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PROCEEDINGS  
of the  
Biological Society of  
Washington

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# BIOLOGICAL SOCIETY OF WASHINGTON

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## PROCEEDINGS

**1039th Meeting—28 June 1964**

### EIGHTY-EIGHTH ANNUAL MEETING

President Charles O. Handley, Jr., called the meeting to order at 3 p.m. with twelve members present. Reports were received from the Corresponding Secretary, the Treasurer, the Audit Committee, and the Nominating Committee. The latter announced that the officers and council members listed on Page *iii* were elected by a nearly unanimous mail ballot. The President read the names of the twelve new members who had been elected during the year by the council. No formal communications were scheduled.



PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

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A KEY TO THE GENERA OF ANTHOMYIINAE  
KNOWN TO OCCUR IN AMERICA NORTH OF  
MEXICO, WITH NOTES ON THE GENUS *GANPERDEA*  
ALDRICH (DIPTERA, ANTHOMYIIDAE)

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Although the Anthomyiinae include many forms of economic importance, no satisfactory key to all the genera found in America north of Mexico is available. It is hoped that the key here presented will enable workers to place their material in the proper genus more easily and surely. The classification is that used by Stone, et al. (1965).

The genus *Ganperdea* Aldrich for a long time has been considered a synonym of *Neohylemyia* Malloch. It is shown here that the type-species of the two genera are sufficiently different to necessitate either recognizing the genera as distinct (as is here done) or broadening the concept of *Leucophora* Robineau-Desvoidy enough to contain both of them.

Family ANTHOMYIIDAE

Without well-developed postscutellum or hypopleural bristles; sixth (anal) wing vein nearly always attaining wing margin although often very weakened apically; third and fourth wing veins never distinctly convergent apically.

Key to Subfamilies of ANTHOMYIIDAE<sup>1</sup>

- 1 (2). *Stpl* 1 to 3; front equally wide in both sexes and always without cruciate interfrontal bristles; lower calypter never projecting beyond upper; scutellum without fine

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<sup>1</sup> The following abbreviations are used: *acr*, acrostichal (hairs); *ad*, anterodorsal bristle; *av*, anteroventral bristle; *dc*, dorsocentral bristles; *pd*, posterodorsal bristle; *pra*, prealar bristle; *pv*, posteroventral bristle; *sa*, supra-alar bristle; *stpl*, sterno-pleural bristles; *t<sub>1</sub>*, *t<sub>2</sub>*, fore and hind tibiae, respectively.



- erect hairs on lower surface; propleura usually with fine (pale) hairs in center (if bare in center and with 2 or 3 *stpl*, scutellum bears only two strong bristles well behind apex); costal spine lacking ..... SCATOPHAGINAE
- 2 (1). *Stpl* 2 to 5; front in male usually less than  $\frac{1}{3}$  of head width, or when broad (as in female) usually with cruciate interfrontal bristles; lower calypter frequently projecting beyond upper; propleura bare or with fine (black) hairs in center; scutellum with strong apical bristles; costal spine frequently well developed.
- 3 (4). Lower costal margin of wing with several equally large, but rather short, stout bristles; scutellum without hairs beneath; front of both sexes about  $\frac{1}{3}$  of head width, with cruciate interfrontals (small in *Circia*) ..... FUCELLIINAE
- 4 (3). Lower costal margin of wing without conspicuous bristles, or if such are present, one or two at costal fracture are larger (costal spine); scutellum nearly always with fine erect hairs beneath; front usually narrowed in male ..... ANTHOMYIINAE

Subfamily ANTHOMYIINAE

Key to Tribes and Genera Known to Occur in America North of Mexico

- 1 (10). Eyes broadly separated in the male, and arista pubescent to nearly bare (plumose in some exotic genera); calyp-teres small to very small; cruciate interfrontal bristles present ..... Tribe CHELISIINI
- 2 (3). Wing narrowed basally; anal vein sometimes not attaining wing margin ..... *Chelisia* Rondani
- 3 (2). Wing elliptical or broadest towards base; anal vein attaining wing margin.
- 4 (5). Cheek half as high as eye; antennae large; costal spine reduced; male hind basitarsus suddenly constricted near base ..... *Myopina* Rob.-Desv.
- 5 (4). Cheek much less than half as high as eye; hind basitarsus of male of usual form.
- 6 (7). Third antennal segment hardly more than the length of the second; parafacials and cheeks narrow; *t*<sub>3</sub> without *pv* spur ..... *Chiastochaeta* Pokorný
- 7 (6). Third antennal segment at least twice as long as second; parafacials and cheeks somewhat broadened.
- 8 (9). *T*<sub>3</sub> with *pv* spur ..... *Chirosia* Rondani
- 9 (8). *T*<sub>3</sub> without *pv* spur; with 1 *ad* and 2 *pd* ..... *Pseudochirosia* Ringdahl

- 10 (1). Eyes more or less closely approaching each other in male (front at narrowest point less than  $\frac{1}{3}$  total head width), or if more widely separated, arista long-bipectinate; calypteres moderately developed — Tribe ANTHOMYIINI
- 11 (14). Pteropleura with bristle or hairs.
- 12 (13). Pteropleura with a noticeable bristle on dorsal margin below wing base; propleura bare ..... *Emmesomyia* Malloch
- 13 (12). Pteropleura with several fine hairs; prosternum and propleura with fine black hairs ..... *Eremomyioides* Malloch
- 14 (11). Pteropleura bare.
- 15 (16). Eyes hairy and abdomen broad, not much longer than wide; eyes in both sexes distinctly separated .....  
..... *Alliopsis* Schnabl and Dziedzicki
- 16 (15). Eyes bare, or if hairy, abdomen much narrower than long and eyes contiguous in male.
- 17 (18). Propleura with fine erect black hairs; proboscis robust, not lengthened; arista pubescent to nearly bare .....  
..... *Anthomyia* Meigen
- 18 (17). Propleura bare, or if haired, proboscis long and slender and arista bare.
- 19 (20). Scutellum silvery gray with blackish lateral spots; abdomen elongate-cylindrical ..... *Eustalomyia* Kowarz
- 20 (19). Scutellum colored otherwise, or abdomen flattened dorsally.
- 21 (24). Proboscis elongate and slender, as long as thorax (except in *Proboscimyia brevis* Hockett); vibrissae approximated.
- 22 (23). Arista long-bipectinate, swollen at base;  $t_3$  with 2 *ad*, 2 *pd*;  $t_1$  with 2-3 posterior bristles; calypteres subequal .....  
..... *Neohylemyia* Malloch
- 23 (22). Arista nearly bare;  $t_3$  with 2-3 *ad*, 2-3 *pd*; lower calypter protruding beyond upper ..... *Proboscimyia* Bigot
- 24 (21). Proboscis less elongate.
- 25 (26).  $T_3$  with long and strong mid *ad* and *pd* bristles, each half as long as tibia ..... *Paraprosalpia* Villeneuve
- 26 (25).  $T_3$  with median bristles shorter.
- 27 (28). Arista plumose; lower calypter protruding beyond upper; legs black ..... *Hydrophoria* Robineau-Desvoidy
- 28 (27). Arista pubescent to bare, or if plumose, lower calypter not protruding.
- 29 (30). Hypopleura with some small hairs in front of and behind spiracle; oral margin protruding beyond vibrissae .....  
..... *Calythea* Schnabl and Dziedzicki
- 30 (29). Hypopleura bare.
- 31 (32).  $T_1$  with dorsal preapical as long as tarsal segments 1 and 2 together;  $t_3$  with only 1 conspicuous dorsal bristle; lower calypter protruding beyond upper — *Anthomyiella* Malloch

- 32 (31).  $T_1$  with dorsal preapical not longer than basitarsus;  $t_3$  with more than 1 conspicuous dorsal bristle; lower calypter not conspicuously protruding. (Except in *Hylemya* subg. *Paregle*).
- 33 (34). Male abdomen not flattened;  $t_3$  with series of *pv* hairs or bristles; female usually with 2 or more strong curved apical spines on cerci; front of female less than  $\frac{1}{3}$  of total head width; vibrissae approximated (closer to each other than cheek width directly below eye); *cf.* also *Ganperdea* ..... *Leucophora* Robineau-Desvoidy
- 34 (33). Male abdomen flattened basally; otherwise not as above.
- 35 (36).  $T_3$  with 2 *pd* and  $t_2$  lacking mid-ventral bristle ..... *Pegomya* Robineau-Desvoidy
- 36 (35).  $T_3$  with less or more than 2 *pd*, if with only 2,  $t_2$  with mid-ventral bristle.
- 37 (38). Vibrissal area with many long accessory setulae invading ventral half of facial margin; vibrissal angle and oral margin noticeably protruding beyond frontal margin in profile: *pra* reduced ..... *Macateeia* Malloch
- 38 (37). Vibrissal area with only a few accessory setulae which do not invade face; oral margin not unusually produced.
- 39 (40). With 4 postsutural *dc*; *stpl* 3 + 2 ..... *Macrophorbia* Malloch
- 40 (39). With 3 postsutural *dc*; *stpl* fewer.
- 41 (42). Sides of scutellum with more than a single row of hairs below the marginals; interfrontals absent in both sexes; posthumeral bristles duplicated, lower equal in size to upper in male;  $t_3$  with 2-3 *ad* ..... *Eremomyia* Stein
- 42 (41). Sides of scutellum with no more than a single row of hairs below the marginals; lower posthumeral not developed or much smaller than upper;  $t_3$  with 4 or more *ad*.
- 43 (44). Arista long-bipectinate (Fig. 6);  $t$  with 1-2 posterior and 1 small *ad*; costal spine very small ..... *Ganperdea* Aldrich
- 44 (43). Arista bare or pubescent ..... *Hylemya* Robineau-Desvoidy (including subgenera *Acrostilpna* Ringdahl, *Botanophila* Lioy, *Craspedochaeta* Macquart, *Crinurina* Karl, *Delia* Rob.-Desv., *Egle* Rob.-Desv., *Hylemyza* Schnabl and Dziedzicki, *Lasiomma* Stein, *Paregle* Schnabl, *Pegohylemyia* Schnabl, *Phorbia* Rob.-Desv., *Pycnoglossa* Coquillett)

## Genus GANPERDEA Aldrich

*Pergandea* Aldrich, 1919, Proc. Ent. Soc. Wash. 21: 106; type-species by original designation, *P. apivora* Aldrich; *preocc.* by Ashmead 1905 in Hemiptera.

*Ganperdea* Aldrich, 1921, Ins. Ins. Mens. 9:98; nom. nov. for *Pergandea* Aldrich, not Ashmead.



Huckett, 1924, Cornell Univ. Agric. Expt. Sta. Men. 77:37; Séguy, 1937, Gen. Ins., fasc. 205: 129; Huckett, 1965, in Stone *et al.*, U.S. Dept. Agr., Agr. Handbook 276: 867; as syn. of *Neohylemyia* Malloch.

As shown in the foregoing key, the genera *Neohylemyia* Malloch (type-, and sole known, species, *N. proboscidalis* Malloch) and *Ganperdea* differ in characters usually considered of generic value in the Anthomyiidae. However, it is likely that both genera, as well as *Proboscimyia* Bigot, may be synonyms or subgenera of *Leucophora*. Several species of the latter genus and *Ganperdea apivora* (Aldrich) are known to be inquilines or parasites in the nests of solitary bees and wasps. Nothing is known of the biology of *Neohylemyia* and *Proboscimyia*.

Two species may be referred to *Ganperdea*, although they differ from each other in rather important characters, most of which, however, are developed to some extent in one or another of the many species of *Leucophora*. The type-species of *Ganperdea* has such a broad front in the male that it would key to the tribe Chelisiini were the cruciate interfrontal bristles not absent or extremely small and fine.

Key to Known Species of *Ganperdea* Aldrich

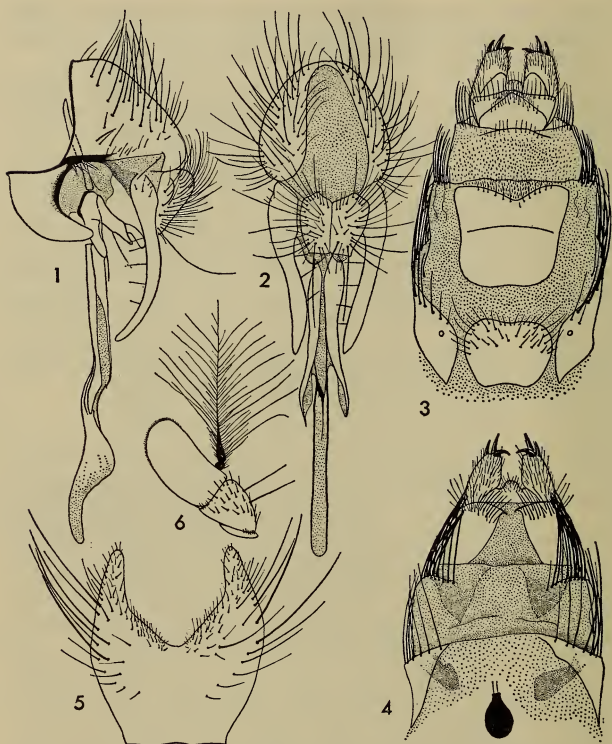
- 1 (2). Thoracic dorsum gray pruinose with narrow median brown stripe; presutural *acr* hairs usually quite weak, in one irregular row; *pra* usually hardly distinguishable from surrounding hairs; *stpl* 1 + 1. lower posterior bristle usually not distinguishable; fine hairs on lower surface of scutellum usually lacking; male front 0.35 to 0.37 of total head width, sometimes with very small pair of cruciate interfrontals; male postabdomen as in Figs. 1 and 2; female postabdomen as in Figs. 3 and 4; male fifth sternite as in Fig. 5 -----  
 ----- *G. apivora* (Aldrich)
- 2 (1). Thoracic dorsum largely brown pruinose with slightly darker middle stripe; presutural *acr* hairs strong, in two distinct rows; *pra* usually rather strong, nearly half as long as *sa*; *stpl* 1 + 2, lower posterior bristle usually strong; fine hairs on lower surface of scutellum distinct; male front 0.07 to 0.08 of total head width; postabdomen and male fifth sternite as figured by Huckett 1924, Figs. 50, 140, 155, 168 -----  
 ----- *G. mallochii* (Huckett)

*Ganperdea apivora* (Aldrich)  
 (Figs. 1-6)

*Pergandea apivora* Aldrich, 1919, Proc. Ent. Soc. Wash. 21: 106.

*Ganperdea* [*apivora*] Aldrich, 1921, Ins. Ins. Mens. 9: 98.

*Neohylemyia apivora* (Aldrich) Séguy, 1937, Gen. Ins., fasc. 205: 130; Huckett, 1965, in Stone *et al.*, U.S. Dept. Agr., Agr. Handbook 276: 867.



FIGS. 1-6. Details of *Ganperdea apivora* (Aldrich) paratypes. 1, male postabdomen, sinistral view; 2, same, posterior view; 3, female postabdomen, ventral view; 4, same, dorsal view; 5, male fifth sternite; 6, male right antenna, mesal view.

The holotype and allotype of *G. apivora* were collected from the cells of the bee *Anthophora abrupta* Say at Carondelet, Missouri, in 1877; paratypes also were from Santa Fe and Pecos, New Mexico. Also in the United States National Museum collections are a specimen from Denver, Colorado; two from Camp Franklin, Chesapeake Beach, Maryland 5 June 1938 (David C. Hall); and three from Beltsville, Maryland, emerged indoors from cell of anthophorid bee, 13-16 May 1963 (N. Teter).

The postabdomen of neither sex has been described; therefore, figs. 1-6 are presented for comparison with those of *G. mallochii* (Huckett), *v.i.*

In the male postabdomen (Figs. 1 and 2) the aedeagus and surstyli (posterior forceps) are longer, more slender, and more curved in *G. mallochii*, and the gonapophyses differ in shape and number of bristles. The fifth sternite (Fig. 5) also is somewhat broader and has longer processes than in *G. mallochii*.

The female postabdomen (ovipositor; Figs. 3 and 4) is also very similar to that of *G. mallochii*; the cerci bear three strong apical spines; the details of bristling and shape of sclerites, however, differ somewhat. There are three spermathecae of the shape shown in Fig. 4.

*Ganperdea mallochii* (Huckett), **new combination**

*Neohylemyia mallochii* Huckett, 1924, Cornell Univ. Agric. Expt. Sta. Mem. 77: 37, pl. V, Fig. 50; pl. XII, Fig. 140; pl. XIII, Fig. 155; pl. XV, Fig. 168; Leonard, 1928, Cornell Univ. Agric. Expt. Sta. Mem. 101: 837; Séguy, 1937, Gen. Ins., fasc. 205: 130; Huckett, 1965, in Stone *et al.*, U.S. Dept. Agr., Agr. Handbook 276: 867.

The only known material is from Ithaca and Long Island, New York; Leonard lists the same records. Huckett's original description includes figures of the male and female postabdomens and male fifth sternite.

LITERATURE CITED

STONE, A., *ET AL.* 1965. Catalog of the Diptera of America north of Mexico. U.S. Dept. Agr., Agr. Handbook 276: i-iv, 1-1696.



PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW SPECIES OF FRESHWATER OSTRACOD  
FROM PUERTO RICO<sup>1</sup>

BY EDWARD FERGUSON, JR.

*Lincoln University of Missouri, Jefferson City, Missouri 65101*

Genus *Cypris* O. F. Müller, 1776

Shell very tumid, width greater than three-fourths length and equal to or exceeding height. Natatory setae of antennae well developed and reaching to or beyond tips of terminal claws. Ultimate podomere of maxillary palp with a width about one-third its length. Furcal rami well developed with a length more than 20 × least width, dorsal seta normal.

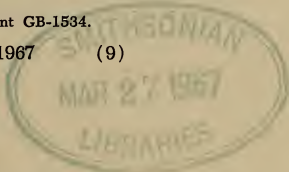
Key to the Species of *Cypris* from North America  
and the West Indies

1. Length of valves less than 2.0 mm ..... 2  
    Length of valves greater than 2.0 mm .....  
        ..... *C. pubera* (O. F. Müller, 1776)
2. Length of valves 1.2 mm; surface with numerous thimble-shaped  
    puncta ..... *C. subglobosa* Sowerby, 1840  
    Surface of valves without thimble-shaped puncta ..... 3
3. Anteroventral margin of valves rounded; furcal ramus approxi-  
    mately 20 × least width ..... *C. floridensis* Ferguson, 1964  
    Anteroventral margin of valves with a prominent protuberance;  
    furcal ramus with a length 26 × least width .....  
        ..... *C. puertoricensis*, new species

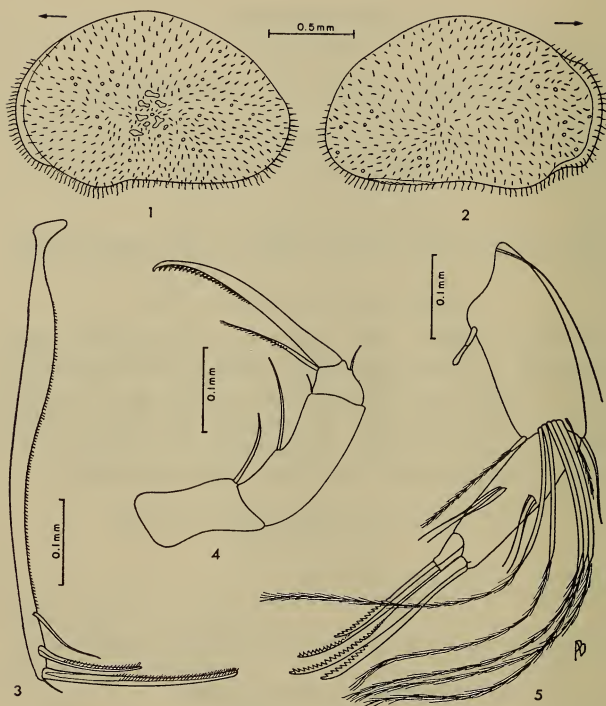
***Cypris puertoricensis*** new species  
Figs. 1-5

*Female*: Valves brown in color, boldly arched dorsally, sloping downward posteriorly, anterior margin of both valves with a narrow flange, ventral margin slightly sinuate with prominent protuberance at anteroventral angle; surface covered with short stout hairs and a few scattered puncta; right and left valves equal in length, greatest height anterior of middle and more than six-tenths length; hairs along margins except

<sup>1</sup> Supported by National Science Foundation Grant GB-1534.







