurring north of Mexico. Twenty-one species of *Orphulella* have been recorded from the United States, but through synonymy and corrections of distributional data this number has been reduced to four species and two subspecies. The variation in structural and color features is very great and has been mainly responsible for

the naming of so many supposedly distinct species. The aedeagus of the male genitalia has proved very helpful in distinguishing species, although the majority of specimens may be identified by external characters. Keys for identification of species and for distinguishing *Orphulella* from closely allied genera are presented. The most closely related genera occurring in the United States are *Dichromorpha* and *Clinocephalus*.

The most widely distributed and best known species of *Orphulella* in the United States are *speciosa* and *pelidna*; both occur over the eastern part of the country and as far west as the Rocky Mountains, and *pelidna* is represented west of the Rocky Mountains by the subspecies *desereta*. In the Southwest *compta* occurs, and along the Atlantic and Gulf coasts a fourth species, the halophilous *olivacea*, is found. The last species has a southern subspecies, *halophila*, in the southern half of Florida and along the southern coast of Texas.

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EXPLANATION OF PLATES

Plate VI

Fig. 1. *Orphulella compta* Seudd. and *O. speciosa* (Scudd.). Distribution of specimens examined. Each symbol represents an area from which one or more specimens have been seen. In case of two localities so close that symbols would overlap, only one has been used.

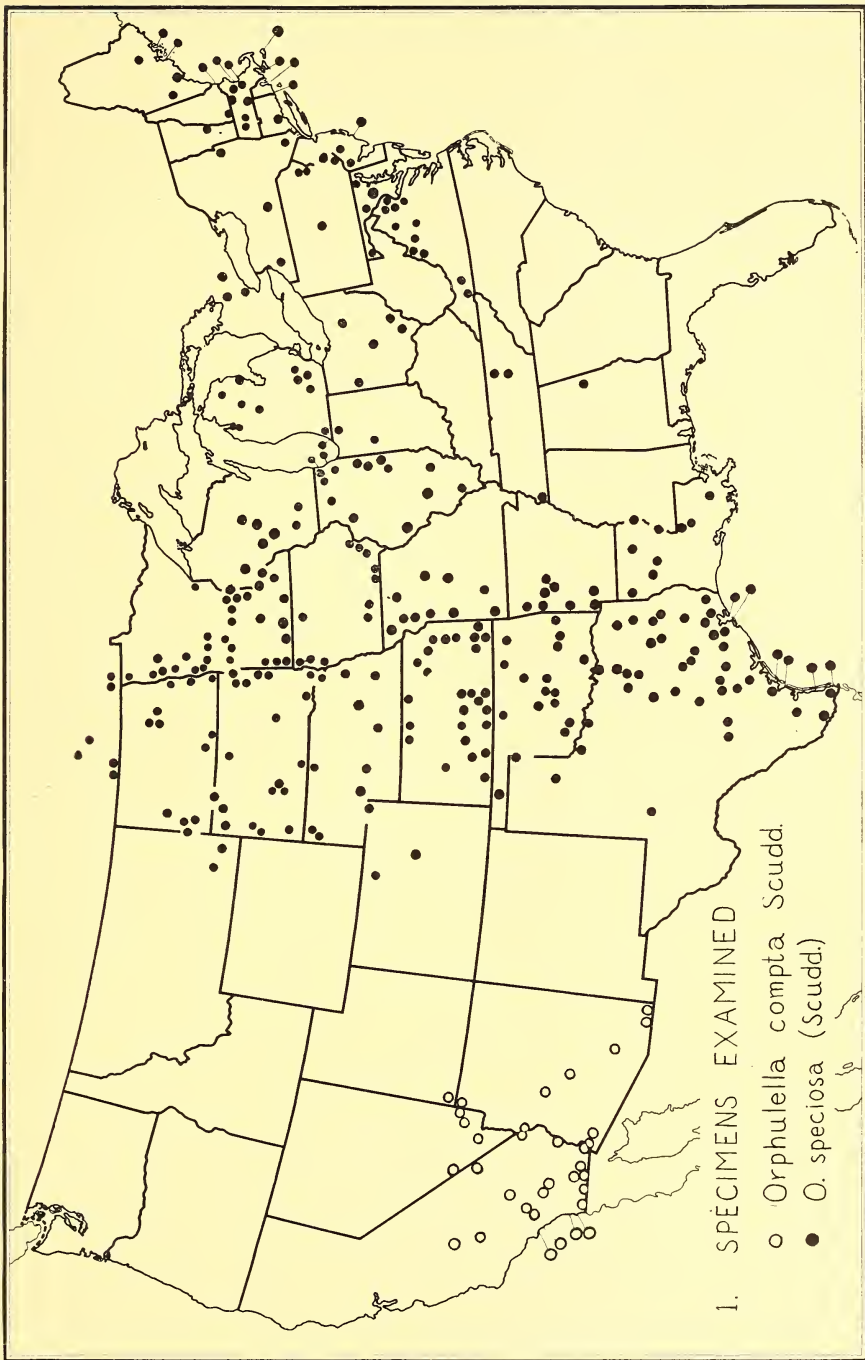
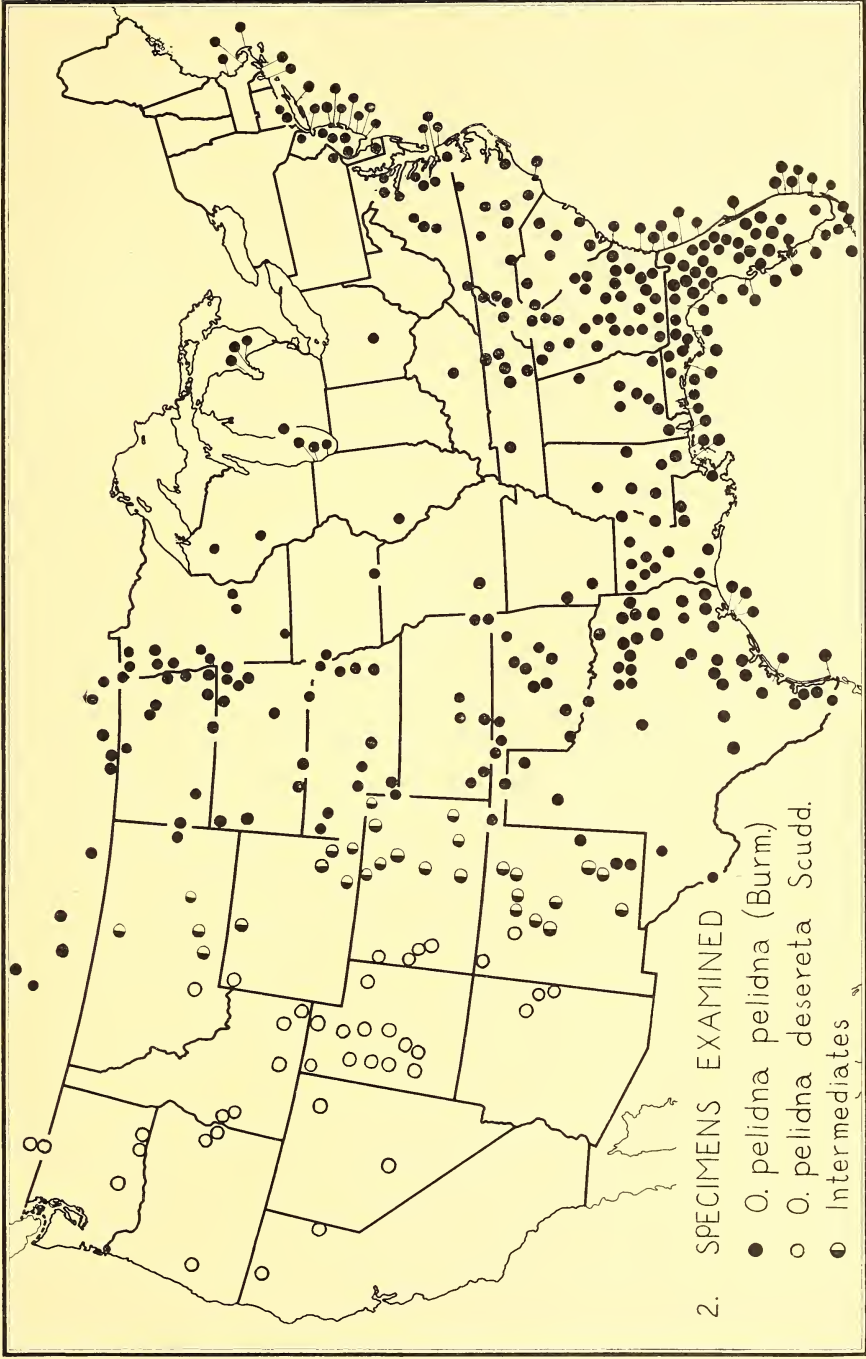


Plate VII

Fig. 2. *O. pelidna pelidna* (Burm.), *O. pelidna desereta* Scudd.  
and intermediates. Same as fig. 1.



2. SPECIMENS EXAMINED

- *O. pelidna pelidna* (Burm.)
- *O. pelidna desereta* Scudd.
- ◐ Intermediates

## Plate VIII

Fig. 3. *O. olivacea olivacea* (Morse) and *O. olivacea halophila* R.  
& H. Same as fig. 1.

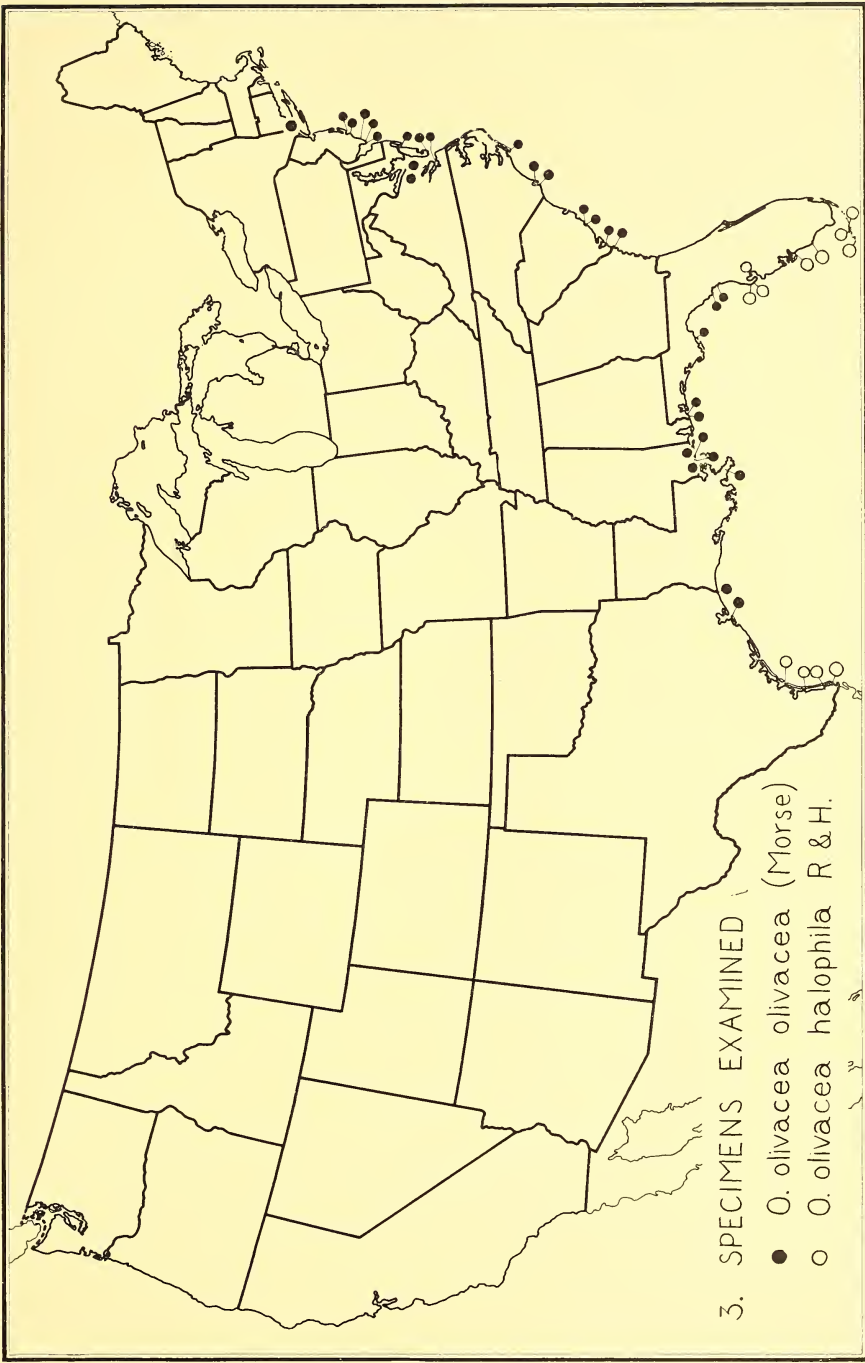
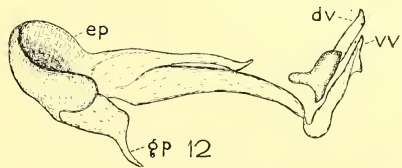
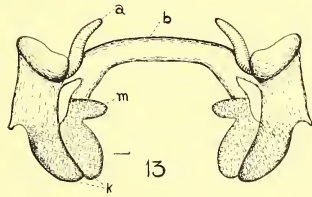
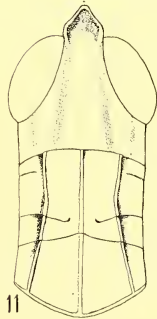
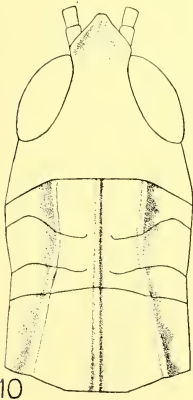
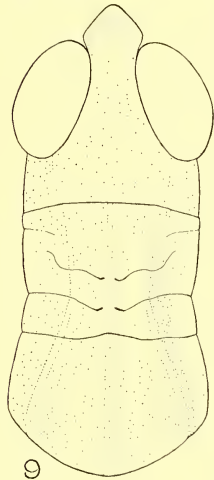
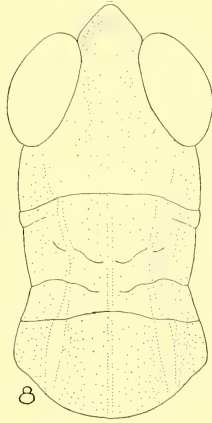
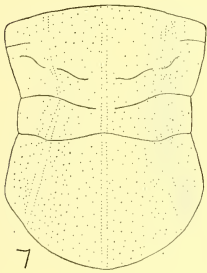
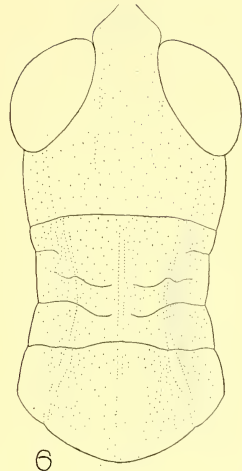
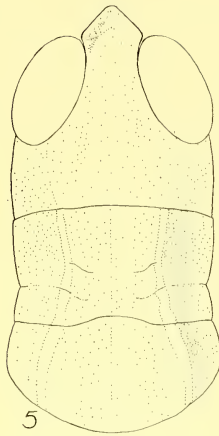
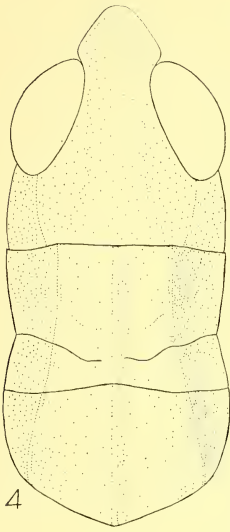


Plate IX

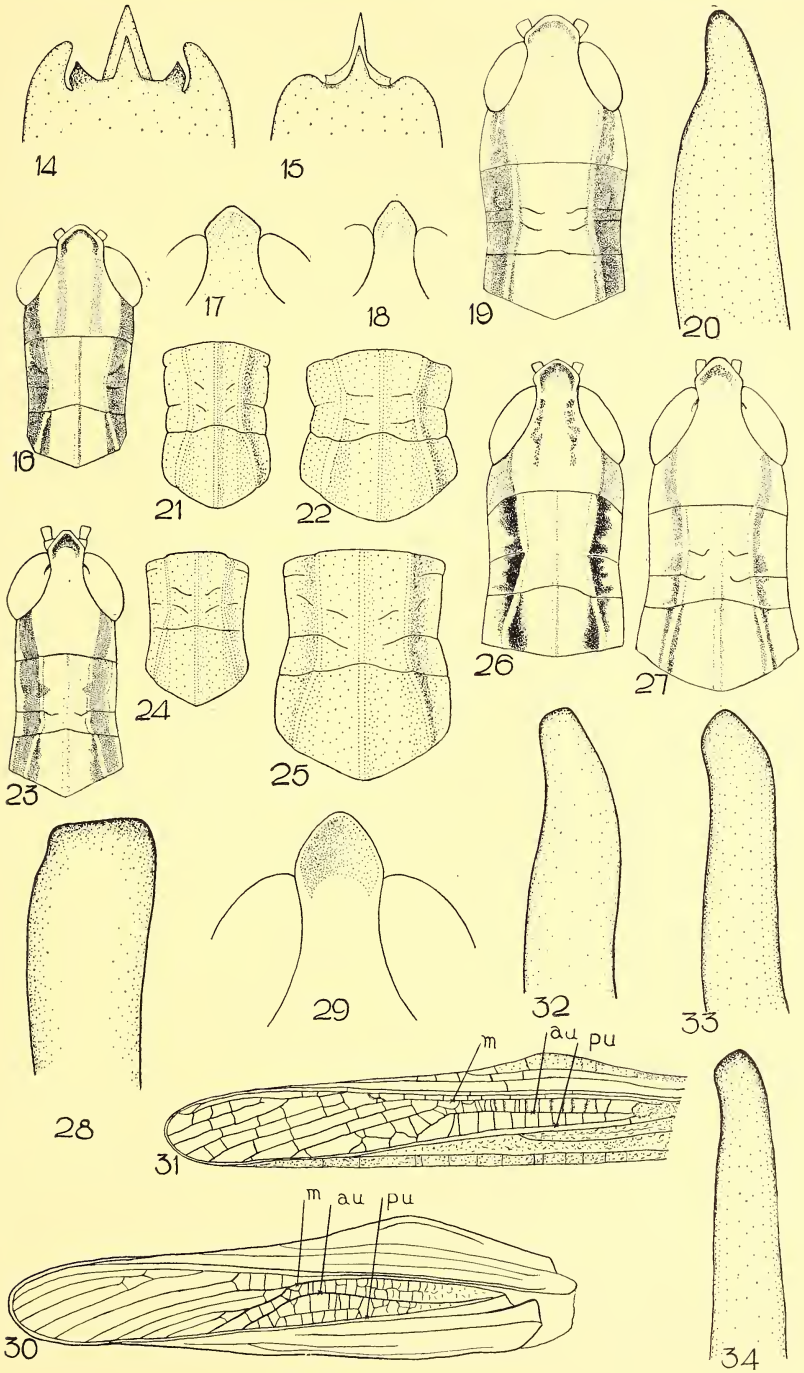
- Fig. 4. *O. compta*, female. Dorsal view of head and pronotum. San Bernardino Ranch, Cochise Co., Ariz. 3,750 ft.
- Fig. 5. *O. pelidna desereta*, male paratype. Same view. Salt Lake Vall., Utah. Aug. 1-4, 1877.
- Fig. 6. *O. pelidna pelidna*, female. Same view. Green Dell Farm, 2 mi. w. Pohick, Fairfax Co., Va. Aug. 25, 1912.
- Fig. 7. Same, female. Dorsal view of pronotum. Nelson Co., Va. Aug. 14, 1921.
- Fig. 8. *O. olivacea halophila*, male paratype. Dorsal view of head and pronotum. Key West, Fla. July 3-7, 1912.
- Fig. 9. *O. olivacea olivacea*, male. Same view. Virginia Pt., Galveston Co., Tex. July 21, 1912.
- Fig. 10. Same, female paratype. Same view. Greenwich, Conn. Aug. 23, 1892.
- Fig. 11. Same, male paratype. Same view. Same data.
- Fig. 12. *O. pelidna pelidna*, male. Left lateral view of endophallus and aedeagus of genitalia. Kittson Co., Minn. July 23, 1936. Abbreviations: dv, dorsal valve of aedeagus; ep, endophallic plate; vv, ventral valve of aedeagus; gp, gonopore process.
- Fig. 13. Same, male. Dorsal view of epiphallus. Same specimen as in fig. 12. Abbreviations: a, ancora; b, bridge; k, posterior lobes; m, median lobe.





## Plate X

- Fig. 14. *O. punctata* (Deg.), female. Ventral view of apex of subgenital plate. Panama, Panama.
- Fig. 15. *O. pelidna pelidna*, female. Same view. Clemson, S. C. July, 1913.
- Fig. 16. *O. speciosa*, male. Dorsal view of head and pronotum. Boardman Plains, Grand Traverse Co., Mich. Sept. 2, 1919.
- Fig. 17. Same, female. Dorsal view of vertex. Devers, Tex. Nov. 12, 1931.
- Fig. 18. Same, male. Same view. Rosenberg, Tex. June 25, 1897.
- Fig. 19. Same, female. Dorsal view of head and pronotum. 5 mi. s. Paris, Va. July 30, 1933. 1,800 ft.
- Fig. 20. Same, male. Lateral view of dorsal valve of aedeagus. Crookstown, Minn. July 20, 1936.
- Fig. 21. Same, male paratype of synonymous *picturata*. Dorsal view of pronotum. Dallas, Texas.
- Fig. 22. Same, female. Same view. Mt. Park, Okla. Aug. 22, 1905.
- Fig. 23. *O. compta*, male. Dorsal view of head and pronotum. Yuma, Ariz. Sept. 21, 1916.
- Fig. 24. *O. speciosa*, male. Dorsal view of pronotum. Rosenberg, Tex. June 25, 1897.
- Fig. 25. *O. compta*, female. Same view. El Centro, Calif. Swept from grass. June 19, 1934.
- Fig. 26. Same, female paratype of synonymous *affinis*. Dorsal view of head and pronotum. Coronado, Calif. July 24, 1897.
- Fig. 27. Same, female. Same view. Indian Reserve, across river from Yuma, Ariz., electric light. June 18, 1915.
- Fig. 28. Same, male. Lateral view of dorsal valve and aedeagus. Yuma, Ariz. Sept. 21, 1916.
- Fig. 29. *O. compta*, male. Dorsal view of vertex. Douglas, Ariz.
- Fig. 30. *O. speciosa*, female. Left tegmen. Paris, Va. July 30, 1933. Abbreviations: au, anterior ulnar vein; m, median vein; pu, posterior ulnar vein.
- Fig. 31. Same, male. Same view. Crookston, Minn. Aug. 30, 1936.
- Fig. 32. *O. olivacea olivacea*, male paratype. Lateral view of dorsal valve of aedeagus. Greenwich, Conn. Aug. 23, 1892.
- Fig. 33. Same, male. Same view. Tybee Is., Chatham Co., Ga. Oct. 2, 1911.
- Fig. 34. Same, male. Same view. Cedar Keys, Fla. Aug. 15, 1905.



## Plate XI

- Fig. 35. *O. olivacea halophila*, male. Lateral view of dorsal valve of aedeagus. Corpus Christi, Nueces Co., Tex. July 29, 1912.
- Fig. 36. Same, male. Same view. S. end Padre Is., Tex. Dec. 12, 1910.
- Fig. 37. *O. pelidna*, intermediate between subspecies, male. Same view. Roswell, N. M. Aug.
- Fig. 38. *O. pelidna pelidna*, male. Same view. Fulfurias, Tex. Dec. 5, 1932.
- Fig. 39. Same, male. Same view. Coddysshore, Va. Oct. 18, 1936.
- Fig. 40. Same, male. Same view. Bellport, N. Y.
- Fig. 41. Same, male. Same view. Crookston, Minn. July 19, 1936.
- Fig. 42. *O. pelidna desereta*, male. Same view. Penticton, British Columbia.
- Fig. 43. *O. compta*, male. Same view. Douglas, Ariz.
- Fig. 44. *O. pelidna desereta*, female. Dorsal view of pronotum. Gazelle, Calif. Sept. 4, 1897.
- Fig. 45. Same, female paratype. Dorsal view of head and pronotum. Salt Lake Vall., Utah, 4,300 ft. Aug. 1-4, 1877.
- Fig. 46. *O. pelidna pelidna*, male. Same view. Whiting, N. J. Aug. 8, 1920.
- Fig. 47. *O. olivacea halophila*, female. Dorsal view of pronotum. Corpus Christi, Nueces Co., Tex. July 29, 1912.
- Fig. 48. Same, female paratype. Dorsal view of head and pronotum. Key West, Fla. July 3-7, 1912.
- Fig. 49. *O. compta*, female. Dorsal view of vertex. Brawley, Calif., on alfalfa, May 26, 1937.
- Fig. 50. *O. pelidna pelidna*, female. Base of left tegmen. Mt. Mitchell, N. C., 6,711 ft. Aug. 20, 1933. sv, spurious vein; other abbreviations as in fig. 30.
- Fig. 51. Same, male. Same view. Rock Creek, D. C.
- Fig. 52. *O. pelidna*, intermediate between subspecies, male. Dorsal view of pronotum. La Junta, Colo. July 22-23, 1919.
- Fig. 53. *O. pelidna pelidna*, male. Same view. Atison, N. J. July 31, 1911.

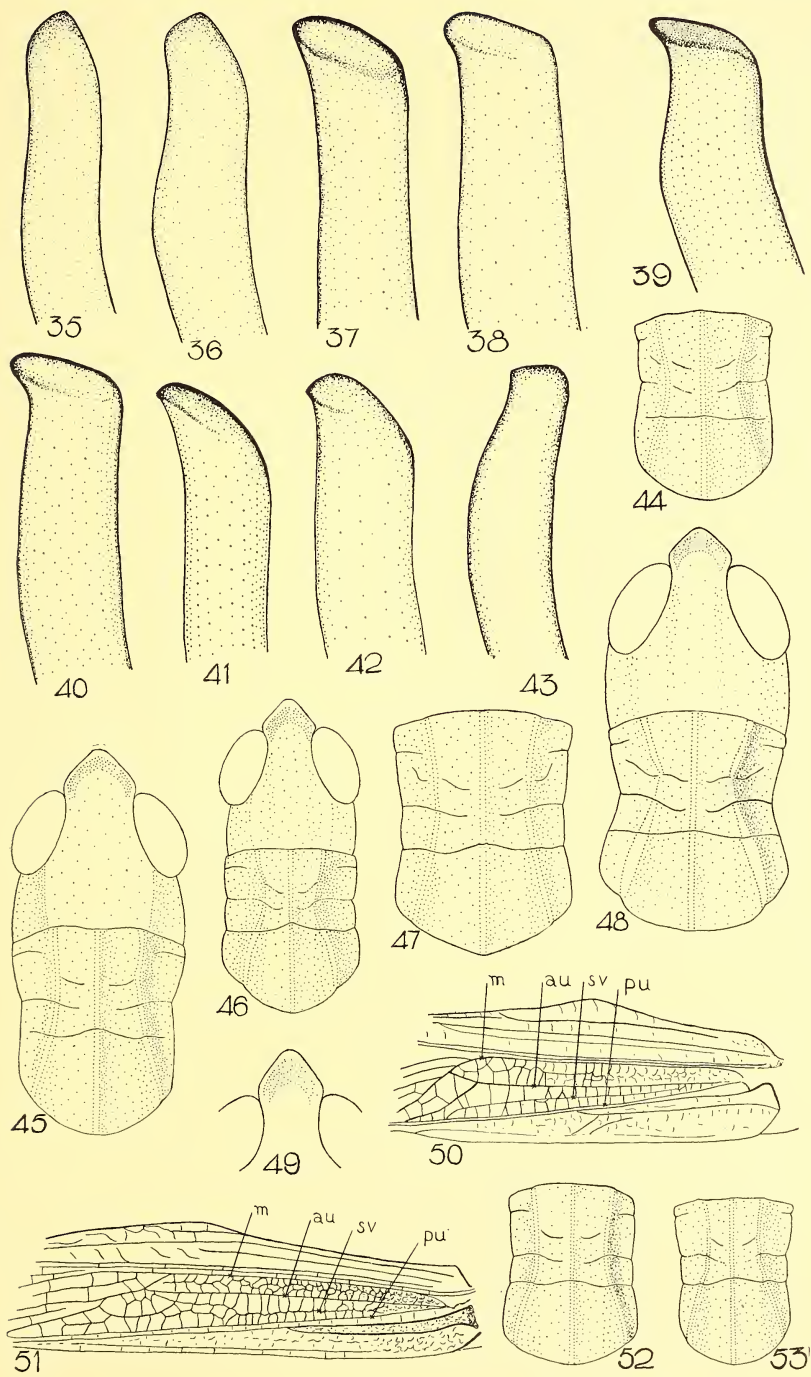
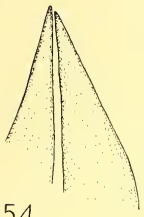
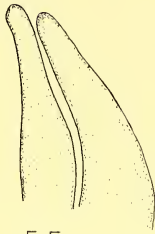


Plate XII

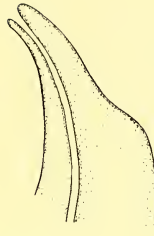
- Fig. 54. *Cordillacris occipitalis* (Thos.), male. Lateral view of apex of aedeagus. Scotts Bluff Co., Nebr. Aug. 9, 1938.
- Fig. 55. *Dichromorpha viridis* (Seudd.), male. Same view. Great Falls, Va. Sept. 12, 1912.
- Fig. 56. *Clinocephalus elegans* Morse, male. Same view. Wildwood Jct., N. J. Sept. 8, 1924.
- Fig. 57. *Parachloebata scudderi* (Bol.), male. Same view. Baracoa, Cuba. Oct. 4.
- Fig. 58. *Dichromorpha viridis*, female. Ventral view of apex of subgenital plate. West Pt., N. Y. Aug. 23, 1925.
- Fig. 59. *Paratruxalis filatus* (Walk.), male. Apex of left tegmen. Asuncion, Paraguay.
- Fig. 60. *Cordillacris occipitalis*, female. Ventral view of apex of subgenital plate and lower valve of ovipositor. Abbreviations: eg, egg guide; ls, lateral basivalvular sclerite; vs, first ventral basivalvular sclerite. Ft. Collins, Colo. Aug. 11, 1901.
- Fig. 61. *Clinocephalus elegans*, female. Ventral view of subgenital plate. Tybee, Ga. Aug. 13, 1903.
- Fig. 62. *Dichromorpha viridis*, male. Dorsal view of supra-anal plate. Rosslyn, Va. Aug. 24, 1916.
- Fig. 63. *Clinocephalus elegans*, male. Dorsal view of supra-anal plate and furcula. Same specimen as in fig. 56.
- Fig. 64. Same, male. Lateral view of epiphallus from left side. Same specimen as in fig. 56.
- Fig. 65. *Orphulella pelidna pelidna*, male. Same view. Ocean View, Va. Aug. 9.
- Fig. 66. *Dichromorpha viridis*, male. Same view. Abbreviations as in fig. 13. Same specimen as in fig. 55.
- Fig. 67. *Cordillacris occipitalis*, male. Same view. Same specimen as in fig. 54.
- (Figs. 10, 11, 16, 19, 23, 26, and 27 drawn by H. B. Bradford, others by the author.)



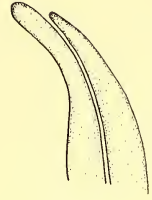
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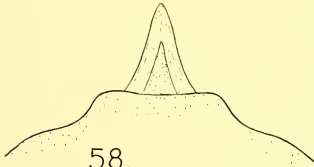
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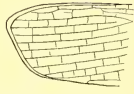
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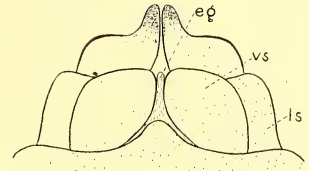
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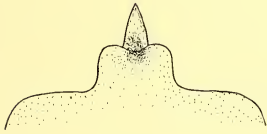
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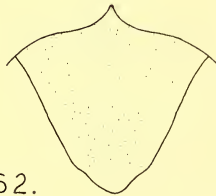
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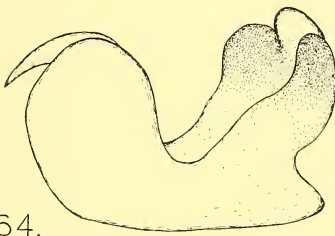
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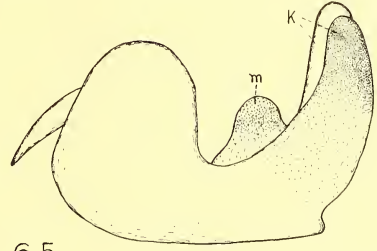
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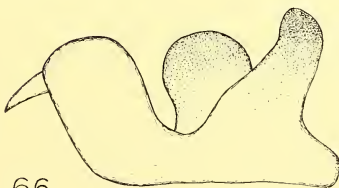
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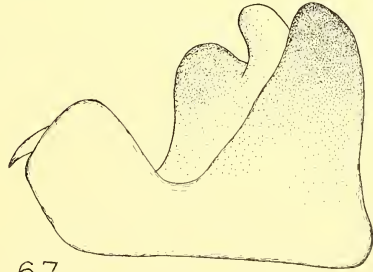
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# ENTOMOLOGICA AMERICANA

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## TAXONOMIC STUDIES IN CANTHARIS (COLEOPTERA: CANTHARIDAE)

BY JOHN WAGENER GREEN  
EASTON, PA.

No work of a systematic nature covering the species of *Cantharis* of the United States and Canada has appeared since Leconte's Synopsis of the Lampyridae in 1881. Some changes and corrections in the Leconte classification are now necessary. It is here proposed to divide the genus primarily on the form of the third tarsal joint. Those species in which this segment is not emarginate at apex form a natural division of probably generic rank and it is with this part of *Cantharis* that the present paper is concerned. It comprises all of the components of Leconte's groups A, B and C except *dentiger* and *carolinus* and the subsequently described *neglectus*. The ungual structure of *decipiens* was incorrectly observed by Horn. It belongs to Leconte's group D.

The species of the first division as above defined are all small, rarely exceeding seven millimeters in length. They occur throughout Canada to Alaska and in the United States they are absent only in the Pacific Coast States. Two very old specimens purporting to have been taken in California and Washington have been seen, but no recent ones. The older descriptions, employing mainly the variable factors of color and the conformation of the pronotum, are of little or no use in making identifications. The result of such attempts is, in most collections, a state of complete confusion. It is

hoped the descriptions here presented, when used in conjunction with the genitalic diagrams, will be more successful. Unfortunately characters derived from the males must be utilized to a large extent in the construction of the synoptic tables.

This essay is admittedly of a preliminary nature, providing a foundation for further research. Those species in which the claws are appendiculate, or broadly toothed, present a most difficult study to which but little is here contributed. An exhaustive investigation of the genital segments of both sexes may provide the answers to many questions, but for this work dried cabinet specimens are not satisfactory and fresh material must be accumulated. Several species, *rectus* in particular, are extremely variable and will no doubt be divided into valid specific units. The advisability of splitting the complex now known as *Cantharis* should be investigated, involving a study of foreign genera. Many specimens have come under observation that very likely represent species additional to those herein recognized. New ones are described only from adequate series including males and only where the probability of adding to future synonymy is remote. Several of the forms considered as species may eventually be reduced in rank, but they are at least sufficiently distinct to require names.

The species of *Cantharis* under consideration are monotonously similar in appearance and structure. The tarsal claws furnish the most important characters of use in grouping and defining the species. Two general types occur: appendiculate, or provided with a broad and blunt basal tooth; and cleft, or acutely toothed. There are many variations of the latter form.

In a majority of the species the anterior margin of the clypeus has a subtriangular median notch and is most prominent at the apices of the limiting angles, the margin on each side sloping backward obliquely. In a second type of clypeal structure the anterior margin is flatly arcuate each side of the median notch, approaching the truncate; or the notch may be reduced to a feeble sinuation. I have used the terms biarcuate or feebly sinuate to describe this modification (Figs. 14, 15 and 16).

Of great value is the degree of enlargement of the eyes in the male. This is measured by the ratio between the distance the eyes are separated at their nearest point, and the length of the eye, both dimensions being observed from directly above the head.

The antennae are filiform, the joints never compressed or notably triangular. Useful differential characters are supplied by the antennal length and the relative proportions of the joints.