FIGS. 1-5, *Cypris puertoricensis*, new species. 1, mesial view of right valve of female holotype; 2, mesial view of left valve of female holotype; 3, furcal ramus of female paratype; 4, second thoracic appendage of female paratype; 5, antepenultimate and ultimate podomeres of second antenna of female paratype.

dorsally. Length 1.52-1.58 mm; height 0.96-0.98 mm. Spines of the maxillary processes smooth; length of distal podomere of palp three times width; spines of palp smooth. Natatory setae of second antennae bearing short hairs along distal two-thirds, setae do not reach tips of claws. First thoracic leg with respiratory plate bearing five setae. Ultimate podomere of third thoracic appendage elongate, length approximately three-fourths that of antepenultimate podomere and bearing at the distal end a short spine-like seta and a longer seta, which appears

at times to be reflexed. Length of furcal ramus about  $26\times$  least width; furca with distinctive shape, proximal one-half of dorsal ramus convex, ramus bears short hairs along entire length except at attached end; length of terminal spine twice that of subterminal, both spines pectinate along distal three-fourths; dorsal seta slightly removed from subterminal spine and with a length three-fourths that of spine; length of terminal seta one-third that of dorsal one.

*Type-specimens:* Stained microscopic mounts of the female holotype, no. 113377, and two female paratypes, nos. 113378 and 113379 are deposited in the United States National Museum.

*Type-locality:* The specimens of *C. puertoricoensis* were sent to me by Dr. Vernon Proctor, Professor of Biology, Texas Technological College, Lubbock, Texas. Dr. Proctor and his students raised specimens of this ostracod from eggs that were attached to samples of *Chara zeylanica* collected on 27 July 1961 by Dr. Harold W. Harry from lime sink ponds located between the towns of Hatillo and Arecibo, Puerto Rico.

*Remarks:* *Cypris puertoricoensis* differs from other species of *Cypris* in possessing a prominent protuberance at the anteroventral angle of each valve, and in the structure of the furcal ramus; the ramus is apparently much longer in proportion to the width than in other species.

*Explanation of Figs. 1-5:* All specimens were stained with a 1% alcoholic solution of eosin Y and mounted in Canada balsam.



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PROCEEDINGS  
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A NEW CYCLOPHORID LAND SNAIL FROM THE  
WEST INDIES (PROSOBRANCHIA), AND THE  
DISCUSSION OF A NEW SUBFAMILY

BY FRED G. THOMPSON

*Florida State Museum, University of Florida*

Recent collections of land snails from the West Indies have brought to light several new forms. One species of outstanding importance represents a new genus and species of the family Cyclophoridae. Anatomical evidence from this species when compared with others necessitates the taxonomic changes presented below.

I wish to express my gratitude to Dr. Albert Schwartz and Mr. Richard Thomas of Miami, Florida, for collecting and providing the material upon which this paper is based. I am also grateful to Drs. Harold A. Rehder and J. P. E. Morrison of the U. S. National Museum (USNM) for the loan of important comparative material.

The American cyclophorid land snails are in a state of taxonomic confusion. This results from the lack of knowledge about the anatomy of many species and genera, and from the overemphasis of shell and opercular characters for recognizing generic and suprageneric categories.

Tielecke (1940) proposed a system of classification of the cyclophorid mollusks in which he established major categories on the basis of various conchological and anatomical characters, particularly the female reproductive system. His system of classification probably reflects natural relationships, but it ignored nomenclatural priority. He placed the neotropical genera of helicoid cyclophorids in the Family Poteriidae (= Neocyclotinae), and separated them from Old World groups on the basis that the bursa copulatrix is imbedded in the uterine wall and enters the uterus through the oviduct. In other families the bursa copulatrix discharges into the uterus through a separated duct. Tielecke's work was overlooked by most later workers on American cyclophorids. Torre, Bartsch and Morrison (1942) monographed the neotropical species and distributed them among four subfamilies and many genera that were based solely upon conchological characters. They recognized two

subfamilies of helicoid cyclophorids. The Amphicyclotinae contained those species with a chondroid or chitinous operculum, and the Aperostominae consisted of forms with a calcified operculum. Baker (1943: 137) showed that Bartsch and Morrison (*in* Torre, Bartsch and Morrison, 1942: 187) had misapplied the name *Aperostoma* Troschel, 1847, and that their use of the name was superseded by *Neocyclotus* Fischer and Crosse, 1872. Morrison (1955) reviewed the classification of the American species and established a system of suprageneric classification based on the morphology of the male reproductive organ. He relegated opercular characters to generic importance. The Amphicyclotinae of previous authors was raised to familial status (Amphicyclotidae), characterized by the presence of a slender mid-dorsally located verge with a complete tubular vas deferens, and allied to the marine family Lacunidae. He proposed the Amphicyclotidae to include several West Indian genera and the mainland genus *Amphicyclotus* Crosse and Fischer, 1879. The subfamily Neopupinae Kobelt and Moellendorff, 1898, replaced Megalomastominae Torre and Bartsch (*in* Torre, Bartsch and Morrison, 1942: 3). The Neopupinae includes those cyclophorids in which the verge is located on the side of the head and has an open seminal groove extending from the base to the tip. This subfamily consists of West Indian pupinoid genera and the mainland genera *Tomocyclus* Crosse and Fischer, 1872, and *Aperostoma*. The subfamily names Aperostominae of previous authors and Poteriinae Thiele, 1929, were replaced by Neocyclotinae Kobelt and Moellendorff, 1898, which includes those neotropical genera in which the verge is located on the center of the nape, has an open seminal groove extending from the base to the tip, and has a small accessory flagellum.

Solem (1956) reviewed the classification of the Mexican helicoid cyclophorids and made many generic and specific changes. He did not treat suprageneric categories because of the lack of anatomical material, but showed that the Amphicyclotidae as defined by Morrison was nomenclaturally incorrect, for its type-genus had anatomical features that placed it in the Neocyclotinae. Solem's observations were based on *Amphicyclotus palenquensis* (Pilsbry) and *A. texturatus* (Sowerby) (*vide* Tielecke, 1940: 340). I have examined material of *A. parvus* Thompson, *A. megaplanus* Morrison, and *A. ponderosus* (Pfeiffer), all of which support Solem's conclusions regarding *Amphicyclotus*. The reason for Solem's later use of the familial name Poteriidae is not clear (1959: 180). Its use for the same group is predated by thirty years by the name Neocyclotinae.

The Amphicyclotidae as defined by Morrison (1955: 160-162) is known to include *Crocidopoma* Shuttleworth, 1857, *Amphicyclotulus* Kobelt, 1912, *Cyclohaitia* Bartsch, 1942, *Cycloblandia* Bartsch, 1942, and *Lithacaspis* new genus. This group is characterized by the presence of a long, slender verge located on the center of the nape and has an enclosed tubular vas deferens. As in the Neocyclotinae, the bursa



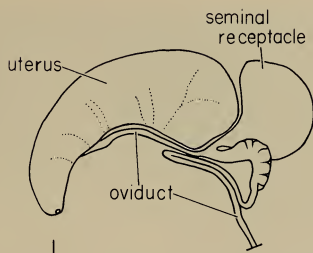


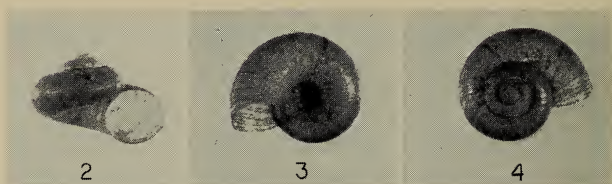
FIG. 1. *Cycloblandia b. beauianus* (Petit). Gross morphology of female genital system exclusive of ovaries.

copulatrix is imbedded in the uterine wall and discharges through the oviduct (Fig. 1). The group apparently is confined to the West Indies and is a natural assemblage. I agree with Solem (1956: 42) that the characters used by Morrison were overemphasized, but the group does merit subfamilial recognition. Since *Amphicyclotus* anatomically does not belong in this group a name change is necessary. This group should be known as **Crocidopominae** new subfamily. Type-genus: *Crocidopoma* Shuttleworth, 1857.

The Crocidopominae is most closely related to the Neocyclotinae because of the structure of the bursa copulatrix. It consists of a lineally distributed series of genera extending from eastern Cuba east and south through Hispaniola, Puerto Rico and the Lesser Antilles to St. Lucia Island. Three of these genera, *Crocidopoma* (and its questionably distinct subgenus *Cyclocubana* Torre and Bartsch, 1942), *Cyclohaitia* and *Amphicyclotulus*, are alike in possessing raised spiral chords or threads on the shell. They differ by opercular characters. *Amphicyclotulus* has a simple, flat, chondroid operculum, *Cyclohaitia* has a chondroid operculum with an expanded, fimbriated outer edge, and *Crocidopoma* has a raised spiral lamella on the chondroid basal plate, which is filled in with a thick calcareous deposit. *Cycloblandia* and *Lithacaspis* are alike in having only fine, incremental striations on the shell. They differ from each other by opercular characters. *Cycloblandia* has a simple, flat, chondroid operculum, as does *Amphicyclotulus* to which it is subgenerically allied. *Lithacaspis* has a raised spiral lamella that is filled in with and partially covered by a thick calcareous deposit. It should be emphasized that the differences between these genera are not very striking, and further collecting in the West Indies may reveal intermediate series of species.

#### **Lithacaspis** new genus

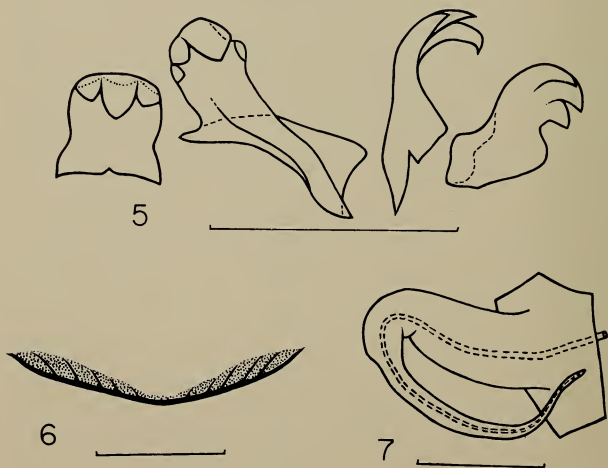
Shell small; helicoid; unicolored, grayish-yellow. Aperture circular, simple, without siphonal notch. Peristome simple, sharp. Umbilicus



FIGS. 2-4. *Lithacaspis xanthoglauca* new species, holotype, UMMZ 216551.

wide, about  $\frac{1}{5}$ - $\frac{1}{4}$  major diameter. Sculpture of embryonic whorls consisting of very fine dense granules. Sculpture of postembryonic whorls consisting of fine, irregular incremental striations. Operculum (Fig. 6) calcified; basal chondroid plate with raised, oblique spiral lamella; interspaces of lamella filled in with thick calcareous deposit that tends to cover and obscure lamella; nucleus of operculum generally barren or with very thin calcareous deposit.

The verge (Fig. 7) is about 2 mm long and is located on the center of the nape at a distance behind the tentacles about equal to the



FIGS. 5-7. *Lithacaspis xanthoglauca* new species. 5, radular teeth, scale equals 50 microns; 6, diagrammatic cross-section of operculum, thickness of calcareous deposit (stippled) slightly exaggerated, scale equals 1 mm; 7, verge, scale equals 1 mm.

snout length. When contracted, the verge is U-shaped, and is folded posteriorly under the mantle with the distal end pointing forward and lying to the right of the base. The basal half of the verge is relatively stocky; beyond this point the distal half becomes constricted and very slender. The vas deferens is simple, tubular, completely enclosed within the verge, and terminates at the tip.

The single complete radula examined is 3.69 mm long, and has 44 transverse rows of teeth. The cusp formula is 3-4-3-3 (Fig. 5).

*Type-species: Lithacaspis xanthoglauca* new species.

*Etymology:* The generic epithet is derived from the Greek λιθακος, meaning stony, and ασπις, meaning little shield, and alludes to the heavily calcified operculum. The name is of the feminine gender. The genus at present is monotypic and is known only from St. Lucia Island.

#### **Lithacaspis xanthoglauca** new species

*Description:* Shell (Figs. 2-4) very small. Depressed helicoid, 0.70-0.77 times as high as wide. Shiny; covered with a light yellowish gray periostracum. 4.0-4.1 whorls at maturity; periphery, base and shoulders evenly rounded. 1.8 raised, rounded embryonic whorls; first whorl 0.6-0.7 mm in diameter; remaining whorls regularly increasing in size; minor diameter of shell 0.71-0.74 times major diameter. Suture deeply impressed. Aperture circular; slightly oblique; complete; hyaline, showing color of periostracum; width of aperture 0.45-0.47 times major diameter. Umbilicus deep, showing all previous whorls; 0.19-0.28 times major diameter. Embryonic whorls sculptured with very minute, dense granules. Postembryonic whorls with very fine, irregular incremental striations that extend from suture to umbilicus, where they become a little stronger and more distinct; striations also a little more intense near suture. Sexual dimorphism not apparent.

Operculum consisting of about five whorls. Basal plate with thin spiral lamella projecting obliquely outward. Interspaces between spiral lamella with thick calcareous deposit that usually is continuous over lamella. Outer edge of chitinous basal plate not fimbriated.

*Measurements of holotype:* height, 5.1 mm; major diameter, 7.3 mm; minor diameter, 5.4 mm; aperture width, 3.4 mm; umbilicus, 1.4 mm; 4.0 whorls.

*Measurements of paratypes:* height, 4.8-5.8 mm; major diameter, 6.2-8.3 mm; aperture width, 2.9-3.7 mm; umbilicus, 1.1-2.3 mm.

*Type-locality.* 1.7 mi. N Forestiere, Castries Quarter, St. Lucia Island, West Indies.

*Types:* Holotype: University of Michigan, Museum of Zoology (UMMZ) 216551 (male); collected 31 March 1963 by Albert Schwartz. Paratypes: UMMZ 216552 (4), USNM 668735 (2); same data as the holotype.

*Lithacaspis xanthoglauca* is similar in shell characters to *Cycloblandia beauianus* (Petit) from Guadalupe, which is the only species that it

closely resembles. Besides the opercular differences discussed above, it differs from *C. beauianus* by being lighter in color, being smaller, having fewer whorls, and by having finer axial sculpture. *C. beauianus* has a yellowish brown periostracum, is 10.5–11.3 mm in major diameter, 6.9–7.8 mm high, and has 4.4–4.6 whorls.

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A NEW ARMORED SEAROBIN FISH, *PERISTEDION UNICUSPIS*, FAMILY PERISTEDIIDAE, FROM THE STRAITS OF FLORIDA<sup>1</sup>

BY GEORGE C. MILLER

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Exploratory fishing on the continental slope of the western North Atlantic by the U. S. Bureau of Commercial Fisheries has shown that armored searobins, *Peristedion* Lacépède, are an important component of the benthic fauna. Presence of three to five species of armored searobins in a single trawl haul is not unusual because the catch may have been made over a wide depth range on a steep slope on several different bottom types. The following catch of peristediids was made in the Straits of Florida off Cay Sal Bank, at *Silver Bay* station 2458: five specimens of *Peristedion antillarum* Teague; one *P. truncatum* (Günther); two *P. longispatha* (Goode and Bean); three *P. greyae* Miller (in press); and two specimens of a fish that I describe here as a new species, distinguished from the closely related *P. longispatha* and *P. greyae*.

The terminology, counts, and measurements follow the methods given by Miller (in press).

Harvey R. Bullis, Jr., made available to me for study the peristediids collected during the operation of the U. S. Bureau of Commercial Fisheries exploratory vessels, *Silver Bay* and *Oregon*, in the western Atlantic. The illustrations are by Grady W. Reinert.

***Peristedion unicuspis*** new species

Cay Sal armored searobin

Figs. 1-3

*Diagnosis:* Single retrorse spine on posterior scutes of superomedian

<sup>1</sup> Contribution No. 32, Tropical Atlantic Biological Laboratory, Bureau of Commercial Fisheries, Miami, Florida; and Contribution No. 84, Biological Laboratory, Brunswick, Georgia.

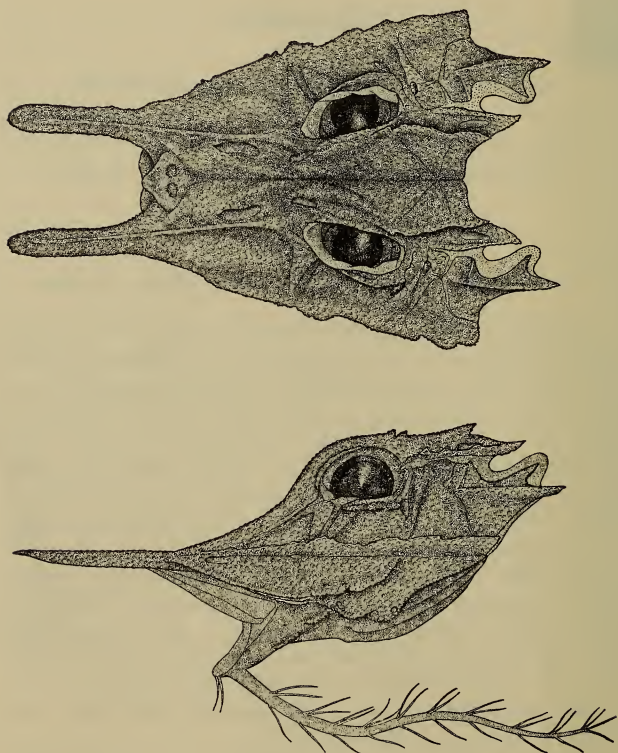


FIG. 1. *Peristedion unicuspis*, holotype. Dorsal and lateral views of head.

series; chin barbels 8 to 9, in 5 groups, arranged  $2 + 2 + 2 + 1 + 1$  or  $2 + 2 + 2 + 2 + 1$ , on each side of mandibular symphysis; filamentous barbel very long, extending past middle of first ventral scute; first free ray of pectoral long, extending past distal end of pectoral joined rays and anal fin origin; no dark margin on second dorsal fin.

*Holotype*: USNM 200382, 146 mm standard length (SL), 170 mm total length (TL), collected at *Silver Bay* station 2458, lat.  $23^{\circ}40'N.$ , long.  $79^{\circ}18'W.$ , on 5 November 1960 with a balloon trawl fished at a depth of 290 fathoms.

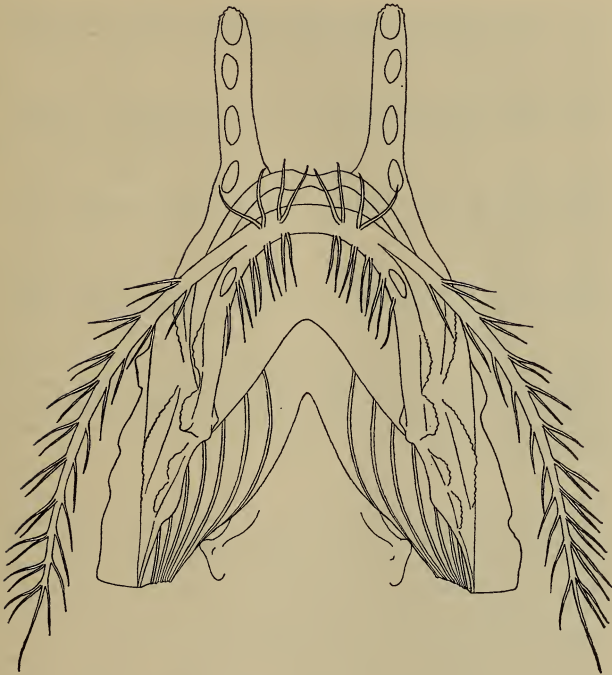


FIG. 2. *Peristedion unicuspis*, holotype. Ventral view of head, showing arrangement of barbels.