The form of the pronotum is rather variable individually, as in most lampyroid genera. The lateral margin is usually acute, or approximately so, throughout, and the sides distinctly reflexed. In some species the margin becomes definitely obtuse at the anterior angles and the sides correspondingly less reflexed. The anterior angles are described as evident when there is a distinct change in the curvature of the margin at that point, and as obsolete when the curvature is regularly continuous with the apical margin.

The elytra are irregularly transversely rugulose in all the members of this division except *longulus*. As *excavatus* is a common and easily recognized species it is used as a basis for comparison in describing the vestiture and sculpture of the elytra. For example, the pubescence would be long, normal or short if it is longer than, equal to, or shorter than that of *excavatus*.

The vestiture of the abdomen is of a dual nature, the ventral segments being sparsely clothed with conspicuous pubescence and also provided with a secondary system of minute scale-like hairs more densely placed but absent at apex. In *nigriceps* and *greeni* the secondary vestiture is so excessively minute as to be difficult to observe.

The females differ from the males in having the eyes smaller, the antennae shorter and more slender, the pronotum broader, the elytra sometimes less elongate, the tarsi shorter, and the claws usually of different structure. Definite modification of the apical margin of the seventh or last ventral segment of the female is rare in this division of *Cantharis*, whereas in the balance of the genus it is quite pronounced in all the species. In the males the seventh segment is broadly emarginate and an apparent eighth segment or aedeagal cap is visible beyond it.

The male genitalia consist of a median lobe enclosed within a bulbously tubular tegmen which is modified distally to form a projecting dorsal plate and two ventro-lateral processes or lobes. The membranous internal sac, when everted, is seen to be variously provided with patches of bristles and would undoubtedly furnish details of taxonomic interest. The entire aedeagus is weakly sclerotized and cannot be properly studied from cabinet specimens. Valuable diagnostic characters are derived from the lobes of the tegmen and this has been the principal criterion for the segregation of species. These features are described by means of diagrams rather than by inadequate verbiage. The dorsal plate is subject to considerable individual variation in length and in the depth of its apical

sinuation. The genitalia are usually more or less distorted in drying but may be sufficiently restored by immersion for a half hour in ten per cent caustic potash solution, although this is not necessary for purposes of identification. They are very easily extracted by squeezing the tip of the abdomen of a completely relaxed specimen with a fine forceps. Except in a few of the more isolated and stable species the male genitalia adhere quite closely to a general type. Interbreeding between species may not be impossible and may account for some of the non-conforming individuals that occasionally appear. In this collection of Mr. C. A. Frost is a male of *scitulus* mounted with a female of *nigriceps* and labelled "in coitu."

Mr. H. S. Barber of the U. S. National Museum has used a technique for preparing soft-bodied Coleoptera, such as *Cantharis*, by which the natural form is preserved and the appendages distended. The specimens are first killed in the cyanide bottle or by any other means that does not produce violent muscular contraction. Before any drying occurs the aedeagus is partly drawn out and the specimens put into a vial partly filled with 50% alcohol and a few drops of benzol. The beetles swell by osmotic absorption of the benzol and, when fully distended, are hardened by adding strong alcohol to the vial until the benzol dissolves and the solution clears. At later convenience they are dehydrated by absolute alcohol, cleared in benzol or xylol, and dried. Fine punctures made in the body wall when dehydration is nearly complete will facilitate the process. Collapse of a specimen is usually due to incomplete dehydration which often is visible as a whitish cloudiness of the viscera when the specimen is finally cleared in the volatile oil before drying. Specimens simply preserved in 70% alcohol sometimes distend very well when treated as above described. Preparations of this nature are needed in *Cantharis* for a more critical study of the several undivided complexes herein considered as species. This method may also be applied to immature stages if such are wanted for convenient reference as dry specimens. The larvae of this family, however, present a field for research that is practically untouched.

The description following the synoptic table are divided into three parts: first—color and size; second—a general description of the male, omitting those parts that are practically constant throughout the division; and third—the most important points wherein the female differs from the other sex. It must be understood that an average individual is described and that some latitude should be allowed for variation, particularly in the form of the pronotum and, to a less extent, in other structures.

The species of *Cantharis* are usually very abundant in the latitude of New York City from the middle of May to early July, occurring only sparingly thereafter. The season is a little later further north and at higher altitudes, and a month or more earlier in the Gulf States. Many of the species are of wide distribution and so common that detailed records of the specimens studied would burden the text with long lists of very doubtful scientific interest. For this reason most of the distribution records, except for new species, are condensed to a list of the states in which the species is known to occur. Unless the number of examples studied is small, thirty or less, no numerical records are given. All published records not personally confirmed have been discarded.

A description of *Cantharis fulvus* Scop., a European species, is given in an appendix. Specimens labelled "Tex" have been seen but these should be confirmed by recent captures before it is included in our list.

During the course of this study many thousands of specimens have been examined, including the type material of the Leconte, Melsheimer and Fall collections, and the general collections of the Museum of Comparative Zoology, American Museum of Natural History, Philadelphia Academy of Natural Sciences and the U. S. National Museum. I am particularly indebted to Mr. H. C. Fall, who, for several years before his death, generously assisted by supplying the correct interpretations of various species and by his advice and encouragement. Mr. and Mrs. Kenneth M. Fender of McMinnville, Oregon, who are at present studying that part of *Cantharis* not treated in this paper, have supplied much invaluable information and their entire accumulation of specimens belonging to Division I. My sincere thanks are also due the following for the loan or gift of material or for otherwise cooperating in this work: H. S. Barber and R. E. Blackwelder, U. S. National Museum; C. S. Brimley, North Carolina Department of Agriculture; O. L. Cartwright, Clemson College; E. T. Cresson, Jr., Philadelphia Academy of Natural Sciences; C. H. Curran, American Museum of Natural History; P. J. Darlington, Museum of Comparative Zoology; J. J. Davis, Purdue University; George A. Dean, Kansas State College; Richard Dow, Boston Society of Natural History; P. W. Fattig, Emory University; C. A. Frost, Framingham, Mass.; Herman Hornig, Reading Public Museum; M. T. James, Colorado State College; G. F. Knowlton, Utah State Agricultural College; Heinrich Kuntzen, Berlin, Germany; Clay Lyle and J. M. Langston, Mississippi State College; C. E. Mickel, University of Minnesota; Rev.

Bernard Rotger, Durango, Colorado; M. W. Sanderson, University of Arkansas, and L. G. Saunders, University of Saskatchewan.

#### SYNOPSIS AND DESCRIPTION OF SPECIES

After removing those *Cantharis* having the third tarsal joint emarginate, the remaining species are divided into two sections corresponding to Leconte's A and B.

An adequate knowledge of the species of Section A must be deferred until they are more thoroughly collected, particularly in the Mid-west. Large series of both sexes taken at the same time and place are desirable. A few of the more conspicuous species are described as new but it is probable that many others are still unrecognized. No very satisfactory synoptic table could be devised. The females are frequently difficult or impossible to identify unless accompanied by males. Related to *fraxini* and *tantillus* there exists a confusion of forms that has completely defied analysis.

Section B is divided into three more or less natural groups, comprising species for the most part abundantly distinct and of easy determination. Some difficulty may be encountered in deciding to which of the first two groups a species belongs. The relative lengths of the second and third antennal joints is an uncertain character due to variation in the degree of distension or contraction of these segments. In general a species will belong to that group for which any two of the three diagnostic characters are satisfied. The only apparent exception to this rule is *coloradensis*, but in this species the non-sinuate clypeal apex places it definitely in Group 2.

Some of the differential characters in the synoptic table may not be readily apparent and must receive careful study. Antennae described as stout or slender differ only slightly in thickness, although the distinction is quite evident on direct comparison. The length and separation of the eyes cannot be correctly estimated but should be determined by actual measurement. A slide rule is extremely convenient for reducing these ratios. An oblique view of the claws, conveying an erroneous impression, should be avoided. It has not been considered necessary to make drawings of the male protarsal claws for each species. Instead a number of types are presented and each species referred to the one it most nearly resembles. Any finer distinctions would be nullified by individual variation. The genitalic diagrams, mainly taken from dried cabinet specimens, are not to be interpreted too literally. However, they show the essential points of difference and enable many species to be recognized without further examination. Except in Section A there



should be little difficulty in properly placing the females by comparison with the males and by observing characters common to both sexes. The figures in parentheses following the couplet numbers may be used to run the key backwards.

## KEY TO CANTHARIS L., 1758, page 400

|   |                    |
|---|--------------------|
| Third tarsal joint simple .....             | <i>Division I</i>  |
| Third tarsal joint emarginate at apex ..... | <i>Division II</i> |

*Division I*

1. All claws in the female and at least some in the male  
 appendiculate ..... (*Section A*) 2  
 Claws cleft or acutely toothed in both sexes.  
 (*Section B*) 11

*Section A*

- 2 (1). Claws similar in the sexes, appendiculate ..... 3  
 Claws dissimilar in the male, some being cleft ..... 5
- 3 (2). Eyes of male not strongly enlarged, separated by over one  
 and one-half times their length; pronotum scarcely  
 transverse, prominently tumid each side on basal half;  
 epipleura pale ..... 4  
 Eyes of male strongly enlarged, separated by obviously  
 less than one and one-half times their length; pro-  
 notum distinctly transverse, not prominently tumid  
 basally, lateral margin unusually obtuse at anterior  
 angles; epipleura concolorous ..... (3) *sylvaticus* n. sp.
- 4 (3). Sutural margin of elytra concolorous; antennae shorter,  
 median joints four times as long as wide in the male.  
 (1) *excavatus* Lec.  
 Sutural margin of elytra pale; antennae very long and  
 slender, scarcely shorter than the body in the male,  
 the median joints over five times as long as wide.  
 (2) *antennatus* n. sp.
- 5 (2). Male protarsal claws cleft, the others appendiculate ..... 6  
 Male protarsal claws and the posterior claw of each of the  
 other tarsi cleft, the anterior claw of meso- and meta-  
 tarsi appendiculate ..... (10) *walshi* Lec.
- 6 (5). Pronotum entirely black, or rufous at the anterior angles.  
 (8) *fraxini* Say  
 Pronotum yellow, with or without median dark stripe ..... 7
- 7 (6). Femora black, epipleural margin of elytra concolorous ..... 8

- Femora normally yellow, epipleural margin of elytra usually pale ..... (9) *tantillus* Lec.
- 8 (7). Lateral margin of pronotum distinctly obtuse anteriorly; antennae of male rather stout; form short; average length less than 5 mm. .... 9
- Lateral margin of pronotum acute or only feebly obtuse anteriorly; antennae of male long and slender; form elongate; average length exceeding 5 mm. Eyes of male very large, separated by not over one and one-fifth times their length ..... (6) *parvicollis* n. sp.
- 9 (8). Eyes of male small, separated by more than one and one-half times their length ..... 10
- Eyes of male larger, separated by less than one and one-half times their length; antennae of male three-fourths as long as the body; elytral pubescence of normal length ..... (4) *vilis* Lec.
- 10 (9). Antennae of male very short and stout, three-fifths as long as the body; elytral pubescence rather long and sparse; pronotal vitta narrow or wanting (Texas).  
(5) *impar* Lec.
- Antennae of male longer and less stout, at least three-fourths as long as the body; elytral pubescence of normal length; pronotal vitta broad (N. J.).  
(7) *proximus* n. sp.

Section B

- 11 (1). Elytral pubescence distinct, not prostrate, similar in the sexes; male protarsi not perceptibly dilated ..... 12
- Elytral pubescence prostrate, extremely minute in the male, occasionally distinct in the female; male protarsi perceptibly dilated. Color pale, the elytra often vittate ..... (Group 3) 41
- 12 (11). Clypeal apex oblique each side of median notch, never rectilinear (biarcuate in *hirticulus*); sutural margin of elytra not pale (except in some *campestris* and immature *nanulus*); third antennal joint of male at least twice as long as second (except in *mandibularis*, *vestigialis*, *picticornis* and *tenuis*) ..... (Group 1) 13
- Clypeal apex biarcuate, feebly sinuate or medially rectilinear (except in *imbecillis*); sutural margin of elytra pale (except in *coloradensis* and color phases of *scitulus*, *rectus*, *cruralis*, *oriflavus* and *heterodoxus*);

third antennal joint of male less than twice as long as second (except in some *coloradensis*) ..... (*Group 2*) 28

*Group 1 (Section B)*

- 13 (12). Male protarsal claws widely cleft, the tooth stout and blunt (Figs. 1 and 2) ..... 14  
 Male protarsal claws rather narrowly cleft, the tooth more slender (Figs. 4 and 6 to 10) ..... 16
- 14 (13). Eyes of male larger, separated by obviously less than one and one-half times their length; pronotum with lateral margin acute ..... 15  
 Eyes of male smaller, separated by one and one-half times their length; pronotum in part strongly alutaceous, lateral margin obtuse anteriorly. Color totally black; tooth of claws very stout and subtruncate, especially in the female ..... (11) **umbrinus** n. sp.
- 15 (14). Clypeal apex oblique each side of median notch; antennae of male nine-tenths as long as the body, third joint three times as long as second; anterior margin of pronotum less broadly rounded, the anterior angles obsolete ..... (12) **cartwrighti** n. sp.  
 Clypeal apex usually biarcuate; antennae of male three-fourths as long as the body, third joint two and one-half times as long as second; anterior margin of pronotum more broadly rounded, the angles evident. (13) **hirticulus** n. sp.
- 16 (13). Eyes of male larger, separated by not more than one and one-half times their length; pronotum black or bicolorous, never entirely pale ..... 17  
 Eyes of male smaller, separated by obviously more than one and one-half times their length (except *vestigialis*, in which the pronotum is entirely yellow) ..... 22
- 17 (16). Size small, average length less than 5 mm.; elytral pubescence long and very sparse; head between the eyes indefinitely concave and with sparse subgranulate punctures ..... 18  
 Size larger, average length over 5 mm.; pubescence somewhat shorter and denser; head not as above ..... 19
- 18 (17). Size larger; eyes of male separated by one and one-fourth times their length; antennae longer and less stout; elytral pubescence pale brown ..... (14) **mimeticus** n. sp.

Size very small; eyes of male separated by nearly one and one-half times their length; antennae shorter and stouter, elytral pubescence sparser, cinereous.

- (15) *nanulus* Lec.  
 19 (17). Pronotum black, or indefinitely piceous laterally, usually distinctly alutaceous; third joint of male antennae less than twice as long as second; claws unusually small in both sexes (Alaska, Canada, White Mts. of N. H.).  
 (16) *mandibularis* Kirby  
 Pronotum yellow with median dark area, usually not distinctly alutaceous; third joint of male antennae twice as long as second; claws normal ..... 20  
 20 (19). Pronotum not or feebly transverse, strongly narrowed in front, median dark area covering basal tumidities; elytral pubescence pale brownish; male with larger eyes and long, slender antennae, over three-fourths as long as the body ..... (17) *angulatus* Say  
 Pronotum usually distinctly transverse, not strongly narrowed in front; male with smaller eyes and shorter antennae, not over three-fourths as long as the body. 21  
 21 (20). Elytra bicostate and deeply rugulose, pubescence pale brown; pronotum with sides feebly sinuate and anterior angles evident, dark area covering basal tumidities; antennae of female usually as stout as in male (Fla.) ..... (18) *costipennis* Lec.  
 Elytra not costate, coarsely but shallowly sculptured, pubescence cinereous; pronotum with sides rounded and usually obsolete anterior angles, dark area narrow and not covering basal tumidities; antennae of female slender ..... (19) *lineolus* Fab.  
 22 (16). Pronotum yellow, ground sculpture wanting ..... 23  
 Pronotum black or bicolored (rarely entirely yellow in *flavipes*) ..... 25  
 23 (22). Legs, coxae and antennae totally black; male with third antennal joint twice as long as second (S. W. States).  
 (20) *ruficollis* Lec.  
 Legs and coxae not totally black, antennae with basal joints at least partly pale or fuscous; male with third antennal joint less than twice as long as second ..... 24

- 24 (23). Head entirely reddish yellow beneath; basal half of antennae and epipleural margin of elytra pale; female with normal unguual tooth; male with stout antennae (S. W. States) ..... (22) **picticornis** n. sp.  
 Head partly black beneath; antennae black except first two joints; epipleura concolorous; female with rudimentary unguual tooth (Fig. 13); male with slender antennae (N. J.) ..... (26) **vestigialis** n. sp.
- 25 (22). Elytral pubescence long and suberect ..... 26  
 Elytral pubescence normal ..... 27
- 26 (25). Antennae black, male with third joint twice as long as second; pronotal ground sculpture distinct (Fla.).  
 (24) *degener* Blatch.  
 Base of antennae pale, male with third joint less than twice as long as second; pronotal ground sculpture feeble (Me. to N. C.) ..... (23) **tenuis** n. sp.
- 27 (25). Pronotum with feeble ground sculpture; legs usually partly or entirely yellow, rarely black; female with normal unguual tooth ..... (21) *flavipes* Lec.  
 Pronotum in part distinctly alutaceous; legs black; female with a very small, acute submedian unguual tooth.  
 (25) **campestris** n. sp.
- Group 2 (Section B)*
- 28 (12). Claws in both sexes abruptly bent, basally enlarged and angulate within, the tooth long and parallel-sided (Fig. 12); color variable ..... (39) **heterodoxus** n. sp.  
 Claws not as above ..... 29
- 29 (28). Elytra pale or with lateral vitta; two basal antennal joints pale, contrasting sharply with the third and following joints; eyes of male large, separated by one and one-fourth times their length ..... 40  
 Elytra black or with pale margins (largely yellow in some *nigriceps*); two basal antennal joints sometimes pale but not contrasting sharply with the third joint ..... 30
- 30 (29). Form short and stout; pronotum transverse, as wide as the elytra at base, especially in the female; eyes of male small, separated by twice their length (Mid-western States) ..... 31  
 Form normally elongate; pronotum not as wide as the elytra at base ..... 33

- 31 (30). Elytral pubescence rather long, sparse and suberect; anterior margin of clypeus scarcely sinuate ..... 32  
 Elytral pubescence short, denser and decumbent; anterior margin of clypeus usually distinctly sinuate. Pronotum and elytral margins yellow, the former with indefinite discal spot ..... (28) **septentrionis** n. sp.
- 32 (31). Pronotum entirely yellow; margins of elytra pale; head distinctly alutaceous; third joint of male antennae less than twice as long as second.  
 (27) *luteicollis* Germ.  
 Pronotum with median black area; elytra entirely black; head between the eyes smooth and shining, with indistinct ground sculpture; third joint of male antennae usually twice as long as second.  
 (29) **coloradensis** n. sp.
- 33 (30). Pronotum distinctly alutaceous medially; elytral pubescence decumbent, short and nearly uniform; apical margins of ventral segments usually pale; male with large eyes, separated by less than one and one-half times their length, and stout antennae.  
 (33) *oriflavus* Lec.  
 Pronotum smooth or obsoletely alutaceous ..... 34
- 34 (33). Pubescence normally dense, inclined, longer suberect hairs usually intermixed; eyes of male smaller, separated by at least one and one-half times their length; color variable ..... 35  
 Pubescence sparse, uniform, long and suberect; eyes of male large, separated by not more than one and one-fourth times their length; elytra black with pale lateral and sutural margins (largely yellow in some *nigriceps*) ..... 37
- 35 (34). Male protarsal claws finely cleft, the tooth and apical part both slender and acute, basally contiguous; eyes of male small, separated by one and three-fourths times their length; ventral segments with pale apical borders ..... (30) *scitulus* Say  
 Male protarsal claws more widely cleft, the tooth stout and rather blunt, not contiguous basally with the apical part ..... 36
- 36 (35). Tarsi and antennae slender; pubescence of normal density; protarsal claws of male rather widely cleft (Fig. 2).

Color variable; legs very rarely entirely pale; ventral segments without distinct pale apical borders.

(31) *rectus* Melsh.

Tarsi and male antennae very stout; pubescence dense, suberect hairs numerous and conspicuous; protarsal claws of male less widely cleft (Fig. 4); ventral segments with pale apical borders ..... (32) *cruralis* Lec.

- 37 (34). Claws similar in the sexes, widely cleft, the tooth blunt (Fig. 2); clypeal apex feebly oblique each side of median notch; basal antennal joint not totally pale; head short in front of the eyes; abdomen with distinct secondary vestiture ..... (34) *imbecillis* Lec.

Claws dissimilar in the sexes, protarsal claws narrowly cleft in the male (Fig. 6); clypeal apex feebly sinuate; basal antennal joint very rarely not totally pale; head distinctly elongate in front of the eyes, this more evident in the females; minute secondary vestiture of of the abdomen apparently lacking ..... 38

- 38 (37). Antennae slender, distinctly longer than half the body in both sexes, the median joints at least three and one-half and three times as long as wide in male and female respectively; tarsi slender, first protarsal joint of male at least two and one-half times as long as wide ..... 39

Antennae shorter and stouter, scarcely exceeding half the body length in the female, the median joints two and one-half and two times as long as wide in male and female respectively; tarsi shorter and stouter, first protarsal joint of male twice as long as wide.

(35a) *nigriceps mimus* Fall

- 39 (38). Protarsal claws of male not elongate, narrowly cleft, the tooth distinctly shorter than the apical part and not contiguous with it (Fig. 6) ..... (35) *nigriceps* Lec.

Protarsal claws of male elongate, very narrowly cleft, the tooth subequal in length to the apical part and contiguous with it except at extreme tip (Fig. 9). Tarsi and antennae longer and more slender.

(36) *greeni* Fall

- 40 (29). Head with posterior black spot; elytra entirely yellow; pronotum usually with discal dark spot; elytral pubescence of normal length; antennae and tarsi shorter and less slender ..... (37) *trianguliferus* n. sp.

Head and pronotum entirely yellow; elytra yellow with humeral callus black, or with lateral vitta; pubescence

rather long and sparse; antennae and tarsi longer and more slender ..... (38) *nigrohumeralis* n. sp.

*Group 3 (Section B)*

41 (11). All specimens keying to this point are for the present considered as ..... (40) *longulus* Lec.

(1) *C. excavatus* Lec., Proc. Acad. N. S. Phila., 1881, V-342.

Color black; pronotum reddish yellow, usually with narrow median black stripe; ante-ocular area, mouth parts and epipleural edge of elytra pale; tibiae, tarsi and basal antennal joint beneath dusky. Body beneath, except prothorax, black. Length 5-6 mm.

Male—Eyes separated by one and two-thirds times their length. Antennae slender, nearly nine-tenths as long as the body, third joint two and one-half times as long as second, median joints slightly over four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum nearly as long as wide, narrowed in front, sides sinuate, lateral margin obtuse at the subobsolete anterior angles, basal half prominently tumid each side forming a median depression, ground sculpture indistinct. Elytra transversely rugulose, pubescence inclined, cinereous. Claws appendiculate. Fig. 18.

Female—Eyes separated by twice their length. Antennae nearly two-thirds as long as the body, third joint three-fourths longer than second, median joints three and one-half times as long as wide. Pronotum nearly quadrate, but little narrowed in front.

B. C., Man., Ont., Minn., Ill., Me., Vt., N. Y., Mass., Conn., R. I., Pa., N. J., Md., Va., N. C., S. C., Ga., Fla., Miss., Tenn., Ark., Mo., Iowa, Kans.

The scarcely transverse thorax with prominent basal tumidities imparts a facies that enables this species to be recognized at once. The pale epipleura seem to be constant although in one example from Mississippi only the extreme edge is paler.

(2) *C. antennatus* new species.

Color black; pronotum pale reddish yellow with median dark stripe; ante-ocular area, mouth parts including palpi, several basal antennal joints beneath, lateral and sutural margins of elytra and legs pale, the femora usually darker. Body beneath black; gular region, prothorax and anterior coxae pale. Length 5-6.25 mm.



Differs from *excavatus* as follows: average size larger; antennae longer and very slender, only slightly shorter than the body in the male and nearly three-fourths as long in the female, median joints five and one-half and four and one-half times as long as wide in male and female respectively; pronotum often distinctly transverse; elytra more elongate, the pubescence longer and sparser. Fig. 21.

Pa.—Wind Gap, type, male, VI-20-1939, collected by the author (author's collection); Easton; Manayunk. Ohio—No definite locality. Ill.—No definite locality. Minn.—Houston Co.; Olmstead Co. Mass.—Sherborn. Conn.—Stamford. N. J.—Phillipsburg. Md.—Sparrows Point. Va.—Arlington Co. N. C.—Raleigh; Black Mts.; Graybeard Mt.; Hendersonville. Ga.—Rabun Co.; Stone Mt.

Paratypes, from type locality and Easton, Pa.—M. C. Z. (4); Amer. Mus. N. H. (4); Acad. N. S. Phila. (4); U. S. N. M. (4); Fender (4); author's coll. (12).

### (3) *C. sylvaticus* new species.

Color black; pronotum reddish yellow with median black stripe; ante-ocular area, mouth parts, tibiae, tarsi and first two antennal joints beneath dusky. Body beneath, except prothorax, black. Length 4.5–5.75 mm.

Male—Eyes large, separated by one and one-fourth to three-tenths times their length. Antennae slender, very little stouter than in the female, four-fifths as long as the body, third joint twice as long as second, median joints over four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-fourth wider than long, feebly narrowed in front, sides sinuate, lateral margin strongly obtuse, forming a small tumidity at the evident anterior angles, ground sculpture obsolete, surface with a few granular punctures in front, basal tumidities not prominent. Elytral pubescence and sculpture normal. First protarsal joint three times as long as wide. Claws appendiculate. Fig. 19.

Female—Eyes separated by one and three-fifths to two-thirds times their length. Antennae three-fifths as long as the body, third joint one-half longer than second, median joints over three times as long as wide.

Pa.—Wind Gap, type, male, VI-20-1930, collected by the author (author's coll.); Effort; Mt. Pocono; Stroudsburg. Ont.—Prince Edward Co. Mass.—Sherborn. D. C.—Washington. Va.—No definite locality. Ga.—Atlanta.

Paratypes, all from type locality—M. C. Z. (4); Amer. Mus. N.

H. (4); Acad. N. S. Phila. (4); U. S. N. M. (4); Fender (4); author's coll. (12).

*Sylvaticus* is related to *excavatus* by the unguual structure but otherwise it very closely resembles *vilis* and probably occurs throughout the same range. No variations of importance have been noted.

(4) *C. vilis* Lec., Proc. Acad. N. S. Phila., 1851, V-343.

Form rather short. Color black; pronotum reddish yellow with narrow median black stripe expanded along anterior and posterior margins and occasionally absent; mouth parts except palpi, basal antennal joint beneath and protibiae and tarsi dusky. Body beneath, except prothorax, black. Length 3.5-4.75 mm.

Male—Eyes separated by over one and one-third times their length. Antennae stout, three-fourths as long as the body, third joint twice as long as second, median joints over three times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-fourth wider than long, but little narrowed in front, sides very slightly sinuate, feebly reflexed, lateral margin strongly obtuse at the evident anterior angles, ground sculpture faint, basal tumidities not prominent. Protarsi short, the first joint scarcely over twice as long as wide. Elytral sculpture and pubescence normal. Protarsal claws, cleft, the others appendiculate. Fig. 20.

Female—Eyes separated by one and two-thirds times their length. Antennae slightly over half as long as the body, third joint two-thirds longer than second, median joints two and one-half times as long as wide. Claws appendiculate.

Ont., Que., N. Y., Mass., N. J., N. C., Ark., Ill., Minn.

Its small size, the short and stout antennae of the male, the obtuse pronotal margin and the short tarsi make this a rather easily recognized species. The anterior margin of the pronotum is usually somewhat abruptly reflexed and a more or less interrupted, finely impressed line is discernible at the base of the reflexed surface. Females of *sylvaticus* closely resemble the same sex of *vilis* but have a more distinct tumidity at the anterior angles of the pronotum and the ventral segments more densely reticulate and somewhat opaque, although specimens occur which cannot be placed with any confidence.

(5) *C. impar* Lec., Trans. Am. Ent. Soc., 1881, IX-53.

Form rather short. Color black; pronotum yellow, varying with median darker spot; mouth parts except palpi and base of antennae beneath dusky. Body beneath, except prothorax, black. Length 4-5 mm.

Male—Eyes separated by one and two-thirds to one and three-fourths times their length. Antennae short and stout, nearly three-fifths as long as the body, third joint less than twice as long as second, median joints two and one-half times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-third wider than long, scarcely narrowed in front, sides not sinuate, feebly reflexed, lateral margin strongly obtuse at the evident anterior angles, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture normal, pubescence rather long and sparse, suberect. Tarsi short, first protarsal joint twice as long as wide. Protarsal claws cleft, the others appendiculate. Fig. 22.

Female—Eyes separated by over twice their length. Antennae scarcely longer than half the body, third joint two-thirds longer than second, median joints two and one-half times as long as wide. Claws all appendiculate.

Texas—No definite locality.

*Impar* is closely related to *vilis*, differing in the smaller eyes and shorter antennae of the male, and in the longer and sparser pubescence. It was placed by Leconte in his Section C having the protarsal claws cleft and the others appendiculate. He did not recognize this as a male modification. The faintly impressed line at the base of the reflexed anterior margin of the pronotum is visible as in *vilis*.

(6) *C. parvicollis* new species.

Color black; pronotum pale reddish yellow, usually with median black stripe; ante-ocular area, mouth parts including palpi, and basal antennal joint beneath pale. Legs black, tips of femora and front and middle tibiae and tarsi paler. Body beneath, except prothorax, black. Length 5.5-6.5 mm.

Male—Eyes large and strongly convex, separated by one and one-eighth to one-fourth times their length. Antennae slender, four-fifths as long as the body, third joint two and one-half times as long as second, median joints five times as long as wide. Clypeal apex oblique each side of median notch. Pronotum small, one-fourth wider than long, narrowed in front,

sides conspicuously sinuate, lateral margin acute or slightly obtuse at the evident anterior angles, ground sculpture faint, basal tumidities not prominent. Elytral sculpture and pubescence normal. First protarsal joint two and one-half times as long as wide. Protarsal claws cleft, the others appendiculate. Fig. 23.

Female—Eyes separated by one and three-fifths times their length. Antennae nearly two-thirds as long as the body, third joint three-fourths longer than second, median joints three and one-half to four times as long as wide. Pronotum broader, but little narrowed in front, sides feebly sinuate. Claws appendiculate.

Pa.—Easton, type, male, VI-5-1930, collected by the author (author's coll.); Effort; Wind Gap; Stroudsburg. N. J.—Phillipsburg; Newfoundland. N. C.—Cataloochee Divide; Linville Falls; Hendersonville; Black Mts. (?)

Paratypes, all from type locality—M. C. Z. (4); Amer. Mus. N. H. (4); Acad. N. S. Phila. (4); U. S. N. M. (4); Fender (4); author's coll. (12).

This species resembles eastern examples of *walshi*. The males are readily separated by the unguinal characters, the females are nearly identical. *Parvicollis* may be distinguished from the other species with similar claws by its large size, dark legs, strongly enlarged eyes of the male and the long and slender antennae.

A series from Black Mts., N. C., in the collection of the American Museum of Natural History differs in the extremely large eyes of the male and is referred here tentatively. Other specimens have been seen that suggest the probability of additional species related to the present one. In several examples from Mille Lacs Co., Minn., received from Prof. C. E. Mickel, the color is entirely black except the legs and mouth parts are partly fuscous, the basal tumidities are somewhat prominent and the eyes of the male are smaller, separated by nearly one and one-half times their length. These would key to *fraxini* but have genitalia of the *parvicollis* type.

(7) **C. proximus** new species.

Form rather short. Color black; pronotum yellow with median black stripe wider toward base; head in front of the eyes usually pale, base of antennae beneath dusky. Body beneath black; mouth parts except palpi, gular region and prothorax pale. Length 4-5 mm.

Male—Eyes small, strongly convex, separated by one and

three-fourths times their length. Antennae rather stout, three fourths to four-fifths as long as the body, third joint two and one-half times as long as second, median joints three and one-half times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-fourth wider than long, slightly narrowed in front, sides scarcely sinuate, lateral margin obtuse at the evident anterior angles, disk in front sparsely and feebly granulate-punctate and with evident ground sculpture, basal tumidities somewhat prominent. Elytral sculpture and pubescence normal to a little sparse. First protarsal joint two and one-half times as long as wide. Protarsal claws cleft, the others appendiculate. Genitalia as in *fraxini*. Fig. 24.

Female—Eyes separated by over twice their length. Antennae less stout, three-fifths as long as the body, third joint two-thirds longer than second, median joints two and one-fourth to one-half times as long as wide. Pronotum broader. Claws appendiculate.

N. J.—Boonton, type, male, VI-2-01, collected by Geo. Greene (U. S. N. M. coll.); Ramsey; N. Lisbon; Paterson; Lahaway. N. Y.—Long Island (New Lots).

Paratypes—U. S. N. M. (4); Am. Mus. N. H. (19); author's coll. (1).

This species is closely related to *fraxini* but quite distinct in habitus. The form is less elongate, approaching that of *vilis*; the male antennae are definitely stouter, especially toward base; the eyes of the male are smaller and more convex; the lateral margin of the pronotum is obtuse anteriorly, with the disk sparsely and feebly granulate-punctate and the basal tumidities more prominent. 25 examples.

(8) *C. fraxini* Say, Jour. Acad. N. S. Phila., 1823, III-181.

*ater* Kirby, Rich. Fauna Bor.-Amer., London, 1837, IV-245.

*binodula* Mann., Bull. Moscou, 1846, XIX-512.

*nigrita* Lec., Agassiz Lake Sup., Boston, 1850, IV-229.

Color black; ante-ocular area and mouth parts, except palpi, pale; two basal antennal joints beneath and occasionally the tibiae and tarsi fuscous or pale; pronotum sometimes rufous at the anterior angles. Body beneath black. Length 4.5-6.25 mm.

Male—Eyes not strongly convex, separated by one and three-fifths to two-thirds times their length. Antennae very slender, third and fourth joints but little wider than those following, total length four-fifths that of body, third joint twice as long as

second, median joints four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum three-tenths wider than long, usually narrowed in front, sides sinuate, lateral margin acute, anterior angles subobsolete, ground sculpture usually distinct, basal tumidities not prominent. Elytral sculpture and pubescence normal. Protarsal claws cleft, the others appendiculate. Fig. 24.

Female—Eyes separated by one and four-fifths to nine-tenths times their length. Antennae three-fifths as long as the body, third joint three-fourths longer than second, median joints at least three times as long as wide. Claws appendiculate.

This is a common northern type ranging from British Columbia across Canada and northern United States and extending southward along the mountains to Colorado, Utah and Arizona in the West and to North Carolina and Georgia in the East. One example in the Leconte collection is labelled Lake Tahoe, California. Mannerheim described *binodula* from the Aleutian Islands.

The great majority of specimens in all the collections examined are females. An unusual amount of variation occurs and it is quite probable that several species are involved. The above description applies to the form inhabiting the Eastern States. Many of the more western examples differ in being less elongate, the eyes smaller, the antennae shorter and stouter and the pronotum broader. From the available material it has not been possible to make a satisfactory segregation of these. Extensive collections throughout its range are needed before any definite conclusions may be reached. In an apparently common form occurring in Michigan and Minnesota the sides of the pronotum and occasionally the epipleura are yellow and the basal antennal joint, head in front and legs are partly pale. The color varies to nearly all black as in *fraxini*, although a distinct species seems to be indicated. Similar specimens have been seen from Ontario and also a single example from Maine.

- (9) *C. tantillus* Lec., Trans. Am. Ent. Soc., 1881, IX-69.  
*pusio* Lec., same, page 51.

Leconte described *tantillus* from a very small female specimen labelled "Ill." No method is known for differentiating the females in this part of the genus so it is impossible at present to identify *tantillus* with any certainty. It is inadvisable to erect new species that cannot be definitely defined so I have adopted the expedient of assigning Leconte's name to a heterogeneous assemblage that must

eventually be divided. Their study is rendered more difficult because of the scarcity of males. The following may be considered as typical.

Color black; pronotum reddish yellow with sharply defined median black stripe; front part of head, base of antennae beneath, legs including coxae, and epipleural margin of elytra pale reddish yellow. Body beneath black; mouth parts, gular region and prothorax yellow. Length 3.75–5 mm.

Male—Eyes separated by one and three-fifths to two-thirds times their length. Antennae rather slender, three-fourths as long as the body, third joint twice as long as second, median joints three to three and one-half times as long as wide. Clypeal apex oblique each side of median notch. Pronotum three-tenths wider than long, usually not narrowed in front, sides not sinuate, lateral margin acute or somewhat obtuse at the subobsolete anterior angles, ground sculpture faint, basal tumidities not prominent. First protarsal joint two and one-half times as long as wide. Elytral sculpture normal, the pubescence short. Protarsal claws cleft, the others appendiculate. Genitalia as in *fraxini*. Fig. 24.