*Paratype*: USNM 200383, 138 mm SL, 157 mm TL; data as for holotype.

*Description*: Paratype counts are given in parentheses after holotype counts, if they differ.

Dorsal VIII-19 (VIII-20). Anal 20. Pelvic I-5. Pectoral 12 + 2. Lip barbels 4/2 : 4/2. Chin barbels 9/5 : 9/5 (8/5 : 8/5) in the following groups 2 + 2 + 2 + 2 + 1 (2 + 2 + 2 + 1 + 1). Gillrakers first arch: epibranchial 5; ceratobranchial 17; hypobranchial 4; total 26. Vertebrae 33. Branchiostegals 7.

Scutes: dorsal series 25; superomedian series 32; bicuspid spines 0; inferomedian series 24; accessory scutes 3 (2); ventral series 20; caudal series 2-1-2.

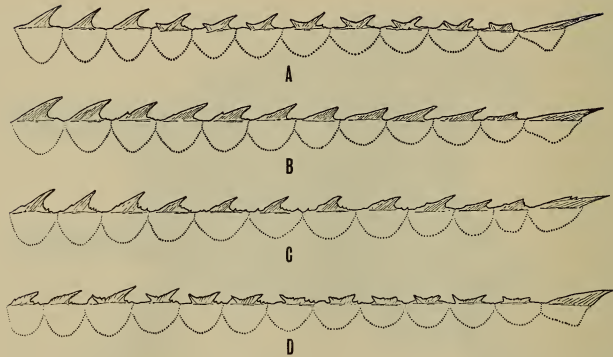


FIG. 3. Comparison of bicuspid spines of scutes of superomedian series: A, *P. greyae* adult (158 mm SL), B, *P. unicuspis* adult (146 mm SL), C, *P. longispatha* adult (158 mm SL), D, *P. longispatha* juvenile (90 mm SL).

Measurements of holotype and paratype in millimeters, expressed in parentheses as percentages of SL. Body depth at first dorsal spine 30.0, 26.5 (20.5, 19.2); at anal fin origin 16.9, 16.0 (11.6, 11.6). Body width at pectoral fin origin 29.8, 25.1 (20.4, 18.2). Head length 55.3, 51.0 (37.9, 37.0). Greatest head width 47.4, 44.5 (32.5, 32.2). Length of joined pectoral fin 27.1, 24.0 (18.6, 17.4). Length of first free pectoral finray 35.3, 30.2 (24.2, 21.9). Length of second free pectoral finray 27.1, 23.9 (18.6, 17.3). Pelvic fin length 25.4, 24.7 (17.4, 17.9).

Measurements of holotype and paratype in millimeters expressed in parentheses as percentages of head length. Filamentous barbel length 51.1, 40.3 (92.4, 79.0). Lip barbel length 6.5, 6.4 (11.8, 12.5). Chin barbel length 4.1, 4.5 (7.4, 8.8). Snout length 26.0, 24.2 (47.0, 47.5), width 21.0, 19.8 (38.0, 38.9). Orbital length 14.3, 13.0 (25.9, 25.5), depth 10.1, 8.1 (18.3, 15.9). Interorbital width 10.8, 10.6 (19.5, 20.8). Rostral exertion length 19.1, 17.2 (34.5, 33.7); width between rostral exertions near their bases 11.5, broken on paratype (20.8, -); greatest width of rostral exertion at base 7.4, 6.9 (13.4, 13.5); width at middle of rostral exertion 3.8, 3.4 (6.9, 6.7); distance between tips of rostral exertions 7.2, broken (13.0, -). Distance between parietal spines 9.1, 9.8 (16.5, 19.2). Nape length 7.9, 6.7 (14.3, 13.1). First (posterior) serrated ridge on mandible, length 3.7, 3.9 (6.7, 7.6); width 1.4, 1.1 (2.5, 2.2). Second (anterior) ridge on mandible scarcely discernible, less than 0.2 mm wide. Fourth infraorbital ridge, length 9.1, 7.3 (16.4, 14.3); width 1.4, 0.8 (2.5, 1.6). First ventral scute, length 16.0, 14.0



(29.0, 27.5); width 13.2, 11.4 (23.9, 22.4). Second ventral scute, length 11.5, 10.3 (20.8, 20.2); width 12.6, 10.7 (22.8, 21.0).

Finrays. Pelvic spines smooth,  $\frac{1}{2}$  to  $\frac{3}{4}$  length of first pelvic soft-ray; spine translucent; pelvic fin connected to body by membrane between inner pelvic finray and lateral dorsal edge of first ventral scute. First anal finray  $\frac{1}{2}$  length of second anal finray. First free pectoral finray long, greatly exceeding length of joined pectoral finrays.

Barbels. Filamentous barbel very long, reaching past middle of first ventral scute with many filaments on barbel. Lip and chin barbels slender, always tapering to point, none ending in enlarged, rounded knob.

Spines and ridges of head. Rostral, nasal, mesethmoid, lateral ethmoid, preocular, supraocular, postocular, and postfrontal spines absent. Frontal I spine very small, 0.4 mm. Frontal II spine small, 1.3 mm, immediately posterior to Frontal I spine (two spines on left side of paratype). Parietal spine small, 3.4 mm, slightly elevated, at posterior termination of parietal ridge; small secondary spine at anterior base of ridge (in paratype ridge, is flat and no secondary spine at anterior end of ridge). Pterotic spine small, 0.3 mm, on nearly obsolete ridge. Posttemporal spine blunt, small, 1.3 mm, at termination of long, low 8.2-mm straight ridge. Opercle spine small, with distal end bicuspid (unicuspid in paratype), at posterior end of 12.4-mm serrated opercular ridge. Perifacial rim: on second infraorbital, narrow, with two small spines followed by a slightly rounded protuberance; on third infraorbital, three separated sharp spines followed by a rounded protuberance with serrated edge; on preopercle, strong concavity posterior to orbit on left side, none on right side; three to five slight indentations on perifacial rim of holotype and paratype; ending posteriorly as wide shelf with posterior edge perpendicular to head. On second infraorbital, three very narrow ridges extending from corner of mouth to second infraorbital spines, nearly parallel to each other and to premaxillary, mouth closed. On fourth infraorbital, pronounced ridge beneath eye extending posteroventrad. On preopercle, dorsal ridge long, narrow, from corner of mouth posterodorsad, terminating below sensory organ on perifacial rim; anterior ventral ridge small, near edge of, and on preopercle, immediately behind posterior ridge of mandible; posterior ventral ridge small, on ventral edge of preopercle with two openings of preoperculo-mandibular canal on either side of ridge. On mandible, first posterior ridge strong, serrated; second ridge short, narrow, anterior to first ridge on left side, but absent on right side (absent in paratype). Rostral exertions of moderate length, 19.1 mm, and width at the base 7.4 mm; in normal position slightly divergent; nearly equal in width from rounded distal ends to base; lacking prominent serrations on distal ends.

Spines and scutes of body. Nuchal spine present, 3.0 mm, approximately  $\frac{1}{2}$  size of first spine of dorsal series; small spine at anterior edge of nuchal ridge (lacking in paratype). Dorsal series: strong, sharp spines

on dorsal scutes, becoming slightly smaller posteriorly. Superomedian series: first scute at anterior end of arch bearing ridge terminating in small tubercle; scutes two, three, and four of arch may have large, sharp spines on ridges; spines strong, sharp, decreasing little in size posteriorly; few spines on posterior eight or nine scutes have extremely small anterior retrorse spines at bases, possibly indicating these spines may be bicuspid in young; superomedian spines located closer to dorsal spines than to inferomedian spines. Inferomedian series: inferomedian scute row arches ventrally immediately posterior to accessory scutes; small retrorse spine at anterior edge of base of main spine (not evident on paratype); posterior two scutes ventral to others in series, without small anterior retrorse spines; all main spines in series strong. Accessory scutes: three scutes between inferomedian and ventral series (two scutes in paratype). Ventral series: first ventral scute with obsolete spine, second with tubercle, third with small spine, fourth with large spine, size of succeeding spines decreasing posteriorly to small tubercle on scute at last anal ray; anterior edge of first ventral scute posterior to bony ridge of pelvic girdle (bony ridge visible beneath skin). Caudal series: two dorsal, one lateral, and two ventral scutes; edges of caudal spines smooth; distal end of lateral caudal spine extending posteriorly as far as ends of dorsal and ventral caudal spines.

Pigmentation. Body and head pale grey. Distal half of membrane between anterior five dorsal spines black. A few small, black pigment spots scattered sparsely on soft dorsal fin rays, no dark margin. Small black spot scarcely visible at middle of pale grey pectoral. Posterior portion of roof of mouth dusky. Peritoneum and air bladder membrane dusky.

*Etymology*: The species name *unicuspis*, derived from Latin—*unus* meaning one, and *cuspis* meaning point (named for the single, retrorse spine found on each posterior scute of the superomedian series of the adults), is regarded as a noun in apposition to the generic name. The species is given the common name, Cay Sal armored searobin, for the locality of capture.

*Relationship*: The two species most closely related to *P. unicuspis* are *P. greyae* and *P. longispatha*. These three species may be distinguished as follows:

- 1a. Two or three prominent, strong, serrated ridges on mandible; filamentous barbel moderately long, not reaching termination of perifacial rim; lip barbel half-counts 4/2, grouped 2 + 2; chin barbel half-counts 12-13/5, usually grouped 3 + 3 + 3 + 2 + 1 or 3 + 3 + 3 + 2 + 2; barbel tips pointed; rostral exertion spine present, nasal spine absent; bicuspid spines present in young and adults; accessory scutes present or absent; distal one-third of pectoral fin dark; wide, dark margin on soft dorsal fin; peritoneum and posterior portion of roof of mouth translucent .. *P. greyae* Miller
- 1b. One prominent, strong, serrated ridge on mandible ..... 2

- 2a. Filamentous barbel very long, extending past termination of perifacial rim to posterior one-half of first ventral scute; lip barbel half-counts 4/2, grouped 2 + 2; chin barbel half-counts 8-9/5 grouped 2 + 2 + 2 + 1 + 1 or 2 + 2 + 2 + 2 + 1; barbel tips pointed; rostral exsertion spine and nasal spine absent in adults; bicuspid spines absent in adults; accessory scutes present; pectoral fin with single small, dark spot at center; lacking dark margin on soft dorsal fin; peritoneum and posterior portion of roof of mouth dusky ..... *P. unicuspis* Miller
- 2b. Filamentous barbel moderately long, not reaching termination of perifacial rim; lip barbel half-counts 2/2, grouped 1 + 1; chin barbel half-counts 11-14/6, usually grouped 1 + 2 + 3 + 3 + 2 + 2 or 1 + 2 + 2 + 3 + 2 + 2; barbels generally with enlarged, rounded tips; rostral exsertion spine and nasal spine present in juveniles, absent in large adults; bicuspid spines or vestiges, present in juveniles and adults; accessory scutes absent; pectoral dusky; dark margin on soft dorsal fin; peritoneum and posterior portion of roof of mouth translucent .....  
..... *P. longispatha* (Goode and Bean)

I have found ontogenetic differences in the bicuspid spines of *P. greyae*, *P. longispatha*, and *P. unicuspis*. In *P. greyae*, bicuspid spines in the posterior portion of the superomedian series were present in both the smallest and largest specimens examined. The number of bicuspid spines in the young of *P. longispatha* decreases and the number of unicuspid spines increases with growth of the fish. Loss of the small anterior cusp of the spine occurs first on anterior scutes and proceeds posteriorly. The small anterior cusp of the bicuspid spine in *P. longispatha* may be connected to the body by a membrane, making the bicuspid spine appear to be unicuspid. I speculate that young *P. unicuspis* also may bear bicuspid spines. The posterior superomedian scutes and the lateral caudal scutes of the three adults and one juvenile of these closely related species are shown in Fig. 3.

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A NEW GENUS AND SPECIES OF MEALYBUG  
FROM THE PHILIPPINE ISLANDS  
(HOMOPTERA : PSEUDOCOCCIDAE)

BY D. J. WILLIAMS

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A mealybug intercepted in Hawaii on *Gardenia* sp. from the Philippine Islands was submitted recently for identification. It bears a striking resemblance to the Hawaiian species *Pseudococcus tympanistus* Ferris in possessing oral collar ducts of an unusually large size, and it is obvious that the species are congeneric.

When he discussed the Hawaiian mealybugs, Ferris (*in* Zimmerman, 1948) left most of them in *Pseudococcus* Westwood. He had an opportunity to establish a new genus for *P. tympanistus* in this work but did not do so. *P. tympanistus* has only a remote relationship to *Pseudococcus* and, together with the new species from the Philippine Islands, forms a distinct genus. It is possible that *P. tympanistus* is not endemic to Hawaii and may have been introduced from southeast Asia.

**Tympanococcus** new genus

*Type-species: Pseudococcus tympanistus* Ferris.

*Recognition characters:* Pseudococcidae with body elongate-oval, anal lobes moderately developed. Antennae 8-segmented. Legs normal, claw without a denticle. Anterior and posterior ostioles present, well developed. Circulus present or absent. Cerarii reduced in number, situated mainly on abdomen; each with 2 conical setae and one or more auxiliary setae. The main characteristic of the genus is the presence of unusually large tubular ducts on dorsum and venter, each with a diameter greater than that of a multilocular disc pore.

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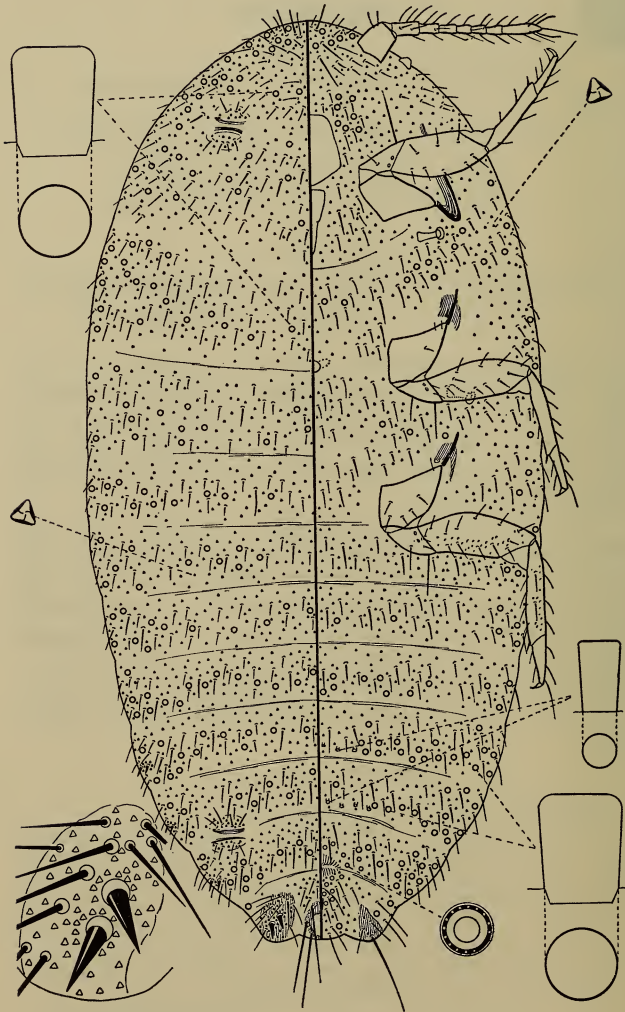


FIG. 1. *Tympanococcus gardeniae* new species.



*Notes:* This genus comes close to *Dysmicoccus* Ferris in possessing cerarii with auxiliary setae and in lacking oral rim ducts. The large drum-like ducts readily distinguish it, however, from *Dysmicoccus* and from *Trionymus* Berg, another related genus.

***Tympanococcus gardeniae* new species**

Fig. 1

*Recognition characters:* Adult female elongate oval, length 2.0 mm in available specimens; anal lobes moderately developed. Antennae 8-segmented, 445–455  $\mu$  long. Legs normal, somewhat robust, with translucent pores on hind femur and tibia; trochanter + femur 340  $\mu$ , tibia + tarsus 340  $\mu$ . Labium 125–135  $\mu$  long. Anterior and posterior ostioles present, each lip with a few trilocular pores and 3 or 4 setae. Circulus absent. Anal ring setae about twice length of diameter of ring. A pair of cerarii on each of posterior 4 abdominal segments; anal lobe cerarii each with a pair of conical setae on a sclerotized plate slightly larger in area than anal ring; this plate also containing numerous trilocular pores and about 10 auxiliary setae. Anterior 3 cerarii each with a pair of smaller conical setae, a few trilocular pores and 1 or 2 auxiliary setae.

Dorsal surface with slender setae of various sizes, not numerous. Multilocular disc pores absent. Trilocular pores rather numerous and evenly distributed. Tubular ducts present, of the oral collar type, with a characteristic size and shape, situated mainly across the middle of the segments, with heavier concentrations toward the margins. These ducts with a diameter greater than that of a multilocular disc pore, longer than wide, without a distinct collar but with the rim forming a slight prominence, sides subparallel.

Ventral surface with a triangular area of sclerotization on each anal lobe and an apical seta only slightly longer than the anal ring setae. Body setae similar to those on dorsum. Multilocular disc pores around vulva only, numbering at most about 28. Tubular ducts of the large type on abdomen and behind the spiracles; a few also present on head. A smaller type present in the mid-region of sixth and seventh segments, numbering about 10 altogether; these with subparallel sides and lacking the usual sclerotized collar. Many of them may be replaced by the large sized ducts. Trilocular pores with an even distribution.

Holotype female, and one paratype female in U.S. National Museum, intercepted from the Philippine Islands, at Honolulu, Hawaii, on *Gardenia* sp., 26 May 1965, by D. Girard and B. Pang Ching.

*Notes:* This species differs from *T. tympanistus* in lacking a circulus, in possessing many more large ducts, and in having only 4 pairs of cerarii instead of 7 or 8.

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A NEW SUBSPECIES OF VARYING LEMMING,  
*DICROSTONYX TORQUATUS* (PALLAS), FROM  
YUKON TERRITORY (MAMMALIA, RODENTIA)

BY PHILLIP M. YOUNGMAN

*National Museum of Canada, Ottawa 4, Ontario*

In 1961 G. D. Tessier and I collected seven varying lemmings from the Ogilvie Mountains, Yukon Territory (Youngman, 1964: 4) thus providing a southernmost record of occurrence for Yukon Territory, western Mackenzie District and eastern Alaska. Subsequent collecting in 1963 and 1964 has added an additional three specimens. The comparison of these specimens with over two thousand specimens from numerous localities from Alaska and Canada gives basis for the recognition of a new subspecies which may be known as:

***Dicrostonyx torquatus nunatakensis* new subspecies**

*Dicrostonyx torquatus*, Youngman, Nat. Mus. Canada, Nat. Hist. Papers 23, p. 4, 1964.

*Holotype*: Young adult female in summer pelage, skin and skull, National Museum of Canada no. 29503; from Yukon Territory: 20 mi. S Chapman Lake (lat. 64°35', long. 138°13'), 5500 ft; collected by Phillip M. Youngman, 18 August 1961, original number 554.