Female—Eyes separated by one and four-fifths times their length. Antennae three-fifths as long as the body, third joint two-thirds longer than second, median joints two and one-half times as long as wide. Claws appendiculate.

This form occurs in the Mid-western States, examples having been seen from Iowa, Minnesota, Kansas and Colorado. Numerous females of this type but of larger average size are to be found in all collections. The following States are represented: Vt., N. H., N. Y., Mass., Pa., D. C., Ill., Wis., Minn.

A large series taken at Wind Gap, Pa., differs conspicuously in the males in the very large eyes separated by one and one-fifth to one-fourth times their length, the longer and more slender antennae with median joints four times as long as wide, the small pronotum narrowed in front and with the sides sinuate, and by the elytra being notably more elongate than in the female. The length varies from 4.75 to 5.75 mm. Intermediate males from other localities have the eyes separated by 1.3, 1.4 and 1.5 times their length so that no line of demarcation based on this character is possible.

Another series, taken at Antrim, N. H., by Mr. C. A. Frost, adds to the confusion and raises the question of whether *fraxini* and *tantillus* should be united. These are of small size, 3.75 to 5 mm. in

length, and have the eyes of the male separated by one and two-thirds times their length, the pronotum black with the sides variably pale, the epipleura concolorous and the legs in great part black. Included with them are examples colored nearly as in the typical form and others almost totally black. What appears to be the same form was collected in Prince Edward County, Ontario, by Mr. Brimley. In most of these the pronotum is black, or with a rufous spot at the anterior angles. I have no doubt that the *fraxini-tantillus* complex is an aggregation of numerous distinct species.

(10) *C. walshi* Lec., Trans. Am. Ent. Soc., 1881, IX-51.

Color variable, typically black with front part of head, basal antennal joints, pronotum except median dark stripe, and legs including coxae pale reddish yellow. The epipleural margin of the elytra is pale and rarely the sutural. Body beneath black; mouth parts, gular region and prothorax yellow. The color varies with the epipleura concolorous, the palpi dusky, and the coxae and legs partly black. Some eastern examples are almost totally black. Length 4.5-6.5 mm.

Male—Variations in the eyes and antennae are recorded below. The following is to be considered as typical. Eyes separated by one and two-thirds times their length. Antennae rather stout, three-fourths as long as the body, third joint nearly two and one-half times as long as second, median joints three and one-half times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-fourth wider than long, slightly narrowed in front, sides feebly sinuate, lateral margin somewhat obtuse at the evident anterior angles, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture normal, the pubescence normal to short. First protarsal joint two and one-half times as long as wide. Anterior claw or meso- and meta-tarsi appendiculate, all others cleft. Fig. 25.

Female—Eyes separated by one and four-fifths times their length. Antennae nearly three-fifths as long as the body, third joint three-fifths longer than second, median joints three times as long as wide. Pronotum with evident ground sculpture. Claws appendiculate.

Pa., N. J., Va., Ohio, Ill., Mo., Iowa, Wis., Minn., Kans., Colo., Tex.

Leconte described *walshi* from three female examples, one of



which is erroneously labelled male. The head is stated to be shining but has the same alutaceous sculpture of other species. As in *tantillus* the identity of *walshi* must be based largely on supposition. Only two specimens have been seen in which the elytral suture is pale, a male from Kansas received from Prof. C. E. Mickel and a female in the Leconte collection.

The range of variation encountered in the eyes and antennae suggests that *walshi*, as defined by the male claws, may be composite. In a male specimen from Missouri the eyes are very large, separated by one and one-fourth times their length. In Minnesota examples this ratio varies from one and one-half to one and three-fifths. In eastern examples taken on the banks of the Delaware River the eyes are still larger, separated by 1.3 to 1.5 times their length. In these specimens the antennae are longer and more slender, the median joints nearly four and three and one-half times as long as wide in the male and female respectively. They also are of larger average size and exhibit a wide range of color variation, a majority of them being almost totally black.

(11) **C. umbrinus** new species.

Color black. Length 5–6 mm.

Male—Eyes separated by one and one-half times their length. Antennae rather slender, nine-tenths as long as the body, third joint three times as long as second, median joints four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-third wider than long, slightly narrowed in front, sides sinuate, feebly reflexed, lateral margin distinctly obtuse at the subobsolete anterior angles, surface in part alutaceous, granulate-punctate in front, basal tumidities somewhat prominent. Elytral sculpture and pubescence normal, the latter cinereous. First protarsal joint nearly three times as long as wide. Protarsal claws widely cleft, the tooth very stout and subtruncate, shorter than the apical part. Other claws similar but more widely cleft, the apical part longer. Figs. 1 and 26.

Female—Eyes separated by twice their length. Antennae two-thirds as long as the body, third joint twice as long as second, median joints three and one-half times as long as wide. Claws more widely cleft, the tooth short and very stout, obliquely truncate.

Pa.—Effort, type, male, VI-6-1931, collected by the author (author's coll.); Belfast; Hummelstown. Me.—Mt. Katahdin;

Wales; Paris. N. H.—Antrim. Mass.—Berlin; Framingham; Natick; N. Attleboro; Reading. Conn.—Canaan. N. J.—Little Falls. Md.—Priest Br. D. C.—Washington. N. C.—Blowing Rock; L. Waccamaw; Raleigh. Ga.—Roberta. Fla.—Detroit.

Paratypes, from type locality and Belfast, Pa.—M. C. Z. (2); Amer. Mus. N. H. (2); Acad. N. S. Phila. (2); U. S. N. M. (2); Fender (2); author's coll. (10).

The broad subtruncate unguual tooth, totally black color and alutaceous pronotum with obtuse lateral margin will easily identify this species. No variations are noted in the numerous examples seen.

(12) **C. cartwrighti** new species.

Color black; front part of head, basal antennal joint beneath and pronotum pale reddish yellow; legs black varying to pale piceous brown, the femora usually darker. A narrow transverse black area extends along the anterior margin of the pronotum medially for half its width and a somewhat larger black area along the basal margin, the latter area produced forward nubilously and sometimes joining the apical. Body beneath, except prothorax, black. Length 5.25–6 mm.

Male—Eyes large and strongly convex, separated by one and three-tenths times their length. Antennae slender, nine-tenths as long as the body, third joint three times as long as second, median joints five times as long as wide. Clypeal apex oblique each side of median notch. Pronotum three-tenths wider than long, narrowed in front, sides scarcely sinuate, lateral margin sharply acute, anterior angles subobsolete, apical margin less broadly rounded than usual, ground sculpture wanting, a few granular punctures in the apical black area, basal tumidities not prominent. Elytral sculpture rather coarse, pubescence long and suberect. First protarsal joint three times as long as wide. Claws nearly similar throughout, widely cleft, the tooth very stout and blunt and a little shorter than the apical part. Figs. 2 and 27.

Female—Eyes separated by one and two-thirds times their length. Antennae seven-tenths as long as the body, third joint twice as long as second, median joints four times as long as wide. Claws widely cleft, the tooth short, blunt and very stout.

N. C.—Black Mts., type, male, VI–11, probably collected by Wm. Beutenmiller (Amer. Mus. N. H.); Gray Beard Mt.; Sunburst; Catalooche Divide. Mich.—Detroit (U. S. N. M.).

Paratypes—Amer. Mus. N. H. (21) ; Frost (2) ; Clemson College (1) ; author's coll. (2).

*Cartwrighti* closely resembles *hirticulus*, differing in the longer antennae with smaller second joint, the form of the clypeus, and in the subobsolete anterior angles and less broadly rounded apical margin of the pronotum. The style of pronotal maculation as described above will usually identify a specimen as *cartwrighti*. The dorsal plate of the male genitalia varies in length and may be considerably shorter than shown in the diagram. 28 examples.

(13) **C. hirticulus** new species.

Color variable ; typically black with ante-ocular area, mouth parts except palpi, side margin of pronotum and tips of femora pale reddish yellow, the tarsi and tibiae dusky. Varies from totally black, excluding mouth parts, to pronotum pale with median black stripe and legs, head in front of the eyes, basal antennal joint and epipleural margin of elytra pale. Body beneath black, the prothorax pale when its dorsal surface is partially so. In examples labelled "Tex" the front part of head, pronotum and legs including the coxae are bright yellow ; the epipleural margin of elytra, apical margins of ventral segments and basal antennal joint beneath pale. Length 5.5–7 mm.

Male—Eyes large and strongly convex, separated by one and one-fifth to one-fourth times their length. Antennae slender, three-fourths as long as the body, third joint two and one-half times as long as second, median joints four times as long as wide. Clypeal apex usually biarcuate, varying to feebly oblique each side of median notch. Pronotum one-fifth wider than long, slightly narrowed in front, sides sinuate, lateral margin acute, anterior angles evident, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture shallow but rather coarse, pubescence long and suberect. First protarsal joint almost three times as long as wide. Protarsal claws rather widely cleft, the tooth stout, blunt and a little shorter than the apical part. Other claws similar but more widely cleft, the apical part longer. Figs. 2 and 28.

Female—Eyes separated by one and three-fourths times their length. Antennae less than three-fifths as long as the body, third joint three-fourths longer than second, median

joints three to three and one-half times as long as wide. Claws widely cleft, the tooth short, stout and blunt.

Pa.—Mt. Pocono, type, male, VII-3-1930, collected by the author (author's coll.); Easton; Wind Gap. N. C.—Blowing Rock; Black Mts.(?). Ind.—Clark Co. Mo.—No definite locality. Ark.—Hope. Texas—No definite locality. Kans.—Onaga. Ga.—No definite locality.

Paratypes, from type locality—M. C. Z. (4); Amer. Mus. N. H. (4); Acad. N. S. Phila. (4); U. S. N. M. (4); Fender (4); author's coll. (12).

*Hirticulus* might be confused with some of the forms of *rectus*, the males having nearly similar claws and clypeal structure. The former species may always be distinguished by its long and suberect pubescence, the large eyes of the male and the smaller second antennal joint. The Texas examples with bright yellow pronotum and legs do not seem to differ otherwise from the darker northern form. They are identified in most collections as *dichrous*. Four males from Black Mts., N. C., in the collection of the American Museum of Natural History have enormously developed eyes, separated by little more than their length, and may represent a distinct species.

(14) **C. mimeticus** new species.

Color black; sides of pronotum pale reddish yellow; mouth parts, except palpi, pale. Body beneath, except prothorax, black. Length 4-5 mm.

Male—Eyes separated by one and one-fourth times their length. Antennae rather slender, four-fifths as long as the body, third joint nearly twice as long as second, median joints three times as long as wide. Clypeal apex notched, sometimes feebly so, broadly rounded varying to oblique each side. Head extremely short in front of the eyes, slightly concave between them and sparsely granulate punctate. Pronotum one-fourth wider than long, scarcely narrowed in front, sides feebly sinuate, lateral margin acute, anterior angles evident, ground sculpture feeble or absent, surface with sparse granular punctures in front, basal tumidities not prominent. Elytral sculpture coarse, pubescence pale brown in color, sparse, long and suberect. Tarsi short, first protarsal joint a little over twice as long as wide. Protarsal claws rather narrowly cleft, the tooth broader than the apical part and slightly shorter. Mesotarsal

claws nearly similar; metatarsal more widely cleft, the apical part longer. Figs. 4 and 29.

Female—Eyes separated by one and four-fifths times their length. Antennae two-thirds as long as the body, third joint two-thirds longer than second, median joints over two and one-half times as long as wide. Pronotum broad, but little narrower than the elytra at base, two-fifths wider than long. Claws widely cleft, the tooth short and stout.

W. Va.—Marlinton, type, male, VII-30-1930, received from Dr. Paul N. Musgrave (author's coll.). Ala.—Pyziton, Clay Co. (Nat. Mus.). N. C.—Valley of Black Mts. Ga.—Rabun Co.

Paratypes, from type locality—M. C. Z. (8, Fall coll.); Amer. Mus. N. H. (2); Acad. N. S. Phila. (2); U. S. N. M. (2); Fender (2); author's coll. (11).

This is a larger species than *nanulus*, with longer antennae and darker pubescence, the male with distinctly larger eyes. The Alabama specimens in the National Museum differ in the somewhat larger eyes of the male. Superficially *mimeticus* bears a close resemblance to *degener*.

(15) *C. nanulus* Lec., Trans. Am. Ent. Soc., 1881, IX-52.

Color black; mouth parts, except palpi, paler; sides of pronotum pale reddish yellow. Body beneath, except prothorax, black; apical margins of ventral segments indefinitely pale. Sutural margin of elytra and legs more or less pale in immature specimens. Length 3.25-4.25 mm.

Male—Eyes separated by about one and one-half times their length. Antennae stout, three-fourths as long as the body, third joint nearly twice as long as second, median joints two and one-half times as long as wide. Clypeus, head and pronotum as in *mimeticus*. Elytra more coarsely sculptured than in *mimeticus*, the pubescence coarser, sparser and cinereous in color. Tarsi and claws as in *mimeticus*; the genitalia similar, with shorter and broader median lobe.

Female—Eyes separated by one and four-fifths times their length. Antennae nearly three-fifths as long as the body, third joint two-thirds longer than second, median joints less than two and one-half times as long as wide. Pronotum and claws as in *mimeticus*.

N. S., Mass., N. J., Mich.

The very small size, sparse and bristling pubescence, and the

feebly concave head with granulate punctures are characteristic features of *nanulus*. The preceding species is similar but readily separated by the tabular characters.

(16) *C. mandibularis* Kirby, Rich. Fauna Bor.-Amer., London, 1837, IV-248.

*nigritulus* Lec., Trans. Am. Ent. Soc., 1881, IX-52. Fall, Pan-Pac. Ent., 1926, II-154.

Color black, mouth parts dusky and occasionally the legs partly fuscous. Length 5-6 mm.

Male—Eyes separated by one and one-half times their length. Antennae slender, three-fourths as long as the body, third joint three-fifths longer than second, median joints nearly four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum three-tenths wider than long, narrowed in front, sides not sinuate, usually broadly reflexed, lateral margin acute, anterior angles obsolete, surface distinctly alutaceous, basal tumidities not prominent. Elytral sculpture normal, pubescence rather short, cinereous. First protarsal joint three times as long as wide. Claws unusually small, protarsal rather narrowly cleft, the tooth a little shorter and broader than the apical part. Other claws slightly less narrowly cleft, the tooth very short. Figs. 3 and 30.

Female—Eyes separated by two and one-fourth to one-half times their length. Antennae over three-fifths as long as the body, third joint one-half longer than second, median joints three to three and one-half times as long as wide. Claws very small, rather widely cleft, the tooth short.

Alaska, B. C., Alta., Man., Hudson Bay, Que., Labrador, Nfld., N. H. (White Mts.).

Characterized by the small claws of both sexes, the totally black color, alutaceous pronotum and elongate second antennal joint of the male. The male genitalia are remarkable because of the unique formation of the lateral lobes. In the Labrador examples the reflexed sides of the pronotum are not noticeably wide. The alutaceous ground sculpture is usually distinct over the entire surface of the pronotum but is occasionally less evident in the females. Fall states that the synonymy of *nigritulus* has been definitely established by comparison with one of Kirby's cotypes.

(17) *C. angulatus* Say, Jour. Acad. N. S. Phila., 1823, III-180.

Color black, sides of pronotum reddish yellow, front part of

head and mouth parts occasionally pale. Body beneath, except prothorax, black. Length 5–7.5 mm.

Male—Eyes separated by one and one-third to four-fourths times their length. Antennae slender, nearly nine-tenths as long as the body, third joint twice as long as second, median joints four to five times as long as wide. Clypeal apex oblique each side of median notch. Pronotum almost as long as wide, strongly narrowed in front, sides feebly sinuate, lateral margin acute, anterior angles obsolete, ground sculpturing wanting, basal tumidities prominent. Elytra coarsely sculptured, pubescence long, suberect, pale brown in color. First protarsal joint nearly three times as long as wide. Protarsal claws rather narrowly cleft, the tooth a little shorter than the more slender apical part. Other claws more widely cleft, the apical part longer. Figs. 4 and 31.

Female—Eyes separated by one and three-fourths times their length. Antennae seven-tenths as long as the body, third joint two-thirds longer than second, median joints three and one-half times as long as wide. Claws widely cleft, the tooth short.

N. J., Md., N. C., S. C., Ga., Ala., Fla., Ark., Ind.

Very easily recognized by the smooth and scarcely transverse pronotum strongly narrowed in front, the long and slender antennae, and the coarsely sculptured elytra with brown pubescence. The median black stripe of the pronotum is wider than in *lineolus* and covers the basal tumidities. No variations have been noted with the possible exception of several old specimens having the pronotum entirely black. This may have been caused artificially, such as by drying in too hot an oven.

Following his description of *Telephorus sayi* (*lineolus*) Leconte says, "The next species (*angulatus*) has a thorax not at all transverse, the black part is much broader, the reflexed margin less narrow, and the disk is laterally excavated before the middle." This fits the present species perfectly and seems to eliminate the necessity of creating a new name for it. Say's description is of no value in arriving at this conclusion.

(18) *C. costipennis* Lec., Trans. Amer. Ent. Soc., 1884, XIII–21.

Color black; pronotum reddish yellow, the median part, including the basal tumidities, black as in *angulatus*. Length 5.75–6.5 mm.

Male—Antennae and eyes as in *lineolus*. Pronotum usually

narrower, one-fourth wider than long, sides feebly sinuate, lateral margin obtuse at the evident anterior angles, ground sculpture sometimes distinct. Elytra deeply and densely rugulose, with two rather prominent but not sharply defined discal costae on each, pubescence brownish as in *angulatus*. First protarsal joint two and one-half times as long as wide. Claws and genitalia as in *lineolus*. Figs. 4 and 32.

Female—Antennae usually stout and scarcely more slender than in male, median joints less than three times as long as wide.

Florida.—Haulover; Enterprise.

The sculpture of the elytra in *angulatus* is very similar to that of *costipennis*, although shallower and with only feebly indicated costae. Examples of the two species may be selected which can scarcely be separated by this character. In *angulatus* the pronotum is always entirely smooth, less transverse, more narrowed in front, the sides more strongly reflexed and with the anterior angles obsolete.

(19) *C. lineolus* Fab., Ent. Syst., 1792, I-219.

*parallela* Say, Jour. Acad. N. S. Phila., 1825, V-168.

*sayi* Lec., Proc. Acad. N. S. Phila., 1851, V-342.

Form rather stout. Color black; ante-ocular area and mouth parts dusky; pronotum reddish yellow with narrow median black stripe. Body beneath, except prothorax, black. Length 5.5-7 mm.

Male—Eyes separated by one and one-half times their length. Antennae less slender than in *angulatus*, three-fourths as long as the body, third joint two and one-half times as long as second, median joints nearly four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum one-third wider than long, scarcely narrowed in front, sides not sinuate, lateral margin acute or slightly obtuse at the obsolete anterior angles, ground sculpture feeble, basal tumidities not prominent. Elytral sculpture rather coarse, pubescence somewhat sparse, cinereous, moderately long. First protarsal joint two and one-half times as long as wide. Protarsal claws rather narrowly cleft, the tooth shorter than the more slender apical part. Other claws more widely cleft, the apical part longer. Figs. 4 and 32.

Female—Eyes separated by about twice their length. Antennae a little over half as long as the body, third joint three-



fourths longer than second, median joints over three times as long as wide. Claws widely cleft, the tooth short and rather stout.

Mass., N. Y., Pa., N. J., Va., N. C., S. C., Ga., Miss., Ark., Tex., Ill.

The narrow pronotal vitta and paler pubescence will distinguish this species from either *angulatus* or *costipennis*. The former differs greatly in its long slender antennae and in the form of the pronotum, the latter in its densely scabrous and costate elytra. The color of the pubescence is best observed by comparison under the microscope, slanting the illumination at a low angle along the elytra. A male from Nantucket, Mass., in the collection of the Boston Society of Natural History has a broad pronotal vitta occupying over half the surface, otherwise no variations have been noted.

(20) *C. ruficollis* Lec., Trans. Am. Ent. Soc., 1881, IX-53.

Color black; pronotum reddish yellow, ante-ocular area and mandibles pale. Body beneath, except prothorax, black. Length 5.5-6.5 mm.

Male—Eyes separated by one and two-thirds to three-fourths times their length. Antennae slender, four-fifths as long as the body, third joint twice as long as second, median joints four and one-half times as long as wide. Clypeal apex oblique each side of median notch. Pronotum small, nearly quadrate, scarcely narrowed in front, sides not sinuate, lateral margin acute, anterior angles evident, ground sculpture wanting, basal tumidities not prominent. Elytral sculpture and pubescence normal, the latter cinereous, sometimes rather short. First protarsal joint three times as long as wide. Protarsal claws rather narrowly cleft, the tooth shorter than the more slender apical part. Other claws more widely cleft, the apical part longer. Figs. 4 and 33.

Female—Eyes small, separated by more than twice their length. Antennae a little over half as long as the body, third joint one-half longer than second, median joints three times as long as wide. Elytra less elongate. Claws widely cleft, the tooth short.

Ariz., N. Mex., Colo., Tex.

No variations have been noted in this species which may be readily identified by its color.

- (21) *C. flavipes* Lec., Proc. Acad. N. S. Phila., 1851, V-341.  
*dichrous* Lec., same as above.

Color variable, typically with head black, the front half yellow, antennae dark, the two basal joints yellow and several following joints pale beneath; pronotum yellow, with or without a black median stripe; elytra black, the margins not paler; legs and coxae yellow. Body beneath black; mouth parts, gular region and prothorax yellow. Varies to legs partly or largely black, mouth parts and base of antennae dusky, pronotal vitta broader. Eastern examples are totally black except ante-ocular area, mouth parts and base of antennae beneath dusky. Length 5-6.5 mm.

Male—Eyes small, separated by twice their length. Antennae slender, nearly three-fourths as long as the body, third joint twice as long as second, median joints three to three and one-half times as long as wide. Vertex slightly rugulose uneven. Clypeal apex oblique each side of median notch. Pronotum one-fourth wider than long, subquadrate or narrowed in front, sides not sinuate, lateral margin obtuse at the evident anterior angles, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture and pubescence normal. First protarsal joint slightly over twice as long as wide. Protarsal claws rather narrowly cleft, the tooth shorter than the more slender apical part. Other claws more widely cleft, the apical part longer. Figs. 6 and 34.

Female—Eyes separated by two and one-fourth times their length. Antennae three-fifths as long as the body, third joint three-fifths longer than second, median joints two and one-half to three times as long as wide. Claws widely cleft, the tooth short and stout.

Ill., Mo., Wis., Minn., Iowa, S. D., Neb., Kans., Colo. N. J.—Phillipsburg. Pa.—Easton.

Twelve specimens representing at least three species stand as *flavipes* in the Leconte collection. Numbers 1 and 2 with pronotal vitta (*flavipes*) and numbers 7 and 8 with the pronotum entirely yellow (*dichrous*) are labelled with green disks, signifying Nebraska, etc. No structural differences are to be observed in the two types. Both were described from Missouri Territory, which would include Nebraska. Specimen number 3 from Texas and number 4 from Illinois are males of the species herein recognized as *walshi*. Number 5 is a larger male of the *flavipes* type with broader pronotal

tum and longer antennae. Numbers 6, 9, 10, 11 and possibly also 12, colored as in *dichrous* but not from Missouri Territory, are *hirticulus*.

The black phase of *flavipes* occurs on willows growing along the banks of the Delaware River above Easton, Pa. It is a curious coincidence that a melanic form of another mid-western species, *walshi*, is also to be found in the same locality. Typical examples of both these species are very much alike in appearance.

(22) *C. picticornis* new species.

Head black, pale in front; pronotum, basal half of antennae, mouth parts, legs and coxae pale reddish yellow; elytra black with narrow pale epipleural margin; apical half of antennae dusky. Body beneath black; head, prothorax and apical margins of ventral segments pale. Length 5-6 mm.

Male—Eyes small, separated by one and three-fourths times their length. Antennae stout, nearly three-fourths as long as the body, third joint three-fourths longer than second, median joints three and one-half times as long as wide. Clypeal apex oblique each side of median notch. Pronotum scarcely wider than long, subquadrate, not narrowed in front, sides sinuate, lateral margin slightly obtuse at the evident anterior angles, ground sculpture wanting, basal tumidities not prominent. Elytral sculpture normal, pubescence rather sparse, long, sub-erect, cinereous. First protarsal joint two and one-half times as long as wide. Protarsal claws elongate, narrowly cleft, the tooth subequal in length to the more slender apical part and contiguous with it except at tip. Mesotarsal claws similar, the tooth shorter. Metatarsal claws more widely cleft, the tooth still shorter. Figs. 10 and 35.

Female—Eyes separated by nearly two and one-fourth times their length. Antennae three-fifths as long as the body, third joint one-half longer than second, median joints three times as long as wide. Pronotum broader. Claws widely cleft, the tooth short and stout.

N. Mex.—Jemez Mts., type, male, VI-4, collected by John Woodgate (author's coll.); Pecos. Ariz.—Phoenix; White Mts., Gila Co. Colo.—Durango.

Paratypes, from type locality—M. C. Z. (2); Amer. Mus. N. H. (2); Acad. N. S. Phila. (2); U. S. N. M. (2); Fender (2); author's coll. (16).

*Picticornis* rather closely resembles some forms of *flavipes*, the

males differing in the somewhat larger eyes, stouter antennae and elongate claws. The color of the antennae, pale epipleura and longer pubescence will, in addition, distinguish the females. In some examples the black area of the posterior part of the head is reduced in size and does not attain the eyes or lateral margins. This is the only known species with black elytra in which the head is totally pale beneath. 32 examples.

(23) **C. tenuis** new species.

Form slender. Color variable; typically black with mouth parts except palpi, and several basal antennal joints beneath pale. The color varies as follows: the head in front of the eyes, mouth parts except tips of palpi, and first two or three antennal joints may be pale; the sides of the pronotum may be indefinitely rufous, more widely so in front; the epipleural edge of the elytra may be narrowly pale, and the trochanters, tips of femora, and tibiae and tarsi pale. Length 5-6 mm.

Male—Eyes small, separated by almost twice their length. Antennae slender, three-fourths as long as the body, third joint three-fifths to two-thirds longer than second, median joints four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum subquadrate, one-fifth wider than long, not narrowed in front, sides feebly sinuate, lateral margin slightly obtuse at the evident anterior angles, ground sculpture feeble, basal tumidities somewhat prominent. Elytral sculpture normal to coarse, pubescence rather long, suberect, sparse, cinereous. First protarsal joint two and one-half times as long as wide. Claws very finely cleft, the tooth slender, acute, a little shorter than the apical part and contiguous with it except at tip. The tooth of the metatarsal claws is shorter. Figs. 9 and 36.

Female—Eyes separated by a little over twice their length. Antennae two-thirds as long as the body, third joint one-half longer than second, median joints three times as long as wide. Claws widely cleft, the tooth short and blunt, scarcely broader than the apical part. Last ventral segment usually produced in a median lobe which may be either rounded or sinuate at apex.

Me.—Paris, type, male, VII-4-16, collected by C. A. Frost (Fall coll.). Mass.—Northboro. Conn.—Cornwall; Stamford. N. Y.—W. Hebron. N. C.—Black Mts.; Swannanoa Val.

Paratypes—M. C. Z. (12, Fall coll.); Frost (2); author's coll. (1).

The claws of the male are nearly as in *greeni* of Group 2 and are more slender than in any other species of Group 1. *Picticornis* has similarly small eyes and long pubescence but differs conspicuously in its color scheme and stout male antennae. The dorsal plate of the male genitalia may be evenly rounded at apex, as shown in the diagram, or medially sinuate. The North Carolina examples differ in having the pronotum yellow with median dark stripe and the claws of the male less finely cleft, the metatarsal rather widely, and the tooth stouter throughout. 24 examples.

(24) *C. degener* Blatch., Can. Ent., 1928, LX-62.

Color black; mandibles and sides of pronotum yellow. Length 4-5 mm.

Male—Eyes separated by one and two-thirds times their length. Antennae stout, three-fourths as long as the body, third joint two and one-half times as long as second, median joints three times as long as wide. Head of normal length in front of the eyes, feebly concave and sparsely granulate punctate between them. Clypeal apex oblique each side of median notch. Pronotum one-fifth wider than long, scarcely narrowed in front, sides feebly sinuate, lateral margin acute, anterior angles evident, surface with sparse granular punctures in front, ground sculpture distinct, basal tumidities not prominent. Elytral sculpture coarse, pubescence cinereous, long, sparse and suberect. Tarsi short, first protarsal joint nearly two and one-half times as long as wide. Protarsal claws rather narrowly cleft, the tooth broader and a little shorter than the apical part. Meso- and meta-tarsal claws less narrowly cleft, the apical part longer. In one example the protarsal claws are elongate and abruptly bent, the tooth as long as the apical part; in the others apparently not so formed. Fig. 37.

Female—Eyes separated by twice their length. Antennae three-fifths as long as the body, third joint nearly twice as long as the second, median joints two and one-half times as long as wide. Claws widely cleft, the tooth rather slender, shorter than the apical part. Abdomen at apex with abortive lobe.

Florida—Dunedin, 3 males and 3 females (Fall coll.); St. Augustine, 1 female (Frost).

Among the species with small eyes *degener* is distinguished by the long and sparse pubescence, bicolored pronotum with distinct

ground sculpture, and by the black legs and antennae, the latter with small second joint in the male. The material examined is insufficient to form any opinion of its variability. Apparently the Fall specimens are from Blatchley's type series.

(25) *C. campestris* new species.

Color black; head in front of the eyes, mouth parts except palpi, basal antennal joint beneath, and pronotum pale reddish yellow, the latter with median dark stripe often abbreviated at each end. The epipleural margin of the elytra may be narrowly pale and sometimes the sutural margin also. Body beneath, except gular region and prothorax, black. The anterior coxae and extreme tips of the others are usually pale. Length 5-5.25 mm.

Male—Eyes separated by one and seven-tenths to four-fifths times their length. Antennae slender, over four-fifths as long as the body, third joint twice as long as second, median joints four times as long as wide. Clypeal apex oblique each side of median notch. Pronotum three-tenths wider than long, feebly narrowed in front, sides not sinuate, lateral margin obtuse at the obsolete anterior angles, ground sculpture distinct in front, basal tumidities not prominent. Elytral sculpture and pubescence normal. First protarsal joint two and one-half times as long as wide. Pro- and meso-tarsal claws narrowly cleft, the tooth slender, acute, distinctly shorter than the apical part and contiguous with it except at tip. Metatarsal claws more widely cleft, the tooth shorter and not contiguous. Figs. 8 and 38.

Female—Eyes separated by twice their length. Antennae three-fifths as long as the body, third joint two-thirds longer than second, median joints three times as long as wide. Claws with an extremely small, slender and acute submedian tooth. Last ventral segment usually produced in an apical lobe.

Neb.—McCook, type, male, collected by Wickham (U. S. N. M.). S. D.—Belvidere; Interior. Kans.—No definite locality. Minn.—Itasca Park; Houston Co.; Otter Tail Co. Iowa—Sioux City.

Paratypes—U. S. N. M. (6); M. C. Z. (1); Univ. Minn. (13); Fender (1); author's coll. (4).

Distinguished from *tenuis* by the slightly larger eyes and longer antennae of the male, the latter with smaller second joint; the more transverse pronotum in part distinctly alutaceous; the shorter elytral pubescence; the less slender claws of the male and the small unguinal tooth of the female. The occasionally pale sutural margin

of the elytra is to be found elsewhere in Group 1 only in immature *nanulus*. The form of the claws in the female is very unusual. 26 examples.

(26) *C. vestigialis* new species.

Color black, pronotum yellow; two basal antennal joints largely pale; legs black, the front and middle tibiae fuscous. Varies with front part of head and mouth parts pale, the palpi darker. Body beneath black; gular region, prothorax and anterior coxae pale. Length 4–5 mm.

Male—Eyes rather large, separated by slightly over one and one-half times their length. Antennae slender, two-thirds as long as the body, third joint three-fourths longer than second, median joints over three times as long as wide. Head very short in front of the eyes, clypeal apex oblique each side of median notch. Pronotum one-fifth wider than long, feebly narrowed in front, sides not sinuate, lateral margin obtuse at the evident anterior angles, ground sculpture wanting, basal tumidities not prominent. Elytral sculpture normal; pubescence sparse, inclined, of normal length. First protarsal joint two and one-half times as long as wide. Pro- and mesotarsal claws narrowly cleft, the tooth subequal in length to the more slender apical part and contiguous with it except at tip. Metatarsal claws less narrowly cleft, the tooth shorter. Figs. 7 and 39.

Female—Eyes separated by nearly twice their length. Antennae one-half as long as the body, third joint two-thirds longer than second, median joints two and one-half times as long as wide. Ungual tooth virtually wanting, reduced to the acute angle of a basal enlargement. Fig. 13.

N. J.—Malaga, female, holotype, V-24-1919; male, allotype, V-16-1920, both collected by F. R. Mason (Acad. N. S. Phila.); Jamesburg; Bamber.

Paratypes—Amer. Mus. N. H. (1 female); Reading Public Museum (1 male and 3 females).

The principal distinguishing character of *vestigialis* is found in the almost complete reduction of the female unguis and it is therefore appropriate to select one of that sex as the holotype. The males agree accurately with the females in every detail except those sexually modified and there can be no reasonable doubt as to their correct association. Since the species occurs in a region that has

been thoroughly worked by collectors, the total of seven specimens seen indicates an unusual rarity. The paratypes in the Reading Museum are in poor condition, the male having lost the head and prothorax. The genitalic drawings were taken from this specimen.

(27) *C. luteicollis* Germ., Insect. Sp. Nov., 1824, page 70.

*cinctellus* Lec., Proc. Acad. N. S. Phila., 1851, V-341.

Form short and stout, parallel. Head black, pale reddish yellow in front of the eyes; antennae black, two basal joints pale, several following joints pale basally and progressively more widely black apically; palpi dusky at tip. Pronotum pale reddish yellow. Elytra black with narrow pale lateral and sutural margins. Body beneath black; mouth parts, gular region, prothorax, legs and coxae pale reddish yellow; ventral segments with pale lateral and apical borders. Length 4-5.25 mm.

Male—Eyes small, separated by twice their length. Antennae rather slender, three-fourths as long as the body, third joint one-half longer than second, median joints three and one-half times as long as wide. Head alutaceous, not broadly concave. Clypeal apex not sinuate, nearly rectilinear medially. Pronotum four-tenths wider than long, as wide as the elytra at base, slightly narrowed in front, sides not sinuate, lateral margin acute, anterior angles evident, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture rather coarse, pubescence uniform, sparse, rather long and suberect. First protarsal joint two and one-half times as long as wide. Protarsal claws narrowly cleft, the tooth slender and a little shorter than the apical part. Mesotarsal claws similar, the tooth shorter. Tooth of metatarsal claws very short, that of the anterior claw often perceptibly smaller. Figs. 6 and 40.

Female—Eyes separated by two and one-third times their length. Antennae nearly two-thirds as long as the body, third joint one-third longer than second, median joints over three times as long as wide. Pronotum as wide or wider than the elytra at base, nearly one-half wider than long. Claws with a very short, slender and acute submedian tooth.

Ill., Iowa, Mich., Wis., Minn.

*Luteicollis*, because of its short and stocky build, could be confused with no other species except the similarly colored *septentrionis*. Leconte described *cinctellus* from Missouri Territory and



Georgia but no examples from the latter locality are in his collection. I do not think it occurs in the Atlantic States.

The authority for the above synonymy is not known to me. Germar's description does not fit this species as well as it does some forms of *nigriceps* and *imbecillis*. His type has probably been destroyed. Dr. Heinrich Kuntzen reports from Berlin that its location is unknown.

(28) **C. septentrionis** new species.

Form short and stout. Head black, pale in front of the eyes, the pale area extending posteriorly between the antennae; antennae black, two basal joints pale, several following joints usually indefinitely paler at base; palpi dusky at tip. Pronotum pale reddish yellow, often with more or less distinct brown median spot. Elytra black with lateral and sutural margins pale, the latter more widely toward base. Body beneath black; mouth parts, gular region, prothorax, legs and coxae pale reddish yellow; ventral segments with pale apical borders. Length 4.5–5 mm.

Male—Eyes small, separated by twice their length. Antennae rather slender, three-fourths as long as the body, third joint one-half longer than second, median joints three and one-half times as long as wide. Head shining, feebly alutaceous, not broadly concave. Clypeal apex feebly sinuate or with a minute notch, sometimes obliquely rounded each side. Pronotum one-third wider than long, as wide as the elytra at base, narrowed in front, sides not sinuate, lateral margin acute, anterior angles and ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture normal, pubescence short, inclined. First protarsal joint two and one-half times as long as wide. Protarsal claws narrowly cleft, the tooth slender and a little shorter than the apical part. Other claws similar but more widely cleft, the tooth shorter. Figures 6 and 41.