*Paratypes*: Nine specimens, Yukon Territory: 20 mi. S Chapman Lake (lat. 64°38', long. 138°13') 5500 ft, 8 (NMC 29499-29502, 29504-05, 33426-27; Ogilvie Mountains, 52 mi. NE Dawson and 14 mi. S Lomand Lake, 5400 ft, 1 (NMC 31337).

*Etymology*: Greenland eskimo *nunatak*, a peak appearing above a glacier.

*Distribution*: Known only from the type-locality and an adjacent peak in the Ogilvie Mountains of north-central Yukon Territory.

*Distinctive characters*: Overall impression of dorsum of adult pelage (capitalized color terms after Munsell, 1954): Dark Gray Brown (10YR 5/2) with thin, dark mid-dorsal stripe. Auricular patches Yellowish Red (5YR 5/6). Venter Pinkish Gray (5YR 7/2). Hairs of underfur of dorsum basally Dark Gray (10YR 4/0), wide subapical band Light Gray (5YR 7/1) proximally, darkening and strengthening to

Yellowish Red (5YR 5/4) and narrowly tipped with black. Guard hairs basally Dark Gray (10YR 4/0) with wide black tip.

*Measurements* (in mm): External measurements of the holotype, followed by those of a young adult male (NMC 29504), are: total length, 129, 128; tail length, 12, 11; hind foot length, 16, 17; ear length from notch, 4, —. Cranial measurements of the same specimens are: condylobasilar length, 25.3, —; length of nasal bones, 6.6, 7.8; breadth of nasal bones, 3.2, 3.5; zygomatic breadth, 16.6, 17.9; lambdoidal breadth, 12.4, —; least interorbital constriction, 3.7, —; alveolar length of upper maxillary tooth-row, 6.5, 6.8.

*Comparisons*: *Dicrostonyx torquatus nunatakensis* Youngman differs markedly from *D. t. rubricatus* (Richardson) and *D. t. kilangmiutak* Anderson and Rand in being overall gray brown dorsally rather than having the dorsum washed with dark red anteriorly, with a gray rump, and in having the venter paler. Specimens in immature pelage are grayer and less yellow than comparable specimens of *D. t. rubricatus* and *D. t. kilangmiutak*. From *D. t. richardsoni* Merriam, *D. t. nunatakensis* differs in being gray brown rather than reddish brown and in being much paler.

*Remarks*: The zygomatic breadth, lambdoidal breadth and alveolar length of upper maxillary tooth-row of *D. t. nunatakensis* are smaller than specimens of comparable age of *D. t. rubricatus* from Griffin Point, Alaska and *D. t. kilangmiutak* from Banks and Victoria Islands, Northwest Territories, however, adequate statistical comparison between the new subspecies and adjacent subspecies cannot be made owing to the lack of sufficient adult or subadult specimens of the new subspecies. The color difference between the subspecies is, however, especially well marked. *Dicrostonyx torquatus nunatakensis* is found in rocky alpine tundra, at the base of a glacial cirque, high in the rugged Southern Ogilvie Range of the Ogilvie Mountains, approximately 250 miles from the nearest recorded specimens from Fort Yukon, Alaska and Richardson Mountains, Northwest Territories. The population density of the new subspecies was highest in 1961 when 450 trap-nights produced seven specimens. In 1963, 510 trap-nights produced only one specimen, and in 1964, 150 trap-nights produced two specimens. It is possible that the species never reaches great density in this rocky alpine habitat. The absence of old adults in the collection also points to the possibility that the harsh environment with its three month growing season rarely permits the survival of older animals. Studies by Vernon and Hughes (1966) indicate that the newly named subspecies probably represents a relict population that became isolated on nunataks above valley glaciers well over 10,000 years ago.

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A NEW SUBSPECIES OF HORSESHOE BAT  
(*HIPPOSIDEROS DIADEMA*)  
FROM THE SOLOMON ISLANDS

BY CARLETON J. PHILLIPS

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In Hill's (1963: 109-111) revision of the genus *Hipposideros* he recognized 16 subspecies of *H. diadema* (É. Geoffroy). This species occurs from the Asiatic mainland southeastward into the Solomon Island group. Five subspecies of *H. diadema* are known from the immediate region of the Solomon Islands: two from islands in the Solomon group; one from Manus Island (Admiralty Islands) northwest of the Solomons; one from Kiriwina Island (Trobriand Islands) and one from New Guinea, both west of the Solomons (Fig. 1).

In 1964, four specimens of an unnamed subspecies were collected at Dala on Malaita Island by members of an expedition from the Bernice P. Bishop Museum. All four were preserved in 70 percent alcohol for about a year. Then the crania were extracted and cleaned and the skins of two were prepared as dried study specimens. These bats are slightly smaller than *Hipposideros diadema oceanitis* Andersen (1905), known from Choiseul, Guadalcanal, Vella Lavella, Fauro, Santa Ysabel, and Bougainville islands in the Solomons, but slightly larger than *Hipposideros diadema demissus* Andersen (1909), known from San Christobal Island in the Solomons (see Laurie and Hill, 1954: 57-58; Hill, 1963: 100-111), and may be named and described as follows:

***Hipposideros diadema malaitensis* new subspecies**

*Holotype*. Adult female, skin and skull, in good condition (originally stored in alcohol for about one year), no. BBM-BSIP 24121, Bernice P. Bishop Museum; from Dala (lat. 8°30'S, long. 160°42'E), Malaita Island, British Solomon Islands Protectorate; obtained on 4 July 1964 by Peter Shanahan, original no. 300.

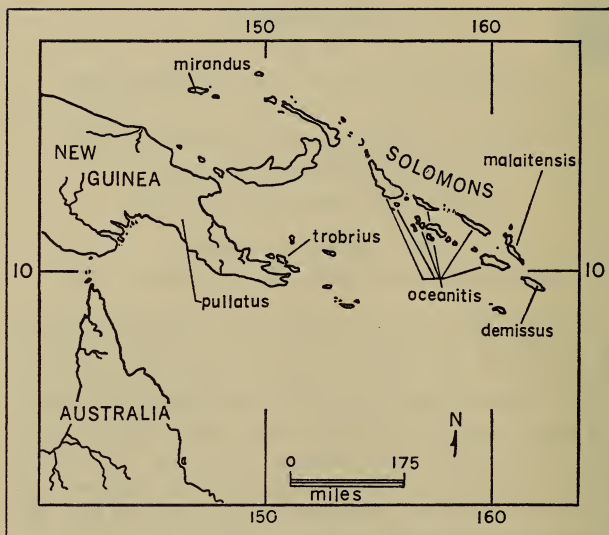


FIG. 1. Distribution of six subspecies of *Hipposideros diadema*.

*Distribution:* Known only from the type-locality.

*Diagnosis:* Size about average for species; wing membranes and interfemoral membrane (naked) dark brown in dried specimens; underside of forearm sparsely set with pale hairs; upper surface of forearm bare; hair soft (10 mm on neck, 15 mm on back), tipped with Mummy Brown (capitalized color terms after Ridgway, 1912) and/or Ochraceous-Buff on back; obscure stripe of Light Buff along sides immediately above attachment of wing membrane; hair of crown and face Light Buff tipped with Prout's Brown; shoulders Ochraceous-Buff, Light Buff tips imparting slightly frosted appearance; hair on throat sparse (10 mm), Cinnamon-Brown; hair on chest (14 mm) and lower abdomen (6–10 mm) dense and soft, Cinnamon-Brown or Prout's Brown, paler tips imparting slightly frosted appearance; braincase narrow; jugal process on zygomatic arch prominent; mandible massive; angular process flexed outward (laterally) about 30 degrees.

*Comparisons:* From five adult *Hipposideros diadema oceanitis* Andersen (1905) from Choiseul Island, *malaitensis* differs as follows: smaller in all external dimensions (forearm averaging 73.5 as opposed to 78.0 mm); slightly smaller in most cranial measurements; breadth of braincase 11.7 as opposed to 12.5 mm; length of mandibular tooth-row

12.7 as opposed to 13.2 mm; paler upper parts; darker underparts; fainter lateral stripe.

From *Hipposideros diadema demissus* Andersen (1909), *malaitensis* differs as follows: larger in all external dimensions (forearm averaging 73.5 as opposed to 67.0 mm); cranium larger, especially zygomatic breadth (17.0 as opposed to 15.0 mm) and length of maxillary tooth-row and mandibular tooth-row (11.1 as opposed to 10.2 mm, and 12.5 as opposed to 11.4 mm, respectively); paler underparts; fainter lateral stripe. (I am indebted to John E. Hill for measurements of the holotype of *demissus*.)

From *Hipposideros diadema trobrius* Troughton (1937), known from Kiriwina Island of the Trobriand Island group (Fig. 1), *malaitensis* differs as follows: tibia longer (averaging 32.5 as opposed to 29.0 mm); third metacarpal shorter (53.1 as opposed to 60.0 mm); braincase narrower (11.6 as opposed to 12.5 mm); mandibular tooth-row shorter (12.5 as opposed to 13.2 mm). (Measurements of *H. d. trobrius* are from Troughton, 1937.)

From *Hipposideros diadema pullatus* Andersen (1905) of New Guinea (Fig. 1), *malaitensis* differs as follows: smaller throughout (forearm averaging 73.5 as opposed to 75 to 82 mm). (Measurements of *H. d. pullatus* are from Hill, 1963: 112.)

From *Hipposideros diadema mirandus* Thomas (1914) of the Admiralty Islands (Fig. 1), *malaitensis* differs as follows: larger throughout (forearm averaging 73.5 as opposed to 68.0 mm). (Measurements of *H. d. mirandus* are from Hill, 1963: 112.)

*Measurements:* Comparative measurements of three subspecies are given in Table 1. Some measurements of the holotype (in mm) are as follows: length of head and body, 78; tail vertebrae, 50; hind foot (including claws), 16; ear, 25; length of forearm, 72.5; length of tibia, 32.1; length of third metacarpal, 52.9; greatest length of skull, 29.8; zygomatic breadth, 16.7; breadth of braincase, 12; length of maxillary tooth-row, 11; length of mandibular tooth-row, 12.4.

*Remarks:* Tate (1941: 373-374) divided the numerous subspecies of *Hipposideros diadema* into two general "groups" according to length of forearm: 80 to 90 mm (southeastern Asia, Borneo, and Java), and 63 to 79 mm (Philippines, Celebes, New Guinea, Australia, Solomon Islands, and some other small adjacent islands). Hill (1963: 108) pointed out that there is no actual west-east cline, even though the larger subspecies occur to the west and the smaller subspecies to the east.

The three subspecies in the Solomon Islands can be distinguished and identified on basis of size, and in themselves form a northwest to southeast cline. As can be seen in Fig. 1, Malaita Island, where *malaitensis* occurs, lies between islands on which the other two subspecies, *oceanitis* and *demissus*, occur. Since *malaitensis* is intermediate in size (Fig. 2), it may be the product of interbreeding between pop-

TABLE 1. Comparative measurements (means and extremes, in mm) of three subspecies of *Hipposideros diadema*. Measurements of the topotype of *H. diadema demissus* are from Tate (1941).

	<i>oceanitis</i> , 5 <sup>1</sup>	<i>malaitensis</i> , 4 <sup>1</sup>	<i>demissus</i> , 2 <sup>1</sup>
Head and body	88.4 (85-93)	83.7 (78-90)	— —
Tail vertebrae	50.8 (50-52)	49.7 (48-51)	— —
Hind foot ( <i>c.u.</i> )	16.9 (16-18)	16.0 (15-17)	— —
Ear	29.4 (29-30)	26.6 (25.0-28.4)	— —
Forearm	78.0 (77.0-78.6)	73.5 (71.4-76.2)	65.2, 68.5
Tibia	34.9 (33.3-36.5)	32.5 (32.1-33.4)	25.5, 28.5
2nd metacarpal	60.8 (58.9-61.7)	54.8 (54.2-55.7)	— —
3rd metacarpal	57.6 (56.3-59.0)	53.1 (52.7-54.1)	47.8, 50.5
4th metacarpal	56.1 (55.2-57.3)	51.7 (51.3-52.2)	46.8, 48.5
5th metacarpal	52.1 (49.5-53.5)	48.4 (47.4-49.2)	44.6, 46.5
Greatest length of skull	31.0 (30.0-31.9)	29.9 (28.9-31.1)	— —
Condylocanine length	27.6 (27.1-28.1)	26.7 (26.2-27.8)	— —
Zygomatic breadth	17.4 (17.1-17.8)	17.0 (16.7-17.3)	14.7, 15.5
Breadth of braincase	12.5 (12.0-12.9)	11.6 (11.4-12.0)	— —
Maxillary tooth-row	11.5 (11.5-11.6)	11.1 (11.0-11.4)	10.2, 10.2
Mandibular tooth-row	13.1 (13.0-13.3)	12.5 (12.4-12.9)	11.1, 11.7
Length of mandible	21.3 (21.0-21.5)	20.1 (19.6-20.8)	18.1, 19.5
Width across upper C	8.2 (7.9-8.4)	7.9 (7.8-8.1)	6.7, —
Width across upper M2	10.7 (10.6-10.9)	10.5 (10.5-10.7)	— —

<sup>1</sup> Numeral denotes number of individuals for which measurements were available.

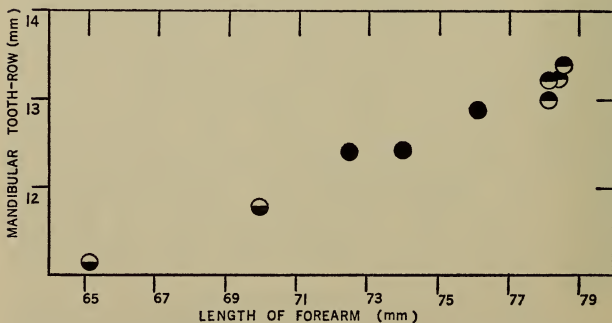


FIG. 2. Comparison of *Hipposideros diadema demissus* (lower half of circle solid), *H. d. malaitensis* (solid circle), and *H. d. oceanitis* (upper half of circle solid). Measurements of *H. d. demissus* are from Hill (1963) and Tate (1941).

ulations of *oceanitis* and *demissus*. Whether or not such is the case, there is little overlap in any external or cranial dimensions between any two of the three subspecies.

*Specimens examined*: Four adults from the type-locality, two females (BSIP 24121, holotype, and BSIP 24126) and two males (BSIP 24122-3). All specimens are deposited in the Bernice P. Bishop Museum. The prefix "BSIP" is part of the catalogue number and refers to the Solomon Islands.

*Acknowledgments*: Some financial support for this investigation was from a grant (DA-MD-49-193-62-G65) from the United States Army Medical Research and Development Command to the Bernice P. Bishop Museum, Honolulu. I thank J. Linsley Gressitt of that museum for making specimens available for study. E. Raymond Hall, J. Knox Jones, Jr., and Jerry R. Choate of The University of Kansas Museum of Natural History, kindly reviewed the manuscript. I appreciate also the assistance of John Edwards Hill, British Museum (Natural History), who provided me with measurements of the holotype of *Hipposideros diadema demissus*.

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*ASTRONEBRIS TATAFILIUS* (EURYALAE:  
ASTERONYCHIDAE), A NEW GENUS AND SPECIES  
OF OPHIUROID FROM THE ALEUTIANS, WITH A  
REVISED KEY TO THE FAMILY ASTERONYCHIDAE

BY MAUREEN E. DOWNEY

*Smithsonian Institution, Washington, D.C.*

In recent years, some collections of invertebrates obtained by the Inter-American Tropical Tuna Commission have been deposited in the U. S. National Museum. Material from the North Pacific Ocean included three specimens of a new genus and species of ophiuroid, and these are described below. The specimens were found clinging to a thick, fleshy alcyonarian by means of their prehensile arms.

I wish to thank Dr. David L. Pawson, Curator-in-Charge, Division of Echinoderms, for his helpful criticism and advice, and Mr. Thomas Phelan, Division of Invertebrate Paleontology, for the excellent photographs.

Suborder EURYALAE Muller and Troschel, 1840

Family ASTERONYCHIDAE Verrill, 1899 (emend. Mortensen, 1933)

***Astronebris*** new genus

*Diagnosis:* Disc and arms covered by thick skin; disc scales few, fragile. Arms roll into vertical coils; arm spines point downwards; no hooks on dorsal side of arms, but distal arm spines transformed into glassy hooks which lack a lamina and perforations.

*Type-species:* *Astronebris tatafilius* n. sp., by monotypy.

*Etymology:* The generic name is masculine, derived from the Greek *astro* (star) and *nebris* (fawn skin), referring to the soft integument. The specific name is in honor of Dr. David L. Pawson, who objected to "pawsoni."

***Astronebris tatafilius*** new species

*Description of holotype* (Fig. 1a, b, c): Disc diameter, 11 mm, arms about 40 m long. Disc and arms covered by thick, soft skin. Disc circular, dorsal side depressed at center. Radial shields large, irregular



FIG. 1. *Astronebris tatafilius* holotype: a, dorsal aspect; b, ventral aspect; c, lateral aspect.

pyriform, sometimes fused in pairs, extending almost to disc center, with thin irregular plates along each side and over narrow proximal end. Disc center with few small, discrete, rounded plates. Ventral surface naked. Genital pores in each interradius conjugate. Genital shield smooth, curved, massive, with small round genital scale at proximal end. Oral shields minute, approximately triangular, mostly concealed by adoral plates; only shield with madreporite extends to gonopore. Adoral plates large, rectangular, partly overlapping first lateral arm plates. Oral plates similar to adoral plates, but smaller, al-

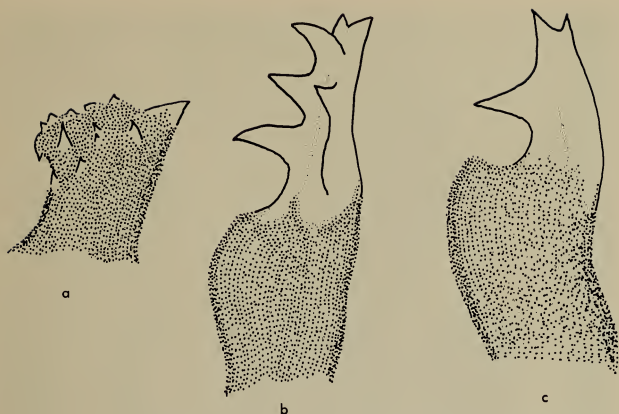


FIG. 2. *Astronebris tatafilius*: a, proximal arm spine of holotype; b, medial arm spine; c, distal arm spine.

most erect. Infradental papillae are 2 or 3 small granules on each side of jaw. Teeth strong, triangular, paired. Tooth papillae absent.

Arms vertically coiled, prehensile, length about 4 times disc diameter. Upper arm plates absent. Minute fragile scales occur over most of arm, but not in naked areas between joints. First ventral arm plate longer than broad, narrower proximally, extending well into mouth. Next few ventral arm plates broader than long, with lateral margins concave. Distal arm plates fragmented, fragile. Lateral arm plates tumid, oblique, ventrolaterally placed. Tentacle scales absent. Arm spines small, glassy (Fig. 2), partly concealed by skin, pointing downwards; 2 spines on proximal arm joints, 3 elsewhere. Proximal arm spines with small glassy pointed tubercles (Fig. 2a). Spines on mid-arm glassy, with several lateral teeth, slightly scooped (Fig. 2b). Distal arm spines with simple hook (Fig. 2c).

*Paratypes*: Disc soft, cushiony; raised and riblike radial shields concealed by thick, smooth integument. Gonopores appear single but are actually conjugate. One specimen with 4 arms (Fig. 3).

*Holotype*: USNM E10694 (dried specimen).

*Paratypes*: USNM E10695 (in alcohol), 2 specimens (one with 4 arms).

*Type-locality*: Amatingnale Island, Aleutians, 37 m, on fleshy pink gorgonian. Collected by Inter-American Tropical Tuna Commission, 13 July 1958.

*Color in alcohol*: When first received the types were fawn colored, with a tinge of pink on the discs, but they are now faded.

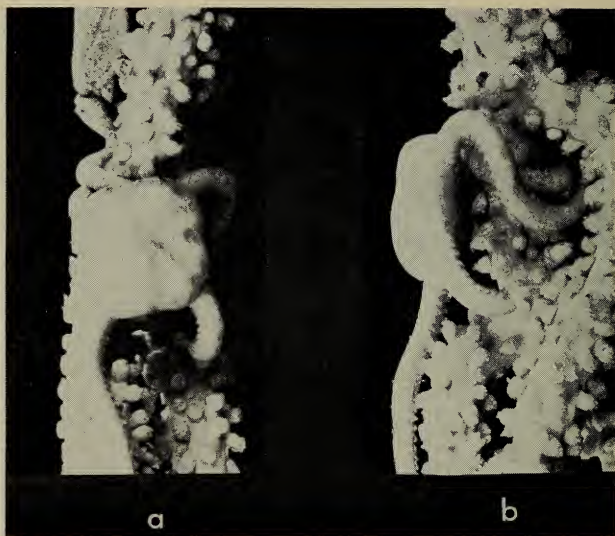


FIG. 3. *Astronebris tatafilius*, four-armed paratype *in situ* upon alcyonarian: a, dorsal aspect; b, lateral aspect.

*Remarks:* This genus is proposed to accommodate a new species of ophiuroid which has doubtful affinities. Because of the thin and fragile character of the scalelike plates, and the large areas of naked skin, *Astronebris* shares some features with members of the family Hemieuryalidae. It also bears some resemblance to the ophiomyxid genus *Ophioschiza* Clark, 1911, but *Ophioschiza* differs from *Astronebris* in having a flattened disc, covered with irregular plates; *Ophioschiza* further lacks oral shields (except the madreporic shield) and has a single genital pore in each interradius. *Astronebris* has three arm spines, while *Ophioschiza* has only one. *Ophioschiza* is obviously misplaced in the Ophiomyxidae, as Clark (1911) has already suggested, and in light of its apparent close relationship to *Astronebris*, it would seem that both genera can be referred readily to the family *Asteronychidae*.

Fell (1960, p. 11) included the genera *Asteronyx* Muller and Troschel, 1842, and *Astrodia* Verrill, 1899, in his key to the family Asteronychidae. The key must now be revised to incorporate the genera *Astronebris* and *Ophioschiza*.



## Key to the Genera of the Family Asteronychidae

- 1 (6) Three or more arm spines. Two genital pores in each inter-radius.
- 2 (5) Three arm spines, never hooked or hooked only on distal part of arm.
- 3 (4) Arm spines never hooked. Disc covered with numerous scales ..... *Astrodia*
- 4 (3) Distal arm spines hooked. Disc scales few ..... *Astronebris*
- 5 (2) More than 3 arm spines which (except for 3 inner ones) are modified as simple hooklets ..... *Asteronyx*
- 6 (1) One arm spine; one genital pore in each interradius .. *Ophioschiza*

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PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTONNOTES ON THE PLANT GENUS *PANDANUS* IN  
FIJI, TONGA, THE NEW HEBRIDES, AND NIUE<sup>1</sup>

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No critical treatment of Fijian *Pandanus* has appeared since Martelli's (1930A). At the same time Martelli (1930B) also discussed *Pandanus* in Tonga. A. C. Smith (1936) discussed two *Pandanus* species, one of them proposed as new. Since 1936 a number of collections, primarily made by A. C. Smith, have become available. These extend the known distributions of certain species and also indicate the need for a review of the taxonomic status of various taxa in the flora of this region of the Pacific.

The Fijian species of *Pandanus* may be arranged in four of the sections of the genus; *Acrostigma*, *Coronata*, *Maysops*, and *Pandanus*. Two other sections, *Hombrobia* and *Microstigma*, are represented by a single species each from the New Hebrides. In Fiji there are several well-defined species, one in Sect. *Acrostigma*, one in *Maysops*, and two in *Coronata*. The species of Sect. *Pandanus* are more difficult to interpret because of the several difficulties, both taxonomic and nomenclatural in nature, which have yet to be solved, and which involve not only the plants of the area here considered but those of the entire Pacific and indeed those of Malaysia and the Indian Ocean. Therefore, consideration of the members of Sect. *Pandanus* is postponed, except for one newly proposed variety. Traditionally, these species which are largely littoral in habitat and dispersed by oceanic currents, have been brought together under a single name; usually either *P. odoratissimus* or *P. tectorius*. Serious drawbacks have stood in the way of using either of these names; in the first case, the name *P. odoratissimus* has been claimed to be illegitimate (see for instance DeWit, 1959). In any event, it is a native of Ceylon and adjacent Malaysia, extending to the Philippines, and may be recognized by its relatively small phalanges, and, in particular, by its very stoutly toothed leaves. I do not believe

<sup>1</sup>Based on studies made at the U.S. National Herbarium through the courtesy of Dr. A. C. Smith.

that this species occurs beyond the limits of Malaysia as defined in the "Flora Malesiana."

With the name *P. tectorius* we have a different problem. The epithet is doubtless to be rejected under the terms of the International Code, since its usage has led to consistent and constant confusion. If, however, steps were taken to reintroduce the name, accompanied by a neotype collection from the type locality (in Tahiti) with mature fruits in abundance, the name could be taken up, and would no doubt be applicable to a widespread but perhaps typically Polynesian species. There are at present quite probably far too many specific "entities" for the Polynesian species of *Pandanus*. Martelli (1933A and 1933B) does not broach this problem; yet he accepts eight species of Sect. *Pandanus* in Tahiti, and three in Rarotonga (one of which is said to occur also in Tahiti). The oldest name he accepts is *P. Menziesii* Gaudich., which, however, is applied to a Hawaiian plant. Brown (1931) accepts *P. tectorius*, and describes a number of taxa as new; nowhere, however, is the name *tectorius* clearly defined or typified. Other writers on Polynesian botany generally use the name *P. tectorius*. Martelli (1934) in his treatment of Samoan Pandanaceae recognizes only two varieties of *P. odoratissimus*, one of them the var. *laevis*, which is cultivated and known only in the sterile state; the other is var. *savaiensis* (Martelli) Martelli, first described as a variety of *P. tectorius*.

The cardinal point is, of course, the matter of specific delimitation. So long as but one species is accepted for the region from the Indian Ocean to the Eastern Pacific, as far north as the Bonin and Hawaiian Islands and south to the Austral Islands and Australia, there is, perhaps, no real objection to using one of these names. But once a more intensive study is made of the plants from this vast area, it becomes abundantly clear that the situation is not nearly so simple. While of course it is true that littoral species are often rather uniform over a large area, it is also obvious that the forces of evolution as expressed in insular environments have not suspended operations. But other considerations complicate the situation immensely. *Pandanus* must be considered as a crop plant in many areas, and it is clear that deliberate man-made introductions of *Pandanus* plants occur, not only in Polynesia, but in Micronesia and in Melanesia, and no doubt across the natural range of the genus. In certain areas the production of numerous cultivars for food or for foliage has been accomplished by a long process of selection; in some cases the number of clones produced (and in general they are always vegetatively propagated) is extraordinarily large, mainly in the Gilbert and Marshall groups.

Merrill (1954) has discussed the nomenclatural problems posed by Parkinson's (1773) book. It is not necessary here to repeat his remarks, but in his general consideration, he calls for an official rejection of the book as a whole. Many, if not most, of the names published in Parkinson's book are *nomina subnuda*; but with *P. tectorius* there is a discus-



sion of eleven lines of print. Unfortunately, other than immediately identifying the genus, there is no way of knowing what species Parkinson meant. St. John (1963) has rejected the name because it is a hyphenated binomial, which he deems a monomial.

Probably a solution by international fiat through the appropriate committees is necessary; and if the general rejection is not approved, only a new typification, as earlier mentioned, can elucidate the situation.

In the meantime one can only use those names which are well-founded, which merely postpones the nomenclatural problems, but at least may further taxonomic knowledge. I have with great hesitation attempted such a temporal compromise in this treatment, knowing full well that future studies will bring about a number of changes. Progress in understanding of the intricately variable Pacific species is bound to depend at least at first on a rather narrow interpretation of taxa, and more important perhaps, much more serious field studies and collecting; and it might be remarked that illustrations are mandatory.

KEY TO THE SECTIONS OF *PANDANUS* IN FIJI, TONGA, NEW HEBRIDES,  
AND NIUE

Drupes all or nearly all one-celled

Stigmas spiniform, longer than broad, subulate or curved-acicular,  
erect or mostly ascending, stigmatic groove dorsal ..... *Acrostigma*

Stigmas suborbicula or reniform, broader than long, flattened

Stigmas lateral, erect or ventral, commonly attached at or near  
the edge of the drupe ..... *Maysops*

Stigmas apical or subapical, plane or slightly oblique .... *Microstigma*

Drupes all or nearly all several-celled

Stigmas radiate or concentric in arrangement

Stigmas lateral and subvertical, arranged around the truncated  
apex of the phalange, centrifugal ..... *Coronata*

Stigmas mostly subplane, each borne on a more or less distinct  
carpel apex, concentric, centripetal ..... *Pandanus*

Stigmas in one or more transverse lines (if several, then parallel)  
..... *Hombronia*

Sect. *Acrostigma* Kurz

1. *Pandanus thurstonii* Wright in Kew Bull. 1894: 348. 1894; Martelli in Univ. Calif. Publ. Bot. 12: 335. 1930; Smith in Bishop Mus. Bull. 141: 12. f. 4-a, e. 1936.

*P. caricosus* sensu Seem. Fl. Vit. 281. 1866 (non [Rumph.] Sprengel, 1826), fide Martelli.

*P. virens* Horne, A Year in Fiji, 264. 1881. *nom. nud.*

Type locality: Viti Levu: Near Suva (*Thurston*, K.).

Reported from Koro, in a swamp at 500 m alt. (Smith 992, BISH, US) by Smith. The species does not reappear in recent collections. The natives of Koro know the plant as *varawa*, and use it in weaving mats. It is endemic.

Sect. *Maysops* St. John

2. *Pandanus joskei* Balf. f. in Journ. Linn. Soc. Bot. 20: 416. 1884; Martelli in Webbia 4 (1): 18. 1913; et 4 (2): t. 24. f. 1-3 1914; in Univ. Calif. Publ. Bot. 12: 334. 1930.

Type locality: "Fiji Isl.". Holotype: *Jeoward*, K. The original description was based on notes and sketches made by Horne.

Reported from Viti Levu ("common between the Wai Manu and the Rewa River on alluvial land; also on damp spots near streams in mountains at sources of Tamarina River, between Suva and the Rewa River" (*Jeoward*); Mt. Korombamba (*Parks* 20344, BISH, UC, US).

A thoroughly distinct and handsome species. It does not appear again in more recent collections at hand.

Fiji: Viti Levu: Mba; vicinity of Nandarivatu, *Gillespie* 3734, BISH.

Sect. *Microstigma* Kurz

3. *Pandanus cominsii* Hemsl. in Hook. f. Icon. 27: t. 2654. 1900; Martelli in Bot. Jahrb. 49: 66. 1912; in Webbia 4: t. 26. f. 20. 1914; in Journ. Arnold Arb. 12: 269. 1931.

Type locality: Solomon Islands; Florida Is. Holotype: *Comins* 363, K.

Reported only from the Banks Group, Vanua Lava Island, just north of the New Hebrides (*Kajewski* 471), by Martelli. The species is common in the Solomon Islands; a peculiar variety occurs in Micronesia on the islands of Truk and Ponape.

In Efaté, New Hebrides, I observed what in all probability was this species but was unable to make a collection, on a trip from Port Vila to Onesua in 1957.

Section *Coronata* Martelli

Key to Species

- Stigmas mostly 4-6 per phalange; phalanges<sup>2</sup> compressed obovate-oblancoolate ..... *P. whitmeeanus* Martelli  
 Stigmas mostly 10-16 (or more) per phalange; phalanges, rhomboid, pentahexagonal, but slightly or not compressed .... *P. citiensis* Martelli
4. *Pandanus whitmeeanus* Martelli in Webbia 1: 364. 1905; 4 (1): 36. 1913; 4 (2): t. 22. f. 4-6. 1914; Setchell, Veg. Tutila Isl., Carnegie Inst. Publ. 341: 117. 1924; Martelli in Univ. Calif. Publ. Bot. 12: 259. pl. 45. f. 8-9. 1930; in Bishop Mus. Occ. Pap. 10 (13): 23. 1934; St. John in Pac. Sci. 14: 228. 1960.

Type locality: Samoa. Holotype: *Whitmee* s.n., K.

<sup>2</sup> The multilocular segment of the cephalium; also termed a polydrupe.

Branching trees to 10 m tall or more; leaves 180–275 cm long, or up to 500 cm long, 8–10 cm broad toward the base, at apex gradually long-acuminate, not or very briefly (3–4 cm) flagellate; margins serrate-dentate, at base the teeth stout, antrorse, hooked, 2–3 mm long; toward middle and at apex teeth reduced, minute, 1.0 mm long or less, crowded (about 6–7 per cm), slightly larger teeth alternating with slightly smaller ones; costa dorsally unarmed at base, dentate along the apical third with teeth subsimilar to those of adjacent margins but slightly more distant; ventral pleats apically set with small antrorse teeth like those of margins; sheathing base indurate, rigid, thick. Syncarps subglobose, obscurely trigonal, erect, c. 22–23 cm long, c. 23 cm in diameter, borne on a trigonal peduncle up to 30 cm long; phalanges 250–350 per syncarp, about 7–8.5 cm long and 3 cm broad when mature, compressed (c. 1.8–2 cm thick), with 3–6, usually 4–6 locules; phalange a unit, the carpels completely connate, narrowly obovate in profile, the apex flat to slightly concave, 5–6-angled; sides smooth; upper  $\frac{1}{4}$  green, lower  $\frac{3}{4}$  yellow to yellow-orange at maturity; bases of mutually adjacent phalanges not connate. Stigmas 3–6, external, on the distal face of the phalange, surrounding the apical areola, nearly vertical, narrowly elliptic or linear, grooved at the base, about  $4 \times 2$  mm, set usually at or near the angles of the phalange; endocarp submedian, with 3–6 seeds usually in two rows, each c.  $18 \times 5$  mm; upper mesocarp fibrous, pithy, solid (not cavernose); lower mesocarp fibrous, the fibers traversing a fleshy pulp. (Fig. 1)

Distribution: Fiji, Samoa, and Tonga: (Cultivated and visited for the leaves, which are of textile quality); New Hebrides.

Local names: "paongo" in Tonga and Samoa; "ndaundreka" in Fiji; "na parou" in Nguna, New Hebrides.

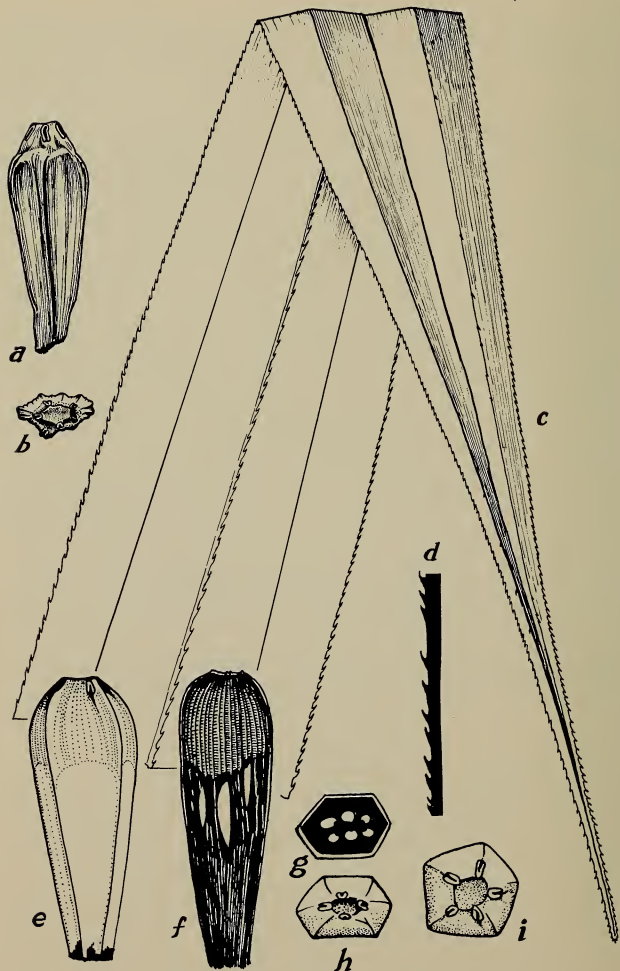
Known in Samoa from Savaii (Safotu, cultivated, *Christophersen & Stehlin* 3597) and from Tutuila (Pango Pango, *Setchell* 300, and Pioa, *Christophersen* 3580); in Tonga from Tongatabu (*Setchell & Parks* 15650).

New Hebrides: Nguna Is. (just north of Efaté), Mt. Mawasi, c. 330 m alt., Sept. 1957, *Stone* 2208, 2210, BISH.

Fiji: Viti Levu: Serua; Flat coastal strip in vicinity of Ngaloa, alt. nr. sea-level, (freely branched tree to 15 m high, in swampy grass-flats and on edge of forest; leaves to 5 m long, locally considered the best for mats, for which young plants are used), *Smith* 9436, US.

The Fijian material cited is the best collection of this species from Fiji. It is a good match for the species, although the fruits are quite immature; a phalange and leaf apex are illustrated. Mature phalanges of *Stone* 2208 from Nguna, New Hebrides, are illustrated.

The discovery of this characteristic species in Fiji and in the New Hebrides is in accord with the pattern of distribution for this region as manifested in various other species. The New Hebridean material is also the first known from that area.



Species dubius aff. *P. whitmeeanus*

*Pandanus corallinus* Martelli in Univ. Calif. Publ. Bot. 12: 359. pl. 45.  
Figs. 10–12. 1930. Yuncker in Bishop Mus. Bull. 220: 50. 1959.

Type locality: Tonga; *Tongatabu*. Holotype: *Setchell & Parks* 15420, UC.

There seems to be no doubt that the phalanges representing this species display the stigmatic structure and arrangement typical of this section. However, there is considerable doubt about the validity of the species, since the phalanges obtained are all from the peduncular region of the syncarp (as evidence by their falcate shape). They are perhaps immature; at best they are distortions of the more lateral or apical phalanges. The color, "coral red," does not correspond either with *P. vitiensis* or with *P. whitmeeanus*; but I regard it as probable that *P. corallinus* will prove to be a synonym of *P. whitmeeanus*. The collection consisted of phalanges which had been made into a necklace or lei and were worn by a Tongan woman at Mua. There is some doubt as to whether they were gathered in Tongatabu or in 'Eua.

5. *Pandanus vitiensis* Martelli in Univ. of Calif. Publ. Bot. 12: 333. pl. 42. 1930; Perry in Journ. Arnold Arb. 31: 208 in obs. 1950.

*P. levuensis* Martelli in Univ. Calif. Publ. Bot. 12: 334. pls. 43–44. 1930.

Type locality: Fiji: Viti-Levu; Tholo-i-Suva, 300 m. Holotype: *Parks* 20980, UC.

The first syntype cited of *P. levuensis* (here chosen lectotype) is *Parks* 20345, from Mr. Korombamba, Viti Levu; it is merely a very immature specimen of *P. vitiensis*, which accounts for the smaller phalanges as described by Martelli. The other syntype cited (Gillespie 3443.I) from Nasinu, Viti Levu, is also quite immature. It may represent *P. whitmeeanus*.

Distribution: Fiji, endemic. A small tree or up to 15 m high.