Female—Eyes separated by two and one-third times their length. Antennae two thirds as long as the body, third joint one-half longer than second, median joints three times as long as wide. Pronotum four-tenths wider than long. Claws rather widely cleft, the tooth much shorter but scarcely stouter than the apical part.

Miss.—Eagle Bend, type, male, July 5, 1922, collected by W. E. Hoffman (Univ. of Minn. coll.); Sawyer, Wadena, Minneapolis.  
Man.—Husavick.

Paratypes—Univ. Minn. (10); M. C. Z. (2); U. S. N. M. (1); author's coll. (2).

This species, colored nearly as in *luteicollis*, has most of the structural details of *coloradensis*. It differs from both in the shorter and denser elytral pubescence. In *luteicollis* there is no trace of the darker pronotal cloud, the form is slightly broader, the pronotum more rectangular, and the unguual tooth is smaller in both sexes. 16 examples.

(29) *C. coloradensis* new species.

Form short and stout, as in *septentrionis*. Color black; ante-ocular area and mouth parts pale, palpi dusky; sides of pronotum reddish yellow. Body beneath, except prothorax, black. Length 4.5–5 mm.

Structurally nearly identical with *septentrionis*. The third antennal joint in the male is, in the majority of the examples seen, fully twice as long as the second. The clypeal apex is not sinuate and is nearly rectilinear medially, as in *luteicollis*. The head is broadly but vaguely concave behind the antennae, smooth and shining and with very feeble alutaceous sculpture. The elytral sculpture is somewhat coarse and the pubescence rather long and suberect, as in *luteicollis*. Genitalia as in *septentrionis*. Figs. 6 and 42.

Colo.—Buena Vista, type, male, July 1–6, 1896, 7900–8000 ft., collected by H. F. Wickham. (M. C. Z. coll.); Florissant (Fall coll.), Durango (Rotger). Utah—Greendale and Neola (Fender). Mont.—Helena (Frost).

Paratypes—M. C. Z. (5); U. S. N. M. (4).

Twenty specimens of *coloradensis* have been examined. It may eventually prove to be a subspecies of *septentrionis*. One example in the Fall collection approaches the latter species in its shorter elytral pubescence.

(30) *C. scitulus* Say, Jour. Acad. N. S. Phila., 1825, V–168.

Color typically black with front of head, basal antennal joint, pronotum, lateral and sutural margins of elytra, and the legs including the coxae pale reddish yellow. The pronotum has usually a small and ill-defined darker median area not attaining the margins. Body beneath black; gular region and mouth parts including palpi, prothorax, and lateral and apical margins of ventral segments pale. A supposed color phase is black with the basal antennal joint dusky, ante-ocular area

pale, and the sides of the pronotum with indefinitely limited rufous area; legs and body beneath black, hypomera, tips of coxae, and apical margins of ventral segments more or less pale. Length 5-6 mm.

Male—Eyes small, separated by one and three-fourths times their length. Antennae slender, about seven-tenths as long as the body, third joint one-half longer than second, median joints three times as long as wide. Clypeal apex very feebly sinuate, the anterior angles broadly rounded narrowing the apex. Pronotum one-fourth wider than long, narrowed in front, sides sinuate, lateral margin acute, anterior angles subobsolete, ground sculpture faint, basal tumidities not prominent. Elytral sculpture and pubescence normal, longer suberect hairs numerous except basally. Tarsi short, first protarsal joint twice as long as wide. Protarsal claws very finely cleft, the tooth slender, acute, shorter than the apical part and contiguous with it basally. Other claws nearly similar, the metatarsal a little less narrowly cleft. Figs. 8 and 43.

Female—Eyes separated by twice their length. Antennae nearly three-fifths as long as the body, third joint one-third longer than second, median joints two and one-half to three times as long as wide. Claws widely cleft, the tooth rather acute, shorter but scarcely broader than the apical part.

N. S., Que., Ill., Me., N. H., Vt., Mass., N. Y., Conn., Pa., N. J., N. C., Tex.

This species closely resembles some of the forms of *rectus*. A relationship with *luteicollis* is indicated by the less elongate elytra, small eyes, form of the clypeus, very narrowly cleft claws of the male, more erect pubescence and partly pale ventral segments.

The dark variant described above is represented by three males and two females from Highlands, N. C., received from Mr. C. S. Brimley. They appear to be structurally identical with typical *scitulus* but no intermediates have been seen.

(31) *C. rectus* Melsh., Proc. Acad. N. S. Phila., 1846, II-305.

*rufipes* Say, Jour. Acad. N. S. Phila., 1823, III-182.

*pusillus* Lec., (not 1881) Proc. Acad. N. S. Phila., 1851, V-343.

Color variable; typically black with anteocular area, basal antennal joints beneath, mouth parts except palpi, sides of pronotum, epipleural and sutural margins of elytra and tibiae and

tarsi pale. The pronotum may be entirely black or, very rarely, entirely pale. The sutural pale margin may become broader toward the base, sometimes extending to the humerus. Specimens occurring at higher altitudes are predominantly black, the elytra concolorous or the epipleural margin alone narrowly pale, the legs black or with the tibiae and tarsi fuscous. Body beneath black, the prothorax pale when its dorsal surface is partially so. Length 5–7 mm.

Male—Eyes separated by one and three-fifths to two-thirds times their length. Antennae slender, over seven-tenths as long as the body, third joint two-thirds to three-fourths longer than second, median joints three to three and one-half times as long as wide. Clypeal apex biarcuate or feebly sinuate. Pronotum one-fourth wider than long, narrowed in front, sides sinuate, lateral margin acute, anterior angles evident, ground sculpture faint, basal tumidities not prominent. Elytral sculpture and pubescence normal, longer suberect hairs not conspicuous, more numerous apically. First protarsal joint two and one-half times as long as wide. Protarsal claws rather widely cleft, the tooth stout, blunt and slightly shorter than the apical part. Other claws similar but more widely cleft, the apical part longer. Figs. 2 and 44.

Female—Eyes separated by twice their length. Antennae three-fifths as long as the body, third joint one-half longer than second, median joints two and one-half to three times as long as wide. The claws differ from the male in being a little more widely cleft.

B. C., Alta., Ont., Que., Nfld., N. S., Ida., Mont., Colo., Minn., Ill., Me., N. H., Vt., N. Y., Mass., Conn., Pa., Ohio, N. J., Md., W. Va., N. C., S. C., Ga., Tenn., Ark., Mo.

It would seem from Melsheimer's description of the second joint of the antennae as "very small, subglobular" that he had some other species before him. His type series consists of three females having the second antennal joint elongate, and a fourth specimen which is now in very bad condition but appears to be *imbecillis*. Specimen number one is designated the lectotype.

*Rectus* is one of the most abundant and widely distributed species and also the most variable. The widely cleft claws and slender antennae of the male, and the normal elytral pubescence and obsoletely alutaceous pronotum will distinguish it from any of its allies. The pronotal ground sculpture may occasionally be quite evident

but not with the dense regularity to be seen in *oriflavus*. Mature examples are extremely rare in which the basal antennal joint and legs are entirely yellow, or the apical margins of the ventral segments distinctly pale. Almost any color combination within the specified limits may be encountered. All attempts at subdivision, not dependent on color, have failed. Some specimens of *rectus* approach *cruralis* in their larger eyes and stouter antennae and tarsi, while others tend in the direction of *scitulus*.

(32) *C. cruralis* Lec., Proc. Acad. N. S. Phila., 1851, V-342.

Color typically black with front part of head, basal antennal joint beneath, pronotum, narrow epipleural and sutural margins of elytra, and legs and coxae pale reddish yellow; tarsi and narrow median pronotal stripe black, the latter sometimes abbreviated at each end. Body beneath black; mouth parts except palpi, gular region, prothorax, and lateral and apical margins of ventral segments pale. Supposed variations are described below. Length 5.25-6.75 mm.

Male—Eyes separated by one and one-half times their length. Antennae short and stout, two-thirds as long as the body, third joint one-half longer than second, median joints two and one-half to three-fourths times as long as wide. Clypeal apex biarcuate or feebly sinuate. Pronotum one-fourth wider than long, narrowed in front, sides sinuate, lateral margin acute, anterior angles obsolete, ground sculpture lacking except on median black stripe, basal tumidities not prominent. Elytral sculpture dense, pubescence rather dense, inclined, numerous long erect hairs interspersed producing a shaggy appearance. Tarsi stout, first protarsal joint two-thirds longer than wide. Protarsal claws not very narrowly cleft, the tooth a little shorter and broader than the apical part. Other claws similar but more widely cleft, the apical part longer. Figs. 4 and 45.

Female—Eyes separated by almost twice their length. Antennae rather stout, one-half as long as the body, third joint one-third longer than second, median joints two and one-half times as long as wide. Claws widely cleft, the tooth short and slightly broader than the apical part.

N. C., S. C., Ga., Fla. (?).

This species appears to be rare. Most of the examples seen were received from Mr. C. S. Brimley of the North Carolina Department

of Agriculture. *Cruralis* is an extreme member of the *rectus* complex and readily distinguished by the shorter and stouter antennae, the stouter tarsi, denser pubescence and bicolored ventral segments. The eyes of the male are larger than in *rectus*, the claws less widely cleft and the dorsal plate more deeply notched. *Cruralis* also differs in habitus because of its relatively larger pronotum and slightly shorter elytra.

Several examples tentatively considered as variants are described as follows. Two denuded males from Georgia in the collection of the Museum of Comparative Zoology have the legs and elytra black, the epipleural edge narrowly pale. Two males from the Castle collection in the Reading Public Museum, taken at Enterprise, Florida, have the epipleural and sutural margins and the trochanters pale; the antennae, legs and ventral segments black; the antennae and tarsi a little less stout and the pubescence somewhat as in *rectus*. While these and other doubtful specimens might seem to indicate the possible suppression of *cruralis*, it is more probable that additional species will be defined at the expense of *rectus*.

(33) *C. oriflavus* Lec., Proc. Boston Soc. N. H., 1874, XVI-273.

Color variable. Head black, yellow in front; mouth parts, except palpi, pale; antennae black, basal joint usually pale. Pronotum yellow, with sharply defined median black stripe. Elytra black, the lateral and usually the sutural margin pale. Legs and coxae yellow, the tarsi dusky; varying to entirely black. Body beneath black; gular region, prothorax and nearly always the apical margins of ventral segments pale. Length 4-6.25 mm.

Male—Eyes rather large, separated by one and one-third to four-tenths times their length. Antennae short and stout, two-thirds as long as the body, third joint one-half longer than second, median joints two and one-half to three times as long as wide. Clypeal apex feebly sinuate. Pronotum one-third wider than long, scarcely narrowed in front, sides sinuate, lateral margin acute, anterior angles evident, surface in part distinctly alutaceous, basal tumidities not prominent. Elytral sculpture normal, the pubescence short, intermixed suberect hairs few and inconspicuous. Tarsi short, first protarsal joint two to two and one-half times as long as wide. Protarsal claws narrowly cleft, the tooth much broader and slightly shorter than the slender apical part and contiguous with it except at

tip. Other claws rather widely cleft, the apical part longer and less slender. Figs. 5 and 46.

Female—Eyes separated by one and three-fourths times their length. Antennae a little over half as long as the body, third joint one-third longer than second, median joints two and one-half to three times as long as wide. Claws widely cleft, the tooth stout and shorter than the apical part.

Mich., Ill., Me., N. H., N. Y., Conn., Mass., Pa., N. J., W. Va., Ohio, N. C., Ala., Miss., Ark., Kans.

Leconte's type is a female from New Hampshire and unquestionably this species. *Oriplastus* is characterized in the male by the short and stout antennae, large eyes and narrowly cleft protarsal claws; and in both sexes by the broader pronotum with very distinct alutaceous ground sculpture and by the short and less erect elytral pubescence. The elytra are perceptibly less elongate than in either *rectus* or *cruralis*. I have seen only one specimen in which the pronotum was not distinctly alutaceous.

(34) *C. imbecillis* Lec., Proc. Acad. N. S. Phila., 1851, V-342.

*albolineatus* Blatch., Can. Ent., 1917, XLIX-143.

Head black, usually pale before the eyes; antennae black, two basal joints often paler beneath; pronotum yellow, with or without median black stripe; elytra black with pale lateral and sutural margins; scutellum dark; legs and coxae yellow. The pale sutural margin is sometimes expanded at base to the humeri. Body beneath black; gular region, mouth parts including palpi and prothorax yellow; last ventral segment paler apically in the female. Specimens from the Gulf States are darker, the antennae totally black, the legs partly or entirely black and the pronotum always bicolored. Length 4.5-6.5 mm.

Male—Eyes large and strongly convex, separated by one and one-fifth to one-fourth times their length. Antennae slender, seven-tenths as long as the body, third joint two-thirds longer than second, median joints four times as long as wide. Clypeal apex notched, the limiting angles rounded, feebly oblique each side. Pronotum one-fourth wider than long, narrowed in front, sides sinuate, lateral margin acute, anterior angles evident, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture coarse, the pubescence sparse, long and suberect. Abdomen with distinct dual vestitude.

First protarsal joint two and one-half times as long as wide. Protarsal claws rather widely cleft, the tooth stout, blunt and a little shorter than the apical part. Other claws similar, a little more widely cleft, the apical part longer. Figs. 2 and 47.

Female—Eyes separated by one and two-thirds times their length. Antennae three-fifths as long as the body, third joint one-half longer than second, median joints three times as long as wide. Claws nearly as in male, widely cleft, the tooth short, stout and blunt.

Ont., Me., Vt., Mass., Pa., N. J., Md., D. C., W. Va., N. C., S. C., Ga., Fla., Miss., Ark., Ind., Ill., Iowa, Kans.

The head in front of the eyes is conspicuously shorter than in the next two species. The clypeus here presents an exception to the biarcuate or sinuate form characterizing Group 2. The species would be obviously misplaced in Group 1. Through the kindness of Mr. J. J. Davis of Purdue University I was able to examine specimens from the type series of *albolineatus* Blatch. These are some of the darker examples referred to above and do not differ in any other way from typical *imbecillis*.

The following points in Germar's description of *Telephorus luteicollis* seem to indicate its identity with this species rather than the *cinctellus* of Leconte: body narrow; habitat Kentucky; antennae black, base piceous; thorax subquadrate, sides subsinuate.

(35) *C. nigriceps* Lec., Agassiz Lake Sup., Boston, 1850, IV-230.

*pusillus* Lec. (not 1851) Trans. Am. Ent. Soc., 1881, IX-52.

*mollis* Fall, Pan-Pac. Ent., 1936, XII-182.

(—a) *mimus* Fall, Pan-Pac. Ent., 1936, XII-182.

Color variable, typically with head black or dark brown, yellow in front; antennae black or brown, two basal joints pale and several following joints slightly paler at base; pronotum and scutellum yellow; elytra yellow, with a more or less distinct broad dusky vitta from humerus nearly to apex; legs and coxae yellow. Body beneath yellow; sides of head dusky, metathorax brown, the ventral segments sometimes partly infusate.

Varies, with intermediates, to a more fully pigmented form in which the brown areas become black; the basal antennal joint alone totally yellow; the elytra black with pale lateral and sutural margins; the ventral segments of the male usually black with pale lateral and apical borders, of the female black except at tip. This is the *pusillus* (1881) of Leconte and the *mollis* of Fall.



In a series from Bay of Islands, Newfoundland, the color is as in *mollis* except the basal antennal joint, palpi, tarsi, coxae and ill-defined median pronotal vitta are dark brown. Length 4.25–5.5 mm.

Male—Eyes large and strongly convex, separated by one and one-tenth to one-fifth times their length. Head in front of the eyes distinctly elongate, this most apparent in the female. Antennae slender, seven-tenths as long as the body, third joint one-half longer than second, median joints three and one-half times as long as wide. Clypeal apex feebly sinuate. Pronotum one-fourth wider than long, narrowed in front, sides sinuate, lateral margin acute, anterior angles evident, ground sculpture obsolete, basal tumidities not prominent. Elytral sculpture coarse, pubescence long, sparse and suberect. Abdomen shining, secondary vestiture excessively minute and difficult to observe. Tarsi slender, first protarsal joint two and one-half times as long as wide. Pro- and meso-tarsal claws narrowly cleft, the tooth slender and acute, shorter than the apical part. Metatarsal claws similar but less narrowly cleft, the apical part longer. Dorsal plate of genitalia variably emarginate at apex. Figs. 6 and 48.

Female—Eyes separated by one and three-fifths to two-thirds times their length. Antennae three-fifths as long as the body, third joint one-third longer than second, median joints three times as long as wide. Claws widely cleft, the tooth shorter and slightly broader than the apical part.

Sask., Ont., Nfld., Minn., Wis., Mich., Iowa, Kans., Ark., Ill., Me., N. H., Vt., N. Y., Mass., Conn., Pa., N. J., Md., Va., N. C., Ga.

*Nigriceps* may be readily distinguished from all other species except *greeni* by the apparently lacking secondary vestiture of the ventral segments, which have, in consequence, a definitely more shining lustre. Some of the forms of *nigriceps* bear a deceptive resemblance to *imbecillis*. On comparing females of the two species the head in the former is seen to be much more elongate in front of the eyes, while the males differ conspicuously in the form of the claws.

Leconte's type, from Lake Superior, is specimen number ten in his *scitulus* series and is almost entirely pale, probably to some extent due to immaturity. In the North Central States similar examples occur, together with the darker *mollis*, which is most commonly encountered in the East. In the many hundreds of indi-

viduals examined the pronotum has shown not the slightest trace of a median vitta except in seven specimens from Bay of Islands, Newfoundland, in the collection of the American Museum of Natural History.

(35a) *C. nigriceps mimus* Fall.

Color as in eastern *nigriceps* except as follows: the pale elytral margins are wider, reducing the black area to a slightly oblique vitta of uniform width extending from humerus nearly to apex; mesosternal side pieces yellow; ventral segments dark brown with pale lateral and apical borders in both sexes. Length 4-5 mm.

Structurally this subspecies differs from *nigriceps* only in the shorter and stouter tarsi and antennae.

Male—Antennae three-fifths as long as the body, median joints scarcely exceeding two and one-half times as long as wide; first protarsal joint twice as long as wide.

Female—Antennae a little over half as long as the body, median joints scarcely exceeding twice as long as wide.

Occurs in southern New Jersey; also at Wyandanch, Long Island (U. S. N. M.).