The most recent collection is that mentioned by Perry, which is cited again here.

Fiji: Viti Levu: Mba: Southern slopes of Mt. Ndelainathovu, on

←

FIG. 1. *Pandanus whitmeeanus* Martelli. (a–d, *Smith* 9436 from Fiji; e–i, *Stone* 2208, from New Hebrides). *a*. immature phalange in profile,  $\times \frac{1}{2}$ . *b*. the same in top view. *c*. leaf apex showing ventral (and at left) dorsal surfaces,  $\times \frac{1}{2}$ . *d*. teeth of leaf-margin in silhouette (from near leaf-base)  $\times \frac{1}{2}$ . *e*. phalange in profile, mature. *f*. the same in longi-section,  $\times \frac{1}{2}$ . *g*. cross-section of the same through the endocarp. *h*. top view of the same. *i*. top view of another phalange from the same collection.

the escarpment west of Nandarivatu, alt. 870–970 m, in dense forest (plant 4–10 m high, trunk straight, slender 15–20 cm diam., unbranched nearly to summit then with a few spreading branches; fruit terminal, surrounded by densely congested leaves; leaves used for weaving mats), 26 June 1947, *Smith* 4917 (A, BISH, BRL, K, US). Locality uncertain (probably near Nandarivatu), *Gillespie* 3734 (A, BISH).

Sect. *Hombronia* (Gaudich.) Warb.

Key to species in Fiji, Tonga, New Hebrides, and Niue

Phalanges mostly 7–15 cm long; coastal and lowland species.

Stigmas mostly 1–3, apical, more or less erect; phalange apex acute or convex; seed usually single, central ..... *P. dubius* Spr.

Stigmas mostly 3–4, or up to 5–7, rarely only 1; phalange apex truncated or concave; seeds usually 2–3, basal ..... *P. compressus* Martelli

Phalanges much smaller, not over 6 cm long;

Montane Samoan species ..... *P. reineckeii* Warb.

6. *Pandanus dubius* Sprengel, Syst. III: 897. 1826; Kurz in Journ. Bot. 5: 127. t. 64, f. 1–2. 1867.

*P. Hombronia* (Gaud.) F.v. Mueller, Victorian Nat. p. 143. 1890.

*Hombronia edulis* Gaudichaud, Bot. Voy. Bonite, Atlas t. 22, f. 17. 1843.

Type locality: Amboina. Holotype: Rumphius, Herb. Amb. t. 80. 1743.

New Hebrides: Nguna Is. just north of Île Vaté; Taloa village, on the shore, 3 Sept. 1957, *Stone* 2207 (BISH; to be distributed); no definite locality, Oct. 1944, *R. Christoffersen* s.n. (A).

First records from the New Hebrides.

A common littoral species throughout Malaysia, Eastern Melanesia, and part of Micronesia. The vernacular name in Ngunese is “na vaku.” The thickish, large, bluntly acuminate glossy coriaceous leaves are water-repellent and favored for coarse matting used as rain guards. The species was observed but not collected on the slopes of Mt. Mawasi, at nearly 300 m elevation, where it had been planted in a settlement; and on Île Vaté, at Onesua, on the north-east coast. The large seeds are edible, with a flavor much like that of coconut meat.

Not known so far from Fiji, Samoa, or Tonga, nor from anywhere else in Polynesia.

7. *Pandanus compressus* Martelli, Webbia 1: 363. 1905; 4: t. 10, f. 14–15. 1913.

*P. tetradon* (Gaudich.) Balf. f. ex Kanehira, Bot. Mag. Tokyo, 52: 236–239. f. 70. 1938. Not *P. tetradon* Ridley, 1915.

*Barrotia tetradon* Gaudich., Bot. Voy. Bonite, Atlas, t. 13, f. 1–8. 1843.



*Barrotia Gaudichaudii* Ad. Brongniart, Ann. Sci. Nat. ser. 6, 1: 264. 1875. Nomen nudum.

Type locality: Solomon Islands. Holotype: *Guppy* s.n., FI.

This species, so very similar to *Pandanus dubius*, but with basal, more numerous seeds and more compressed and apically truncate or slightly concave phalanges, is represented clearly in some photographs sent to me recently by Jacques Barrau (then) of the South Pacific Commission. Close-ups of the fruits and habit of the tree are shown. The plants were growing in Tongariki, Shepherd Is., in the New Hebrides region, where they were called "navaka" (Barrau in lit. 20 August 1964). No specimens were taken; however, there can be no doubt of the identity of the plants. (Fig. 2)

8. *Pandanus reineckei* Warb. in Bot. Jahrb. 25: 581. 1898; in Pflanzenr. 3 (IV.9): 52: 1900; Martelli in Bishop Mus. Occ. Pap. 10 (13): 22. 1934.

Type locality: Tutuila Is., 500–600 m. Holotype: *Reinecke* 459, B.

A full description and citation of all specimens presently known are to be found in Martelli's treatment. The Samoan name for the species is "paongo."

Distribution: The species is endemic to Samoa; it has been collected on the summits of several ranges in Savaii, Upolu, and Tutuila.

#### Section *Pandanus*

The treatment of members of this section is postponed, awaiting a solution to the problem of the identity and typification of *Pandanus tectorius*, and only the description of one new variety of *Pandanus tahitensis* is included here.

9. *Pandanus tahitensis* Martelli in Webbia 2: 428. 1907; 4: 33. t. 7. Figs. 1–3. 1913; in Univ. Calif. Publ. Bot. 17: 152. *nomen*. 1933.

Type locality: Tahiti. Holotype: *MacFarlane* 2, FI.

Distribution: Formerly supposed to be a Tahitian endemic; but if I am correct in the identification, it is found in Tonga and Fiji at least in the form of separate varieties. Here, however, only an undescribed variety from Niue is discussed.

*Pandanus tahitensis* Martelli var. **niueana** B. C. Stone, var. nov.

*Arbor ad 4 m alta; infructescentibus longe pedunculatis, pedunculis c. 30 cm longis; syncarpio c. 30 × 30 cm; phalangibus late obovoideis, apice hemisphericalibus, loculorum apicibus subplanatis convexis non liberis stigmatibus terminalibus depressis hippocrepiformibus.*

A tree to 4 m tall, syncarps pendent on an elongated peduncle c. 30 cm long; syncarp c. 30 × 30 cm; phalanges c. 6 cm long, c. 3.5 cm broad, obovoid or claviform, the apex dome-like, the 5–6 carpels with



apices flush and nearly plane with the phalange-apex surface, the apical sutures shallow (1 mm or less in depth); stigmas terminal, c. 2 mm broad, oblique or plane, hippocrepiform; upper mesocarp cavernose, the chambers c. 10–14 mm high, pithy-fibrous; endocarp supramedian, osseous, reddish, nearly 15 mm long, nearly as broad as the phalange, rimose below, traversed especially laterally by mesocarp fibers; lower mesocarp c. 3–5 cm long, fibrous-fleshy; seeds c. 1 cm (?) long.

Holotype in the herbarium of the Arnold Arboretum, collected on Niue Island, Jan. 1940, by T. G. Yuncker (no. 10238). Isotype at BISH.

Distribution: The variety is known only from the type collection. However, it appears (from illustrations) to be somewhat similar to *Pandanus tectorius* var. *uapensis* F. Brown (1931), known so far only from Uapou, Marquesas. This variety is similar in that the phalanges are apically dome-like, with shallow apical sutures; but differs in the relatively larger endocarp positioned higher in the phalange.

Local name: *Fa niua*. According to Yuncker (1943), who assigned the specimen tentatively to *P. tectorius*, the natives of Niue distinguish two or more forms of *Pandanus*, one which they claim to be native to the island, called *fa vao*, and the other, said to be introduced, called *fa niua*. A third form is called *fa fi*. Should tradition be correct, this variety would presumably be native elsewhere. No specimens have been seen to match this, and only the Marquesan variety mentioned seems close among illustrated taxa. The word *fa* in Niue means *Pandanus*.

#### Nomina dubia

*Pandanus tectorius* var. *laevis* (Kunth) Warb. in Pflanzenr. 3 (IV. 9):

48. 1900; Yuncker in Bishop Mus. Bull. 178: 20. 1943.

A group of specimens are given this name, all of which are unarmed, the leaves lacking teeth; they are similar in having the caudate-flagellate apex characteristic of various species of Sect. *Pandanus*. Whether they represent a single cultivar derived from one species or not, is unknown.

*Pandanus Veitchii* Hort. ex Gard. Chron. 349. 1869; Yuncker l.c.

Again a cultivated plant, normally sterile, of the general relationship of littoral species of Sect. *Pandanus*. This, like the former, reported from Niue.

*Pandanus verus* Rumph. Herb. Amb. 4: 139. t. 74. 1743; Seem. Fl. Vit. 281. 1868.

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FIG. 2. *Pandanus compressus* Martelli, in the Shepherd Islands (Tongariki). Above: head of fruit. Below: habit of the trees showing the relatively broad leaves and pendent heads of fruit. (Photos courtesy of Jacques Barrau, formerly of the South Pacific Commission.)

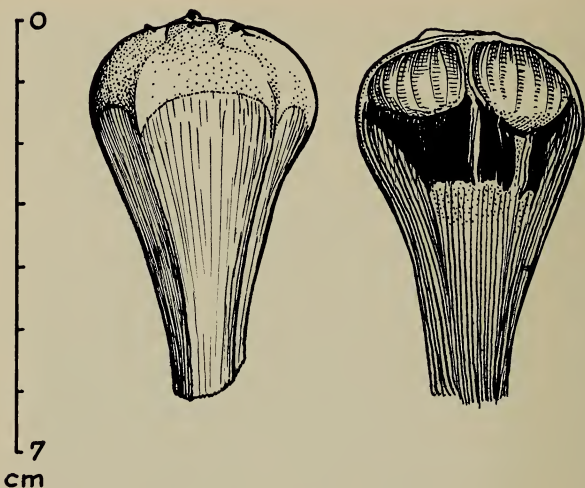


FIG. 3. *Pandanus tahitensis* var. *niueana* Stone. Representative phalange in full side view and in longitudinal section, natural size.

Seemann gives a rather long list of synonyms, some of which apply perhaps in interpretations later given; in any event, the Rumphian name is not tenable, and the plants Seemann had in mind are referable to *Pandanus upoluensis*, *P. tahitensis* and *P. polyacris*.

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A NEW LAND SNAIL OF THE FAMILY  
PROSERPINIDAE FROM CHIAPAS, MEXICO  
(GASTROPODA: PROSOBRANCHIA)

BY FRED G. THOMPSON

*Florida State Museum, University of Florida*

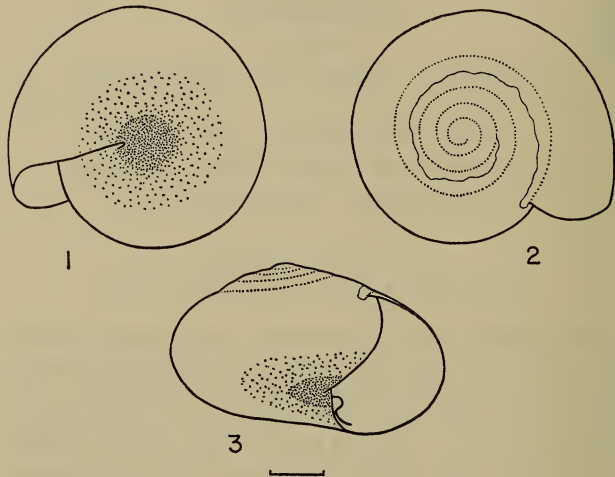
The molluscan family Proserpinidae is represented in Mexico by only a few species, while members of this family have not yet been recorded from Central America (von Martens, 1890-1901: 44-45; 609; Dall, 1926: 486-487). The new species described below is the first record of the genus *Linidiella* Jousseaume (1889) north of Venezuela, and is an important addition to the fauna of Mexico because of the species' zoogeographic relationships.

***Linidiella sulfureus* new species**

*Description:* Shell (Figs. 1-3) small. Depressed helicoid. Spire slightly elevated, weakly convex in outline. Shell 0.63-0.68 times as high as wide. Surface smooth, glossy. Light sulfur yellow. Fresh shells weakly transparent with very fine, light sigmoid radial lines that appear to be in shell matrix. 4.7-5.1 whorls. Nuclear whorl 0.7 mm in diameter. Suture distinct, but weakly impressed, covered with thin enamel wash that extends onto preceding whorls. Periphery of last whorl rounded. Dorsal surface of whorls nearly flattened, only weakly arched between sutures. Ventral surface also nearly flattened. Umbilical area covered with finely granular callus that covers about one-fourth or one-third of the ventral surface. A slight, sparsely granulate deposit extends beyond umbilical callus. Aperture semilunar. Lip simple, but not sharp, weakly recurved at periphery and along base near columella. Lip slightly thickened along baso-columellar region. Columella nearly straight; with single low, but strong, spiral lamella located about midway on columella.

Measurements of holotype: shell height, 3.3 mm; major diameter, 5.2 mm; minor diameter, 4.3 mm; aperture height, 2.6 mm.

Two paratypes are slightly larger than the holotype, but show no noticeable variation in proportions. Measurements for the largest



FIGS. 1-3. *Linidiella sulfureus* new species. Holotype (UF 19025). Scale equals 1 mm.

paratype are: shell height, 4.1 mm; major diameter, 6.0 mm; minor diameter, 4.0 mm; aperture height, 2.8 mm.

*Type-locality:* Chiapas, 8.2 mi. S Solusuchiapa, 1600 ft altitude. Holotype: Florida State Museum, University of Florida Collections (UF) 19025; collected 2 June 1965 by Fred G. Thompson. Paratypes: UF 19026 (8); same data as the holotype.

*Discussion:* *Linidiella* includes three other species, two of which occur in Ecuador, *L. cousini* (Jousseau) and *L. cinnamomea* (Sykes), and one in Venezuela, *L. swifti* (Bland). *L. sulfureus* differs from these species most noticeably by its smaller size and by its more globose form. The South American species all are over 10 mm in major diameter, and all have a sub-discoidal shell (Bland, 1863: 16-17. Jousseau, 1887: 181-182. Jousseau, 1889: 256-257. Sykes, 1900: 136-137). Among the South American taxa *L. swifti* is most similar to *L. sulfureus*, which it resembles in its sulfur yellow color and its glossy surface texture, which is produced, in part, by a thin enamel wash. In *L. swifti* the wash forms a narrow, even band paralleling the suture. In *L. sulfureus* the wash forms an irregular zone above the suture of the last whorl, and extends completely over the earlier whorls. The presence or absence of an enamel wash has not been recorded for the other species of *Linidiella*.

The family Proserpinidae is represented in Mexico by three genera, *Ceres* Gray (1856), *Proserpinella* Bland (1865), and *Linidiella*. *Ceres* is characterized by having a carinate shell with strong spiral sculpture, and six spiral lamellae within the aperture—one on the columella, two on the parietal wall, and three on the lower outer lip. *Proserpinella* and *Linidiella* are alike in having depressed shells with a rounded periphery, a smooth shell covered with a thin wash of enamel, and only a single spiral lamella within the aperture. In *Proserpinella*, the lamella is situated on the parietal wall, while in *Linidiella*, the lamella is located on the middle of the columella. Although the differences between *Proserpinella* and *Linidiella* may appear relatively slight, the lamella are homologous with different structures in the more generalized West Indian genus *Proserpina* Sowerby (1839), which has lamellae on both the columella and the parietal wall. *Linidiella* and *Proserpinella* appear to have diverged through different evolutionary lines from the more generalized West Indian stock, although they may be only subgenerically distinct from *Proserpina*, which is presently confined to Jamaica and Cuba.

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PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTONA NEW FROG OF THE GENUS *OREOPHRYNE* AND  
A LIST OF AMPHIBIANS FROM CAMIGUIN  
ISLAND, PHILIPPINES

BY WALTER C. BROWN AND ANGEL C. ALCALA

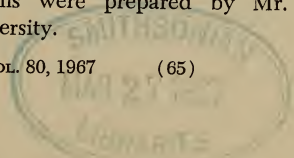
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Menlo College, Menlo Park, California, and  
Silliman University, Philippine Islands*

The genus *Oreophryne* Boettger is represented by several species in New Guinea and the islands of the Indo-Australian Archipelago. Only one, *Oreophryne annulata* Stejneger, is previously known from the Philippines. The type-locality is Davao, Mindanao Island. *Chaparina visaya* Taylor from Biliran Island was placed in the synonymy of *O. annulata* by Parker (1934, p. 167) based on specimens in the British Museum which were identified by Taylor as *C. visaya*. Inger (1954, p. 445) followed in this synonymy.

On the basis of Taylor's description (1920, p. 335), I see no reason for identifying *C. visaya* with the present series from Camiguin Island. The original description certainly would indicate that Taylor's unique holotype was probably conspecific with *O. annulata*. Only a series from the Biliran Island population will make it possible to determine the extent to which this population is differentiated from the southern Mindanao population.

The population on Camiguin Island, as evidenced from a sample obtained during a recent expedition to that island, represents a species which is very distinct from *O. annulata*, however. This species is described in the present paper.

The investigation of the herpetofauna of Camiguin Island, as a result of which this paper is one of the taxonomic reports, was made possible by a grant from the National Science Foundation. Illustrations were prepared by Mr. Walter Zawojski, Stanford University.



**Oreophryne nana** new species

*Holotype*: Stanford University Register no. 22055, a mature female, collected in dipterocarp forest between 1800 and 3000 ft on the northwest side of Nacawa volcano, Mt. Hibok-hibok, Camiguin Island, Philippine Islands, on 3 July 1966 by Lawton Alcala and party.

*Paratypes*: Stanford University nos. 22056-62, same general locality as the holotype.

*Diagnosis*: A small *Oreophryne*, snout-vent length of 17 to 20 mm for several mature females; tips of finger and toes, except for first finger, dilated into moderately large disks; disk of third finger and third toe about equal, and about same as diameter of tympanum; sub-articular tubercles lacking; fingers and toes without webs; venter heavily mottled with brown.

*Description*: Size small, females measuring 17 to 20 mm in snout-vent length at maturity for our sample; (no mature males available); habitus moderately slender; head broader than long; head breadth about  $\frac{1}{3}$  of snout-vent length (Table 1); snout short, bluntly round-pointed; snout length 75 to 95 percent diameter of orbit; interorbital distance greater than breadth of eyelid; tympanum distinct, its diameter about 35 to 70 percent diameter of orbit; canthus rostralis rounded; lores flat, only slightly oblique; vomerine teeth lacking; two palatine ridges present in front of pharynx, but not prominent; finger tips, except first, dilated into moderately large disks, with ventral part separated from dorsal by a circummarginal groove; ventral proximal groove lacking; disk diameter of third finger about 40 to 45 percent length of third finger and usually about twice diameter of disk of

TABLE 1. Snout-vent lengths (in mm) and certain proportions for samples of *Oreophryne annulata* and *Oreophryne nana* (R = range).

	<i>Oreophryne nana</i> (8 specimens)	<i>Oreophryne annulata</i> (2 specimens <sup>1</sup> )
Snout-vent lengths of adult females	R = 16.8-19.8	R = 19.0-23.4
Head breadth divided by tibia length	R = 0.808-0.903	R = 0.919-0.928
1st finger disk breadth divided by 3rd finger disk breadth	R = 0.455-0.600	R = 0.664-0.667
3rd toe disk breadth divided by 3rd finger disk breadth	R = 0.953-1.20	R = 0.833-0.882
3rd finger length divided by head breadth	R = 0.377-0.431	R = 0.440-0.478
3rd finger length divided by snout length	R = 1.05-1.47	R = 1.60-1.79

<sup>1</sup> Snout-vent length is based on 8 specimens.

first finger (Table 1); subarticular tubercles not evident; inner metacarpal tubercle barely evident, flat, elongate; outer not evident; second finger slightly longer than or about equal to fourth (Fig. 1a); hind limb relatively short, length of tibia about 39 to 45 percent snout-vent length and 111 to 124 percent head breadth (Table 1); toe disks moderately large, third toe disk about same size as third finger disk, or slightly larger (Table 1); subarticular tubercles not present, inner metatarsal tubercle flat, moderately elongate; third and fifth toes about equal in length.

Skin of dorsum smooth; venter usually weakly granulate posteriorly.

*Measurements of holotype* (in mm): Snout-vent length 19.4; head length from posterior edge of tympanum to snout tip 6.0; head breadth 6.9; snout length 1.9; orbital diameter 2.2; third finger length, measured from point of separation from fourth finger, 2.6; breadth of third finger disk 1.1; breadth of first finger disk 0.6; breadth of third toe disk 1.1, tibia length 8.3; hind limb length 26.4.

*Color (in preservative)*: Dorsum dusky brown except for snout, upper eyelids, and axillary and loreal regions which are blackish, otherwise occasionally with a few scattered darker blotches; limbs without distinct transverse bands, venter best described as brownish with scattered light blotches, or more rarely light cream, heavily mottled with brown.

*Comparisons*: *Oreophryne nana* differs from *O. annulata* in attaining maturity at a smaller size. Inger (1954, p. 447) gives a snout-vent length of 19.0 to 21.7 mm for 6 mature females of *O. annulata*. Two

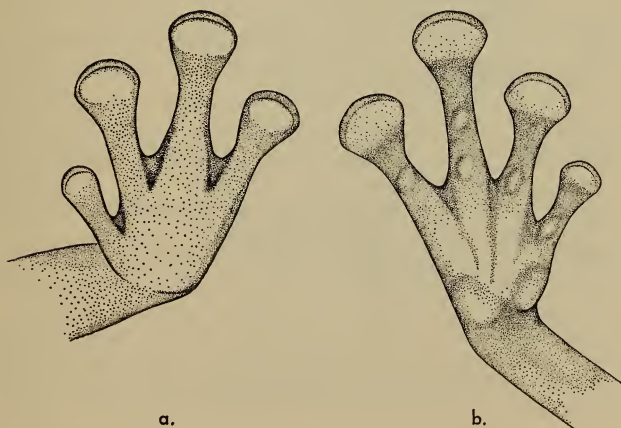


FIG. 1. a, undersurface of hand of *Oreophryne nana*; b, undersurface of hand of *Oreophryne annulata*.

females (S. U. 20120 and 20124) measure 23.2 and 23.4 mm in snout-vent length. *O. nana* differs also in having a darker ventral coloration; a relatively broader third-toe disk as compared to the third finger disk; a less dilated first-finger disk as compared to the third finger disk; a shorter third finger length compared to the head breadth or the snout length; a complete absence of subarticular tubercles (Fig. 1), and a smaller tympanum compared to orbital diameter (Table 1).

Using Parker's key (1934, p. 160), *O. nana* appears to belong to that group of species which includes *variabilis* (Boulenger) and *zimmeri* Ahl from Celebes and *rookmaakeri* Mertens from Flores. It differs from these species, however, in its much smaller size, features of its color pattern such as its darker venter, and its smaller toe disks as compared to its finger disks. In size, *O. nana* appears to be most similar to the *O. jeffersoniana* Dunn from which it is readily distinguished, however, by its much larger digital disks.

#### PRELIMINARY CHECKLIST OF AMPHIBIANS FROM CAMIGUIN ISLAND

Since no information on the herpetofauna of Camiguin Island has previously been published, the following list includes all amphibians collected by our recent expedition to that island.

- Cornufer corrugatus* (Duméril)
- Oeidozyga l. laevis* (Günther)
- Rana c. cancrivora* Gravenhorst
- Rana leytenensis* (Boettger)
- Rana m. magna* Stejneger
- Rana signata grandicula* Taylor
- Rhacophorus leucomystax quadrilineatus* (Boie)
- Kalophrynus p. pleurostigma* Tschudi
- Oreophryne nana* new species

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A NEW SPHENOMORPHID LIZARD (SCINCIDAE)  
FROM THE PHILIPPINE ISLANDS

BY WALTER C. BROWN AND DISCORO S. RABOR

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Eighteen species of Philippine lizards belonging to the genus *Lygosoma* Gray, subgenus *Sphenomorphus* Fitzinger, are described in the literature (Taylor 1922, 1923, and Brown and Alcala, 1961). In the present paper no attempt is made to determine the status of these previously described species. However, a single specimen, collected by the junior author in Surigao del Sur Province, eastern Mindanao Island, is sufficiently distinct from examples of any of these 18 species that it must be recognized as a new Philippine species.

This paper is a derivative of the senior author's program, supported by the National Science Foundation, on the ecology and distribution of the herpetofauna of the Philippine Islands. Illustrations were prepared by Mr. Walter Zawojski, Stanford University. Mr. Hyman Marx provided data on the number of middorsal scale rows characteristic of *S. multisquamatus* Inger.

***Lygosoma (Sphenomorphus) diwata* new species**

*Holotype*: Stanford University Reptile Register no. 24178, a mature male, collected April-May, 1963, near Sibuhay, Diwata Mountains, Surigao del Sur Province, Mindanao Island, Philippine Islands.

*Diagnosis* (based on holotype): A moderate-sized *Sphenomorphus*; midbody scale rows 40; middorsal scale rows between parietals and tail base 93; lamellae beneath fourth toe 15; 5 supraoculars, plus a small, divided scale posteriorly, anterior 2 supraoculars in contact with frontal; an irregularly margined, blackish band from ear to basal part of tail.

*Description of holotype*: A moderate-sized *Sphenomorphus*, snout-vent length 54.0 mm; habitus slender; head not strongly depressed;



head and snout tapering; snout round, pointed, its length about  $\frac{1}{3}$  head length; rostral narrowly in contact with prefrontal; frontonasals narrowly in contact; frontal tapering to sharp point posteriorly; frontoparietals not fused; interparietal large but not completely separating parietals; anterior frenal reduced to small triangular shield widely separated from upper labials; fifth upper labial beneath center of orbit; 5 elongate supraoculars, followed by 6th, which is transversely divided; no nuchals (see Fig. 1); eye moderate, its diameter about 75 percent snout length and 37 percent head breadth; ear large, its diameter about 75 percent eye diameter; 40 scale rows around middle of body; 93 scale rows along middorsal line between parietals and tail base;

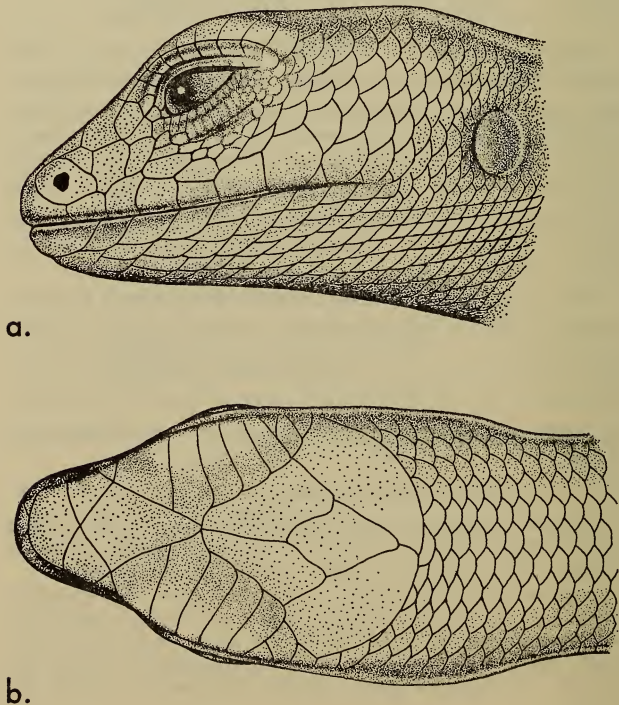


FIG. 1. *Lygosoma* (*Sphenomorphus*) *diwata* new species. (a) dorsal view of head; (b) lateral view of head.

15 lamellae beneath 4th toe on hind limb; limbs pentadactyl, well developed, length of hind limb about 37 percent snout-vent length and slightly greater than distance from fore limb to snout tip.

*Measurements of holotype* (in mm): Snout-vent length 54.0; distance from snout to fore limb 18.2; distance from axilla to groin 26.8; length of hind limb 21.0; head length 12.0; head breadth 7.7; eye diameter 2.9; tympanum diameter 2.2; snout length 3.9.

*Color (in preservative)*: Dorsum dark reddish brown blotched or suffused with blackish-brown, but lacking one or more rows of distinct blackish spots typical of *L. arborens* Taylor or *L. variegatum* Peters; dorsolateral region with an irregularly margined, broad, blackish band or series of blotches from region of ear to basal half of tail; lower lateral surfaces and under surface of head and throat marked by blackish, broken, longitudinal lines; rest of venter uniformly light; limbs heavily mottled with blackish brown.

*Range*: Known only from the type-locality.

*Comparisons*: The Philippine species of *Sphenomorphus* range in size from such small species as *L. (S.) steerei* Stejneger (mature specimens measure from about 26 to 35 mm in snout-vent length) to such large species as *L. (S.) jagori* Peters (mature specimens measure from 65 or 70 mm to 110 mm in snout-vent length). The new species is intermediate in size, belonging to the size group including *L. (S.) arborens* Taylor, *decipiens* Baulenger, *lednickyi* Taylor, *mindanensis* Taylor and *variegatum* Peters.

*L. (S.) diwata* differs from all previously known Philippine species in having a greater number of middorsal scale rows between the parietals and the base of the tail. Other species range from such low counts as 48-55 (some populations of *steerei*) to 65-75 (some populations of *jagori*). When compared to those Philippine species with an equally high midbody scale-count, 36-42, *diwata* also has a lower subdigital lamellar count than any other species. A combination of other characters such as the posterior loreal in contact with the nasal and the less blunt head and snout, further distinguishes this new species from other Philippine species of similar size.

When compared to species known from Borneo, Celebes and the Halmahera group, in terms of number of midbody scale rows and number of subdigital lamellae, it is most similar to *S. sabanus* Inger, *S. multisquamatus* and *L. kinabaluensis* Bartlett, all from Borneo. It is readily distinguished from *sabanus* in terms of the greater number of middorsal scale rows. From *kinabaluensis*, it differs in the greater number of midbody scale rows (40, in contrast to 34-38), and the lower number of supraoculars (5-6, in contrast to 7, and only 2 in contact with the frontal), the posterior loreal narrowly in contact with the nasal (not separated from it); from *multisquamatus* in the slightly greater number of middorsal scale rows (93, in contrast to 77-89), the lower number of subdigital lamellae beneath the fourth toe (15,



in contrast to 18-22), the posterior loreal narrowly in contact with (not separated from) the nasal, and the color pattern.

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*PARAGUNNELlichthys seychellensis*, A NEW  
GENUS AND SPECIES OF GOBIOID FISH  
(MICRODESMIDAE) FROM THE  
WESTERN INDIAN OCEAN

BY C. E. DAWSON

*Gulf Coast Research Laboratory, Ocean Springs, Mississippi*

In connection with a revisionary study of the wormfishes (Microdesmidae) I have had an opportunity to examine a number of interesting recent collections from the western Indian Ocean. Among these is a form which is evidently intermediate between the Indo-Pacific genus *Gunnellichthys* Bleeker and the rather diverse assemblage of eastern Atlantic Ocean and Western Hemisphere species presently included in the nominal genera *Microdesmus* Günther and *Clarkichthys* J. L. B. Smith. The unique features of this fish clearly warrant the erection of a new genus for its accommodation and, since complexities of the systematics of wormfishes will delay completion of the major study, I consider it appropriate to publish its description at this time.

Specimens reported here were obtained during the Seychelles Islands Program of the International Indian Ocean Expedition and have been deposited in the collections of the Academy of Natural Sciences of Philadelphia (ANSP). Head length is measured from tip of lower jaw to base of uppermost pectoral ray; body depth measured at anal fin origin. Caudal fin length is the distance between the rear of the hypural and the tip of the longest ray.

Appreciation is expressed to Dr. James E. Böhlke of the Academy of Natural Sciences of Philadelphia for making this material available for study. Acknowledgment is also made to Drs. Reeve M. Bailey and C. Richard Robins for their critical comments on the manuscript. Semidiagrammatic delineations are by Mr. Harry L. Moore, Jr.

**Paragunnellichthys** new genus

*Type-species: Paragunnellichthys seychellensis* new species.

*Diagnosis:* An elongate, somewhat compressed, gobioid fish of moderate depth, tapering posteriorly, depth at caudal peduncle about half that at anal fin origin; dorsal fin single, low, elongate, with flexible anterior spines and with segmented rays behind, first two spines more widely spaced than successors; dorsal fin origin directly above upper angle of gill opening; anal fin long, low, without spines; the two posterior dorsal and anal fin rays approximated or more closely spaced than fellows; caudal fin rounded to subtruncate, free from other median fins and with 15 principal (segmented) rays; pelvic fins inserted slightly but distinctly in advance of pectoral fins; pelvic fins separate to their bases, each with a slender outer spine and two simple rays, the innermost the longer; pectoral fin narrowly rounded, with narrow base and 11 rays. Head moderately long, about 16 percent of standard length (SL); eye lateral, diameter of fleshy orbit about 16-17 percent of head length, distinct, not obscured by a thick covering of skin; snout and lower jaw rounded, not conspicuously narrowed in front; mouth small, upper lip distinct across symphysis; lower jaw deep, fleshy, protruding, includes most of upper jaw and snout tip when mouth is closed; tongue fleshy, narrow, subtruncate or faintly bilobed at tip; gill opening capacious, subtubiform, restricted to pectoral base and peduncle, not continued forward to isthmus; body and much of head with somewhat embedded, non-imbricate cycloid scales; sensory papillae inconspicuous on head and body. Vertebrae total 48-49, caudal elements most numerous; abdominal prezygapophyses low, not distinctly elevated; splint bones above and below the hypural fan; no predorsal interneurals; proximal pterygiophore of 1st dorsal spine reduced, platelike, inserted between 1st and 2nd neural spines; distal pterygiophores begin immediately behind first dorsal segmented ray; no supplementary proximal pterygiophore between last dorsal spine and anteriormost ray; skull poorly ossified and (in radiographs and cleared and stained material) with frontals failing to reach mesethmoid; post-temporals not distinctly elevated above anteriormost vertebrae.

*Relationships:* This genus is unique among the Microdesmidae in having only two segmented pelvic fin rays and the combination of a free caudal fin with 15 segmented rays, subtubiform gill opening, anterior dorsal fin insertion, non-imbricate scales, low vertebral count and lack of a supplemental proximal pterygiophore. It is similar to *Clarkichthys* and certain species of *Microdesmus* [specifically *M. ionthas* (Jordan and Gilbert) and *M. floridanus* (Longley)] especially in respect to total vertebral counts and general morphology of the gill opening, but it is readily separated from these by the aforementioned combination of characters. The reduced number of segmented caudal fin rays (there are 17 in all genera except *Gunnellichthys*) together

with the absence of predorsal interneurals and supplemental proximal pterygiophore are characters common to *Gunnellichthys*. *Paragunnellichthys* appears to be intermediate between *Gunnellichthys* and the *Microdesmus-Clarkichthys* species complex but more closely related to the former.

*Etymology*: *Para* (Gr. near) + *Gunnellichthys*.

*Remarks*: Although a number of microdesmid species were originally described as having but one or two segmented pelvic fin rays, all have been subsequently shown to possess either three or four segmented rays. Re-examination of the types of *Microdesmus carri* Gilbert and *M. suttukusi* Gilbert shows that each has three segmented pelvic fin rays and 17 segmented caudal elements rather than two segmented pelvic fin rays and 13 segmented caudals as described (Gilbert, 1966). Whereas the branching of pelvic rays is evidently ontogenetic in *Gunnellichthys* and the rays are consistently simple in other genera, the number of rays is a stable generic character within the Microdesmidae.

***Paragunnellichthys seychellensis* new species**

(Fig. 1)

*Holotype*: ANSP 103610; 34 mm SL; Mahé Island, Seychelles, NW end of Beau Vallon Bay; from isolated coral outcrop in sand at depth of 20–25 ft; 15 March 1964; Sta. F-114, International Indian Ocean Expedition, Seychelles Islands Program; James E. Böhlke *et al.* coll.

*Paratypes*: ANSP 103615; 29 and 31 mm SL. ANSP 103656; 33 mm SL, cleared and stained. Other data as for holotype.

*Description*: Dorsal spines 16–18, dorsal segmented rays 30–31, total dorsal elements 47–48; anal rays 28–30; pectoral rays 11; pelvic fin I–2; principal caudal rays 15; vertebrae 21 + 27–28 = 48–49. See Table 1 for proportional measurements and counts.

Body moderately elongate, depth at anal fin origin averages 8.4 percent of SL, tapering to about half body depth at caudal peduncle; compressed, breadth at anal fin origin 2.5 percent of SL, greatest breadth (5.5 percent of SL in holotype) at opercle; caudal fin broadly rounded to truncate, averages 10.9 percent of SL; head 15.5–16.0 percent of SL, its depth subequal to that of body; interorbital strongly convex, its width  $\frac{2}{3}$  to  $\frac{3}{4}$  of eye diameter; head tapers evenly to snout tip without a distinct postorbital depression, eye lateral, high on head, its diameter, averaging 16.4 percent of head length, is slightly greater than snout length; lower jaw prominent, extends about  $\frac{2}{3}$  of eye diameter beyond snout tip, fleshy, includes upper jaw and snout tip when mouth is closed, its lateral depth somewhat greater than eye diameter; lower jaw and snout rounded, not conspicuously narrowed at symphysis; gape short, posterior angle reaches a vertical from front margin of posterior naris, inclined to about 45°; upper lip narrow, continuous across symphysis, concealed laterally by lower jaw and by overhanging snout in front; lower lip fleshy, poorly defined, forming pouchlike lateral expansions

which receive upper lips and snout when mouth is closed, discontinuous across symphysis where it is interrupted by a subtriangular, fleshy, dorsal continuation of the chin; anterior naris opens anterolaterally through a short tubule located medially on the anterolateral margin of snout; posterior naris dorsolateral over preorbital, with a slightly elevated margin, hardly tubiform; nares apparently of subequal diameter, about 8 in eye; jaws with an outer series of enlarged, separated, canini-form teeth and apparently one inner series of smaller, more closely spaced teeth; at least some teeth rounded or truncate, others pointed, little recurved; tongue narrow, fleshy, truncate or faintly bilobed at tip.

Gill opening (Fig. 2) capacious, originates on pectoral fin base just anterior to insertion of uppermost pectoral ray, margin curves slightly forward and downward to unite with the lower margin of the rather elongate pectoral peduncle at a point about half the peduncle width anterior to the lower pectoral ray insertion; branchiostegal membranes expanded to form a voluminous fold which, in preserved material, overhangs the pectoral peduncle and conceals the ventral termination of the gill opening; gill opening directed posteriad, somewhat tubiform, and not continued to isthmus. Dorsal and anal fins terminate on the short caudal peduncle, free from caudal fin, tips of terminal rays reach to or just past hypural; dorsal fin originates slightly in advance of pectoral base, just above upper angle of gill opening, interspaces of first two spines about 15 percent longer than those which follow, the first spine a little shorter than its fellows; dorsal segmented rays largely simple but some posterior rays may be branched at tips; first anal element simple and segmented, remaining rays also appear to be simple but some may be finely branched at tips; last two dorsal and anal fin rays may be closely approximated at their bases (in 2), if separated they are more closely spaced than preceding rays; caudal fin formula  $4 + 2 + 11 + 2 + 4$  (counts of procurrent elements from stained paratype); pectoral fin elongate, narrowly rounded, fin rays simple, 5th and 6th the longest, fin base narrow, peduncle elongate and not completely concealed by opercle and gill membranes; pelvic fins (Fig. 3) separate, inserted distinctly in advance of pectoral fins, below or slightly in advance of dorsal fin origin, with two simple rays, the innermost the longer, and a slender outer spine; anal fin origin beneath interspace between dorsal elements 19 and 20 or 20 and 21.