(36) *C. greeni* Fall. Pan-Pac. Ent., 1936, XII-183.

Very similar to *nigriceps* and colored as in the darker forms of that species (*mollis* Fall). The antennae are longer and very slender, the median joints about four times as long as wide in the male and three and one-half in the female. The tarsi are likewise longer and more slender, the first joint of the male protarsi over three times as long as wide, usually not more than two and one-half in *nigriceps*. The claws of the male are elongate and very finely cleft, the tooth slender, acute, subequal to the apical part in length and contiguous with it except at extreme tip. The tooth of the metatarsal claws is a little shorter. The claws of the female are as in *nigriceps*. Figs. 9 and 49.

N. Y., Va., W. Va., N. C., Ga.

This species occurs in mountainous regions and will probably be found throughout the Appalachian Range. The male genitalia are similar to *nigriceps*, the dorsal plate being always more deeply emarginate in *greeni*. Females of the two species are not definitely distinguishable.

(37) *C. trianguliferus* new species.

Color pale reddish yellow; head with a subtriangular black spot on vertex; antennae black, two basal joints entirely pale; palpi dusky at tip; pronotum yellow, usually with a small ante-median dark spot; scutellum black, tip pale; tarsi dusky. Body beneath yellow; meso- and meta-thorax partly dark and the ventral segments, except apical, more or less so. Length 5-6 mm.

Male—Eyes large and strongly convex, separated by one and one-fourth times their length. Antennae rather slender, three-fifths as long as the body, third joint one-third longer than second, median joints slightly over three times as long as wide. Clypeal apex feebly sinuate. Pronotum very little wider than long, scarcely narrowed in front, sides feebly sinuate, lateral margin acute, anterior angles evident, ground sculpture virtually absent, basal tumidities not prominent. Elytra with shallow sculpture, pubescence normal to rather sparse, suberect hairs intermixed. Protarsi short, first joint twice as long as wide. Protarsal claws narrowly cleft, the tooth subequal in length to the more slender apical part. Other claws more widely cleft, the tooth shorter. Figs. 7 and 50.

Female—Eyes separated by one and three-fifths times their length. Antennae more slender, scarcely over half as long as the body, otherwise as in male. Claws widely cleft, the tooth shorter and slightly broader than the apical part.

N. C.—Orton, type, male, May 2, 1939, collected by D. L. Wray (author's coll.); Clayton; Castle Hayne. N. J.—Lakehurst. Va.—Ft. Monroe. S. C.—Bethune; Loris. Ga.—Milner. Ala.—Mobile; Hazen. Miss.—Pulaski; State College. Fla.—Enterprise; Lake Mary. Ark.—Hope.

Paratypes—M. C. Z. (5); Amer. Mus. N. H. (5); Acad. N. S. Phila. (4); U. S. N. M. (4); Fender (4); author's coll. (19); N. C. Dept. Agr. (10); Clemson College (1); Miss. State College (1).

In immature examples the black spot on the vertex is sometimes not apparent. The shorter and stouter antennae, palpi and tarsi, and the shorter elytral pubescence will distinguish these from the next species. Mr. C. S. Brimley found *trianguliferus* in numbers on *Sarracenia flava* and *Osmunda cinnamomea* at Castle Hayne, N. C., May 15, 1940.

(38) *C. nigrohumeralis* new species.

Color pale yellow; elytra testaceous, humeral callus black

or occasionally with dark lateral vitta; antennae except two basal joints, tarsi and tips of palpi black. Body beneath yellow; metathorax black, ventral segments dusky with pale lateral and apical borders. Length 5.25–7.5 mm.

Male—Eyes large, separated by one and one-fourth times their length. Antennae slender, two-thirds as long as the body, third joint nearly one-half longer than second, median joints four times as long as wide. Clypeal apex biarcuate. Palpi slender. Pronotum very little wider than long, narrowed in front, sides sinuate, lateral margin acute, anterior angles evident, ground sculpture lacking basally and very faint apically, basal tumidities not prominent. Elytral sculpture normal, pubescence rather sparse, long and suberect. Tarsi slender, first protarsal joint nearly three times as long as wide. Protarsal claws somewhat narrowly cleft, the tooth much broader and a little shorter than the apical part. Other claws more widely cleft, the tooth shorter. Figs. 4 and 51.

Female—Eyes separated by one and three-fourths times their length. Antennae three-fifths as long as the body, otherwise as in male. Claws widely cleft, the tooth broader and shorter than the apical part.

S. C.—Bethune, type, male, May 8, 1937, collected by J. G. Watts (author's coll.). Md.—No definite locality. Va.—Cape Henry; Fort Monroe. N. C.—Maxton; Fayetteville; Benson; So. Pines. Ga.—Tifton; Stone Is.; St. Catherine Id. Ala.—Mobile.

Paratypes—U. S. N. M. (17); Clemson College (1); N. C. Dept. Agr. (1); author's coll. (3).

The two basal antennal joints pale and contrasting sharply with the following dark ones will at once segregate this and the preceding species from all others except typical *heterodoxus*, in which the claws are radically different. The pubescence is easily denuded and many old specimens have the appearance of being glabrous.

(39) **C. heterodoxus** new species.

Color variable; typically yellow; head with subtriangular black spot on vertex; antennae black with two basal joints pale; pronotum with ante-median brown spot; elytra with a dark vitta from humerus nearly to apex; tarsi dusky. Body beneath yellow, meso- and metathorax and ventral segments partly dark. The elytral vitta may be reduced to a humeral spot or expanded so only the margins are pale. Varies to black with ante-ocular area, mandibles, underside of first antennal

joint and narrow epipleural edge of elytra pale, the pronotum piceus. Length 5.5–6.25 mm.

Male—Eyes large and strongly convex, separated by one and one-fifth to one-fourth times their length. Antennae slender, seven-tenths as long as the body, third joint one-half longer than second, median joints three and one-half to four times as long as wide. Clypeal apex biarcuate or feebly sinuate. Palpi slender. Pronotum slightly wider than long, narrowed in front, sides feebly sinuate, lateral margin acute, anterior angles evident, ground sculpture faint, basal tumidities not prominent. Elytral sculpture normal, shallow; pubescence short and decumbent. Tarsi short and stout, first protarsal joint twice as long as wide. Claws abruptly bent, enlarged at base and angulate within; pro- and meso-tarsal claws narrowly cleft, the apical part long, slender and acute, the tooth equally as long but very much broader and rather blunt. Metatarsal claws similar, the tooth shorter and more divergent. Figs. 12 and 52.

Female—Eyes separated by one and three-fourths times their length. Antennae a little over half as long as the body, third joint nearly one-half longer than second, median joints three to three and one-half times as long as wide. Palpi less slender. Claws as in male metatarsal, angularly enlarged at base, widely cleft, the tooth long and parallel-sided, shorter and a little broader than the apical part.

La.—Bossier Par., type, male, V-10-38, collected by W. F. Turner (U. S. N. M.). Ill.—No definite locality. N. Y.—No definite locality. Mass.—Northboro. Ky.—No definite locality. (Amer. Mus. N. H.). N. C.—Raleigh. Ala.—Mobile.

Paratypes—U. S. N. M. (10); M. C. Z. (4, Leconte coll.); Acad. N. S. Phila. (3).

The form of the claws will at once identify both sexes of this species. In the pale specimens a resemblance to *trianguliferus* is noted. Those in which the elytral margins are narrowly pale resemble *rectus*. Only one black example has been seen, a male from Northboro, Mass., in the Fall collection. Leconte may have had a specimen of this species as his type of *longulus*, described from "Niagara." 26 examples.

(40) *C. longulus* Lec., Proc. Acad. N. S. Phila., 1851, V-343.  
Lec., Trans. Am. Ent. Soc., 1881, IX-52.

Color pale brownish yellow; antennae black or brown, the

first joint pale or with the tip dusky, several following joints paler at base; elytra with oblique vitta from humerus nearly to apex; tarsi, tibiae and apical part of femora more or less dusky. Varies to entirely pale with the tarsi and antennae darker. Length 5–6.5 mm.

Male—Eyes separated by one and four-fifths to nearly twice their length. Antennae slender, scarcely shorter than the body, basal joint very stout, third joint one-half longer than second, median joints five times as long as wide; vestiture very short; third joint with dense erect pubescence on distal half of anterior face. Clypeal apex oblique each side of median notch. Pronotum as long as wide, varying to somewhat transverse, scarcely narrowed in front, sides feebly sinuate, lateral margin acute, anterior angles subobsolete, ground sculpture distinct, basal tumidities prominent and sparsely punctulate. Elytra with irregular impressed punctures tending to become transversely rugulose, vestiture consisting of sparse and extremely minute prostrate hairs. Protarsi very stout; first joint two-thirds longer than wide, equal in width to the fourth; second and third joints triangular and a little narrower. Mesotibiae perceptibly arcuate and feebly enlarged at tip. Pro- and mesotarsal claws elongate, very narrowly cleft, the tooth equal to or exceeding in length the more slender apical part and contiguous with it except at tip. Metatarsal claws widely cleft, the tooth acute, shorter but scarcely stouter than the apical part. Figs. 11 and 53.

Female—Eyes nearly as in male, very slightly smaller. Antennae two-thirds as long as the body, first joint normal, third joint one-half longer than second, median joints nearly four times as long as wide; vestiture longer, that of third joint unmodified. Elytral vestiture usually distinct, consisting of short, not dense, prostrate hairs variable in length individually. Protarsi distinctly narrower than in male. Mesotibiae unmodified. Claws widely cleft, as in male metatarsal. Apex of last ventral segment produced in a short subtriangular median lobe.

Florida—Crescent City; Enterprise; Jacksonville; Kissimmee; Sanford.

*Longulus* was described from Niagara, presumably New York. It is extremely doubtful if the present species occurs in that locality. In his 1881 paper Leconte applied the name as it is here used. No

specimen from Niagara is now in his collection, nor in the Horn collection at Philadelphia.

Specimens referred here tentatively differ from the preceding description as follows. Male—Antennae shorter, four-fifths as long as the body, third joint two-thirds longer than second, median joints four times as long as wide. Elytral sculpture coarser and more irregular, the pubescence more minute. Mesotarsal claws similar to metatarsal but less widely cleft. Dorsal plate of genitalia with smaller emargination. Fig. 17. Female—Antennae stouter, three-fifths as long as the body, median joints three times as long as wide. Elytral pubescence minute as in male.

Only two males of this form have been seen, in one of which the mesotarsal claws are missing. Should the structure of these claws prove to be constant as above described a valid species would undoubtedly be indicated. All the examples studied are pale brownish yellow with the antennae, except one or two basal joints, and tarsi dusky. The following localities are represented:

N. C.—Wendell; Raleigh; So. Pines; Clayton. S. C.—Meredith. Ga.—Tifton; "Ga." (Leconte coll.); Waycross. Fla.—Walton Co. and Whitfield (U. S. N. M., 3 females from night hawk stomach).

Other examples of more northern distribution, likewise doubtfully referred to *longulus*, have the pubescence minute in both sexes, the male antennae slightly shorter than typical, mesotarsal claws of male similar to protarsal and the dorsal plate as in figure 17. The color varies from entirely yellow except antennae and tarsi to head black posteriorly, pronotum with median brown spot, elytra vittate and metathorax beneath black. These are from

Mass.—Nantucket (Boston Soc. N. H.). N. J.—Lakehurst; Browns Mills; Da Costa. Va.—L. Drummond (U. S. N. M.). N. C.—Castle Hayne.

These forms of *longulus*, while possibly specifically distinct, are represented by inadequate material at present. Some degree of individual variation occurs in their rather indecisive differential characters.

#### APPENDIX

*C. fulvus* Scop., Ent. Carniol., 1763, page 39.

Color reddish yellow; antennae except at base, palpi, tarsi and apical tenth of elytra black. Length 8–10 mm.

Male—Head shining, without ground sculpture, sparsely pubescent, minutely and sparsely punctulate. Eyes separated

by over one and one-half times their length. Clypeus oblique each side of median notch. Antennae slender, three-fourths as long as the body, third joint seven-tenths longer than second, median joints five times as long as wide. Pronotum shining, without ground sculpture, sparsely pubescent, minutely and sparsely punctulate, as long as wide and as wide as the elytra at base, narrowed in front, sides nearly straight, lateral margin acute, anterior angles obsolete, basal tumidities prominent. Elytral sculpture rather fine, not distinctly transversely rugulose; pubescence normal, inclined, fulvous. Tarsi stout, first protarsal joint nearly three times as long as wide. Pro- and mesotarsal claws somewhat elongate, the tooth slender, acute, slightly shorter than the apical part and contiguous with it except at tip. Metatarsal claws more widely cleft, the tooth shorter. Genitalia of the *angulatus* type.

Female—Eyes separated by twice their length. Antennae nearly two-thirds as long as the body, third joint one-half longer than second, median joints five times as long as wide. Claws widely cleft, the tooth somewhat blunt, shorter and slightly stouter than the apical part.

Specimens of this European *Cantharis* have been seen with "Tex" labels, but these are open to suspicion. The description is presented so the species may be recognized if it should occur in the United States. It appears to be related to *angulatus* but is incongruous in any position in our list.



## EXPLANATION OF PLATES XIII—XV

STRUCTURES IN *N. A. CANTHARIS*

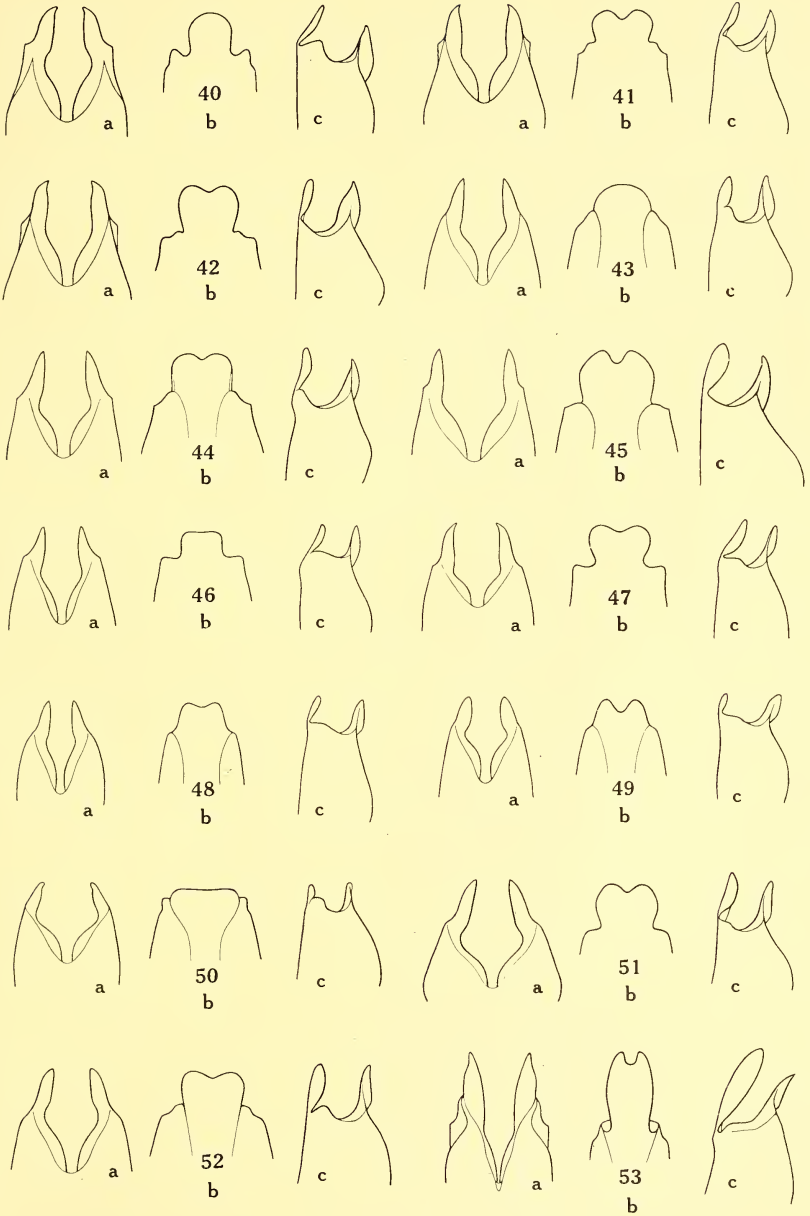
Ventral, dorsal and lateral views of the male genitalia are indicated by the letters a, b and c, respectively, the drawings arranged horizontally, in sets of three for each figure.

- Fig. 1. Male protarsal claw—*umbrinus*.  
Fig. 2. Same—*hirticulus*, *cartwrighti*, *rectus* and *imbecillis*.  
Fig. 3. Same—*mandibularis*.  
Fig. 4. Same—*mimeticus*, *nanulus*, *angulatus*, *costipennis*, *lineolus*, *ruficollis*, *cruralis* and *nigrohumeralis*.  
Fig. 5. Same—*oriflavus*.  
Fig. 6. Same—*flavipes*, *luteicollis*, *septentrionis*, *coloradensis* and *nigriceps*.  
Fig. 7. Same—*vestigialis* and *trianguliferus*.  
Fig. 8. Same—*campestris* and *scitulus*.  
Fig. 9. Same—*tenuis* and *greeni*.  
Fig. 10. Same—*picticornis*.  
Fig. 11. Same—*longulus*.  
Fig. 12. Same—*heterodoxus*.  
Fig. 13. Claw of female—*vestigialis*.  
Fig. 14. Clypeal apex oblique each side of median notch.  
Fig. 15. Clypeal apex biarcuate.  
Fig. 16. Clypeal apex feebly sinuate.  
Fig. 17. *C. longulus*, New Jersey, dorsal view of male genitalia.  
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Fig. 24. *C. proximus*, also *fraxini* and *tantillus*, male genitalia.  
Fig. 25. *C. walshi*, male genitalia.  
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Fig. 27. *C. cartwrighti*, male genitalia.  
Fig. 28. *C. hirticulus*, male genitalia.  
Fig. 29. *C. mimeticus*, also *nanulus*, male genitalia.  
Fig. 30. *C. mandibularis*, male genitalia.

- Fig. 31. *C. angulatus*, male genitalia.  
Fig. 32. *C. lineolus*, also *costipennis*, male genitalia.  
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Fig. 50. *C. trianguliferus*, male genitalia.  
Fig. 51. *C. nigrohumeralis*, male genitalia.  
Fig. 52. *C. heterodorus*, male genitalia.  
Fig. 53. *C. longulus*, Florida, male genitalia.









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