Head with slightly embedded, generally separated, cycloid scales on nape to posterior margin of interorbital region; scales somewhat closer and more abundant on opercle, cheek, infraorbital, branchiostegal membranes and chest; interorbital region, snout, preorbital region and lower jaw apparently naked; body scales similar, non-imbricate but occasionally touching, covering lateral body and predorsal and ventral surface of abdomen except for a small naked area about anal and genital openings; caudal and paired fins naked but with some scales on pectoral

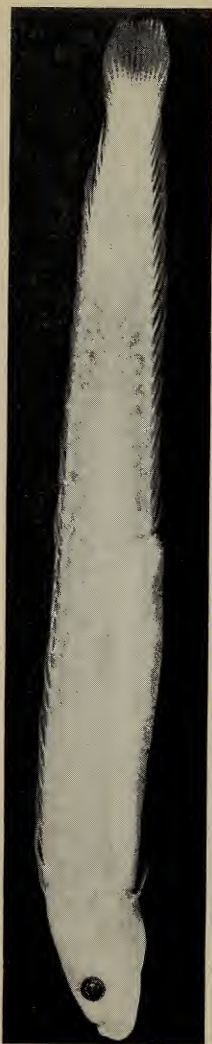


FIG. 1. *Paragunnellichthys seychellenensis*. ANSP 103610; holotype; 34 mm SL.



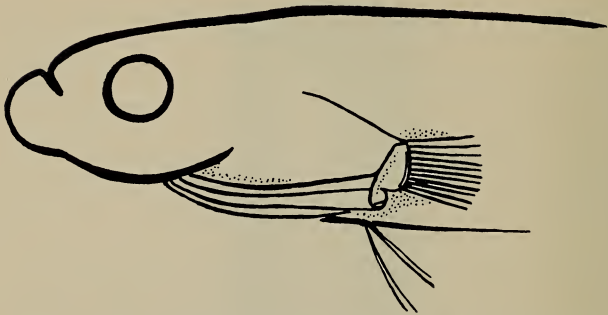


FIG. 2. *Paragunnellichthys seychellensis*. Semi-diagrammatic delineation of gill opening. Anterior dorsal fin elements omitted.

peduncle and continuing into gill opening; body scales inconspicuous but rather large, about 5 in eye diameter.

Dermal sensory papillae inconspicuous, difficult to see; apparently with a transverse interorbital series; a series follows dorsal orbital margin and continues forward onto snout; an indistinct preorbital series margins gape; and there are two separated midlateral rows on the lower jaw paralleling its ventral margin; apparently without prominent rows of papillae on cheek, opercle, infraorbital or body.

No predorsal interneurals. Proximal pterygiophore of 1st dorsal spine (Fig. 4) flattened, subhorizontal, without a descending process, located between 1st and 2nd neural spines; proximal pterygiophore of 2nd spine stronger, chevronlike, with a descending process inserted between 3rd and 4th neural spines and a horizontal process directed anteriorly to terminate between 2nd and 3rd neural spines; subsequent proximal pterygiophores progressively more spinelike, with successive reduction of the horizontal process and with each inserted between succeeding



FIG. 3. *Paragunnellichthys seychellensis*. Semi-diagrammatic delineation of pelvic fin.



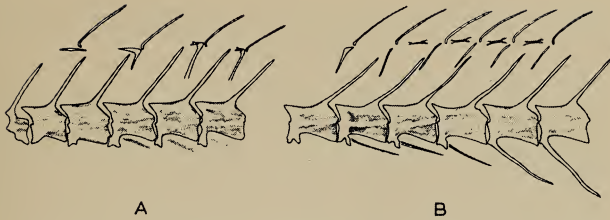


FIG. 4. *Paragunnellichthys seychellensis*. Semi-diagrammatic delineation. A. First five abdominal vertebrae showing dorsal spines and proximal pterygiophores. B. Last four abdominal and first two caudal vertebrae together with last dorsal spine, the five anterior segmented rays, proximal and distal pterygiophores.

neural spines. Distal pterygiophores begin immediately behind the first segmented dorsal ray and after the second anal ray; no supplemental proximal pterygiophore between the last dorsal spine and first ray. Abdominal neural spines strong, slender and pointed, 1st through 3rd somewhat shorter than remainder, which are of subequal length, each located posteriad on centrum; prezygapophyses low, subhorizontal, neither depressed nor dorsally elevated in front; ribs apparently articulate with centra of first two vertebrae, with parapophyses on remaining abdominal vertebrae; ribs gradually increasing in length posteriad to about the 18th vertebra where they are slightly more than twice the vertebral length, subsequent ribs successively shorter; ribs mostly at an attitude of  $45^\circ$ ; epipleurals not visible in radiographs nor are they distinct in the cleared specimen; skull (Fig. 5) short, somewhat elevated, frontals poorly ossified and, in both radiographs and stained material, fail to reach mesethmoid; posttemporals curve well forward and are not distinctly elevated above anteriormost vertebrae; pectoral

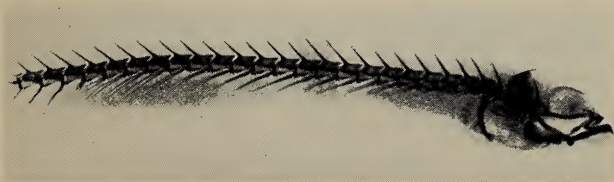


FIG. 5. *Paragunnellichthys seychellensis*. Radiograph of anterior half of ANSP 103610, holotype, showing head, axial skeleton and abdominal ribs.

TABLE 1. Measurements (mm) and counts of *Paragunnellichthys seychellensis*. Figures in parentheses are percentages of standard length or head length.

	ANSP 103610 Holotype	ANSP 103615 Paratype	ANSP 103615 Paratype	ANSP 103656 Paratype	$\bar{X}\%$
Standard length	34.4	29.0	30.9	33.2	10.9
Caudal fin length	3.6(10.5)	3.2(11.0)	3.5(11.3)	—————	
Least caudal peduncle depth	1.5(4.4)	1.3(4.5)	1.3(4.2)	1.4(4.2)	4.3
Body depth at anal fin origin	3.0(8.7)	2.4(8.3)	2.6(8.4)	2.7(8.1)	8.4
Predorsal length to tip of lower jaw	5.9(17.2)	4.7(16.2)	5.3(17.2)	5.4(16.3)	16.7
Preanal length	18.7(54.4)	15.9(54.8)	16.8(54.4)	17.9(53.9)	54.4
Pectoral fin length	3.3(9.6)	2.7(9.3)	3.2(10.4)	3.2(9.6)	9.7
Pelvic fin length	1.7(4.9)	1.2(4.1)	1.6(5.2)	1.5(4.5)	4.7
Distance from pelvic insertion to anal fin origin	13.3(38.7)	11.4(39.3)	12.0(38.8)	12.9(38.9)	38.9
Head length	5.5(16.0)	4.5(15.5)	4.9(15.9)	5.2(15.7)	15.8
Diameter of fleshy orbit	0.9(16.4) <sup>1</sup>	0.7(15.6)	0.8(16.3)	0.9(17.3)	16.4
Distance from anterior margin of eye to tip of lower jaw	1.6(29.1)	1.3(28.9)	1.3(26.5)	1.5(28.8)	28.3
Snout length	0.8(14.5)	0.5(11.1)	0.7(14.3)	0.8(15.4)	13.8
Postorbital length	2.8(50.9)	2.5(55.6)	2.6(53.1)	2.8(53.8)	53.4
Fleshy inter- orbital width	0.6(10.9)	0.5(11.1)	0.6(12.2)	—————	11.4
Tip of lower jaw to angle of gape	1.5(27.3)	1.1(24.4)	1.2(24.5)	—————	25.4
Number of dorsal spines	17	16	18	17	
Number of seg- mented dorsal rays	31 <sup>2</sup>	31	30	30	
Total dorsal elements	48	47	48	47	
Number of anal rays	29	28	29	30	
Anal fin origin beneath interspace between dorsal elements	19/20	20/21	20/21	19/20	

<sup>1</sup> This and following proportions shown in percent of head length.<sup>2</sup> The last two rays of dorsal and anal fins are counted separately.

radials 4, branchiostegal rays 5, the innermost remote; mandible strong, with a short, pointed, terminal ventral process.

Ground color, in alcohol, pale yellow-green; without conspicuous markings; body with a midlateral series of scattered, widely spaced, stellate, brown, micromelanophores from pectoral axil to about 15th anal fin ray; one of the paratypes with small submarginal brown blotches over anterior half of anal fin, these are indistinct even under magnification but suggest the presence of an interrupted anal fin stripe; remaining fins immaculate in all specimens; scales without melanistic margination; eye with black iris and iridescent gray pupil.

The specific name refers to the Seychelles Islands which include the island of Mahé, the type locality.

*Remarks:* Three of the types have enlarged gonads and it is assumed that this is a small species. A partially dissected paratype was found to contain a few, probably less than 200, well-developed ova. These are oval, smooth and each possesses a hyaline tendril; maximum diameters of ten averaged 0.56 mm.

Branching of fin rays is an ontogenetic character in other microdesmids and it is likely that dorsal, anal and pectoral fin rays are branched in larger specimens of *Paragunnellichthys seychellensis*. It is also probable that larger fish have 13 branched caudal rays with a simple ray above and below, a condition presently known only in the genus *Gunnellichthys*.

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PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW SPECIES AND TWO NEW SUBSPECIES OF  
SHRIMP OF THE GENUS *PENAEUS* FROM  
THE WESTERN ATLANTIC

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Many aspects of the biology of various species of *Penaeus* from Atlantic America, particularly of the three most common in North America, have been and continue to be the object of much research. Thus far, however, the information gleaned has little bearing on systematics, and only meager information has been accumulated in this field since Burkenroad (1934, 1939), published his major contributions to the systematics of the genus. He advanced considerably our understanding of the group, but the lack of adequate material prevented him from carrying his work to completion and often from reaching definite conclusions.

I have been able to assemble extensive collections from much of the range of the genus in the western Atlantic, and to carry out biometric studies. Such studies of large series of specimens have revealed several recognizable geographic taxa among the widely ranging species of *Penaeus*. Among them are the species and two subspecies described below. A monograph of the western Atlantic species, subspecies, and subpopulations, including full descriptions and figures, as well as an evaluation of the significant information on the biology of each, is near completion.

The present paper has been made possible through the cooperation of many institutions and individuals. I am particularly indebted to Fenner A. Chace and Horton H. Hobbs for many suggestions, to Daniel M. Cohen for continuous encouragement, and to Harvey R. Bullis for

<sup>1</sup> Isabel C. Canet.



critical material from usually inaccessible localities. Also hearty thanks are due to Maria Manuela Diéguez de Farfante for preparing the drawings included here. The work was done with the support of the Radcliffe Institute for Independent Study, the Bureau of Commercial Fisheries, and the National Science Foundation (Grant No. GB-3907). The various institutions that made material available are cited by abbreviations before each lot to indicate where it is deposited: American Museum of Natural History (AMNH); Centro de Investigaciones Pesqueras, Cuba (CIP); Muséum National d'Histoire Naturelle, Paris (MNHNP); Museum of Comparative Zoölogy, Harvard University (MCZ); University of Miami Marine Laboratory (UMML); United States National Museum (USNM); and Peabody Museum of Natural History, Yale University (YPM).

Particularly useful information pertinent to the species and subspecies described below can be found in the following works: Boschi (1963), Burkenroad (1934, 1939), Davant (1963), Eldred and Hutton (1960), Holthuis (1959), Ives (1891), Lindner (1957), Magalhães (1944), Mistakidis (1965), Ortmann (1891), Pérez Farfante (1953, 1954), Pérez Farfante, Acosta, and Alemany (1961), da Silva (1965), Tremel and Mistakidis (1965).

***Penaeus paulensis* new species**

Fig. 1 a-d

Camarão rosa, ("pink shrimp"); langostino

*Penaeus brasiliensis*: Ortmann, in part, 1891. Zool. Jahr. Abt. Syst. Geogr. Biol. 5(3): 445-449, table 36, Figs. 1 a-c; not *P. brasiliensis* Latreille 1817.

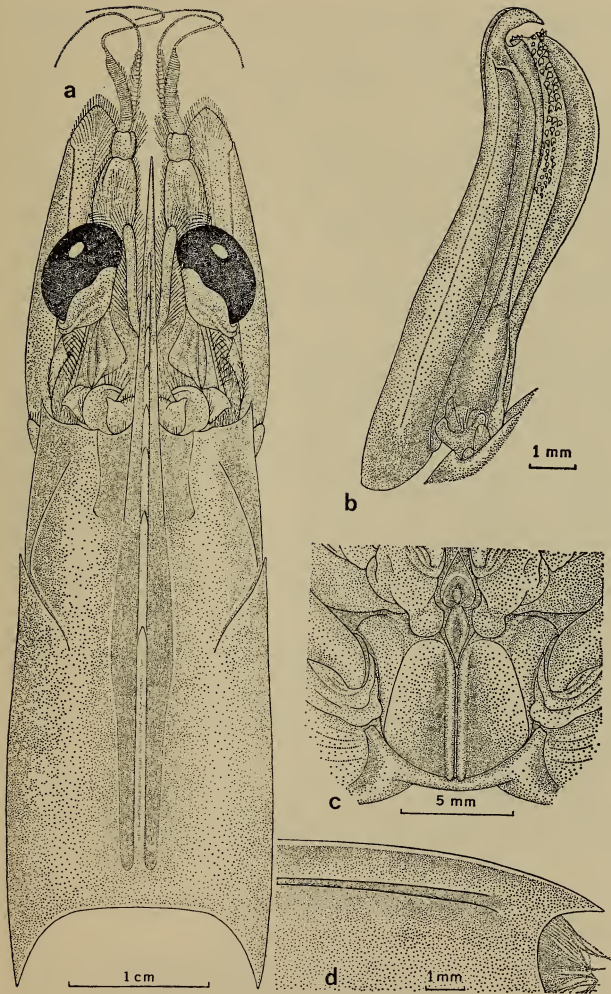
*Penaeus aztecus*: Burkenroad, in part ("Form C"), 1939. Bull. Bingham Oceanogr. Coll. 6, art. 6: 34-45, figs. 32, 33; not *P. aztecus* Ives 1891.

*Holotype*: 1 ♂, USNM 119128, Santos, São Paulo, Brazil, April 1964, M. Vannucci.

*Paratypes*: BRAZIL: RIO DE JANEIRO: 1 ♂, 1 ♀, MNHNP-USNM, off mouth Guanabara Bay, 34-65 fms, 2 December 1961, *Calypso* Sta. 105. 1 ♂, 1 ♀, YPM, Rio de Janeiro. 2 ♂, 2 ♀, USNM, Santana Island, 16 fms, SUDEPE. 1 ♀, USNM, off Rio de Janeiro, 23 August 1925, S. M. Waelsof. SÃO PAULO: 3 ♂, 1 ♀, USNM, off São Sebastião, 20-35 fms, 10 December 1961, *Calypso* Sta. 129. 2 ♂, 2 ♀, MNHNP-USNM, off São Sebastião, 25-30 fms, 10 December 1961, *Calypso* Sta. 130. 3 ♂,

→

FIG. 1. *Penaeus paulensis* n. sp. a, Carapace, holotype ♂ 35 mm c.l., Santos, São Paulo, Brazil. b, Petasma, ♂ 39 mm c.l., S Point do Boi, São Paulo, Brazil. c, Thelycum, ♀ 49.5 mm c.l., Santos, São Paulo, Brazil. d, Sixth abdominal somite (posterodorsal portion), holotype.



MNHNP-USNM, São Sebastião, 11 fms, 11 December 1961, *Calypso* Sta. 135. 2♂, 1♀, MNHNP-USNM, off Point do Boi, 26-40 fms, 11 December 1961, *Calypso* Sta. 136. 12♂, 3♀, MNHNP-USNM, off Point do Boi, 36-30 fms, 11 December 1961, *Calypso* Sta. 137. 2♂, 3♀, USNM, Santos, 8 May 1964, M. Vannucci. 1♂, USNM, Santos, June 1913, H. Leuderwaldt. 1♂, USNM, Santos, 24 October 1949, Carvalho. 11♂, 11♀, USNM, Cananéia, September 1965, V. Sadowski. 4♂, 1♀, MNHNP-USNM, Laje dos Santos Island, 24-75 fms, 14 December 1961, *Calypso* Sta. 143. SANTA CATARINA: 4♂, 5♀, USNM, Lake da Conceição, Santa Catarina Island, 19 November 1965, E. Tremel. 3♂, 3♀, MNHNP-USNM, Zimbros Bay, 16 December 1961, *Calypso* Sta. 148. RIO GRANDE DO SUL: 1♀, MNHNP, off Mostardas, 17 December 1961, *Calypso* Sta. 151. 1♀, MNHNP, off Mostardas, 36-30 fms, 17 December 1961, *Calypso* Sta. 152. 9♂, 13♀, MCZ, Rio Grande, 7 June 1865?, G. Harrington. 3♂, 3♀, MNHNP-USNM, off southernmost end Rio Grande do Sul, 20 December 1961, *Calypso* Sta. 155. URUCUAY: 2♂, 3♀, USNM, Arroyo Balizas, Castillos Lake, 19 April 1961, H. Ferrando. 3♂, 1♀, USNM, Lake de Rocha, 18 April 1961, H. Ferrando. 2♂, 1♀, USNM, Lake de Rocha, 18 April 1961, H. Ferrando.

*Description:* Rostrum short, reaching at least distal half of second antennular segment but not beyond distal end of third, slender and straight in apical portion. Adrostral sulcus (Fig. 1a) broad along entire length, width 1 to 2 times postrostral carina width, long, ending  $\frac{1}{12}$  to  $\frac{1}{20}$  carapace length from posterior margin of carapace. Median sulcus short, ending well anterior to posterior end of adrostral sulcus; shallow, continuous or interrupted, often limited to anterior fossette.

Dorsolateral sulcus (Fig. 1 d) very narrow, relation between keel height and sulcus width (measured at distance about  $\frac{1}{3}$  somite length from posterior margin) 3 to 15, modally 6. K/S (keel/sulcus) relation showing modal value of 6 for all size classes of both sexes.

Third pereopod short, reaching at least distal third of second but not beyond distal end of third antennular segment, shorter in larger individuals.

Petasma (Fig. 1 b): Ventral costa broad and blunt at distal end, extending proximally in extremely slight curve or almost straight line, with free distal border even or with faintly undulating flange; group of medium sized, irregularly set teeth close to apex. Membranous portion of ventrolateral lobule with band of spines, very narrow distally, moderately wide proximally. Distal fold of lateral lobe armed with prominent spinules.

Thelycum (Fig. 1 c): Apical process typically very narrow, bordered by nearly triangular or highly arched ridge, with knob often at center of slightly concave ventral surface. Posterior protuberance with median carina bifurcated anteriorly, forming two ridges converging at apical process, resulting in narrow, diamondshaped structure. Lateral plates

with anteromedian angles divergent, leaving posterior protuberance exposed.

*Color*: Usually pinkish, thus the name camarão rosa ("pink shrimp") is applied to it in different localities within its range.

*Size*: The largest female examined was 54 mm c.l., 215 mm t.l., and the largest male, 40 mm c.l., 171 mm t.l.

*Distribution*: *P. paulensis* ranges from south of Cape Frio along the coast of Brazil to Lake de Rocha and, according to Burkenroad (1939), as far south as Montevideo, Uruguay. The specimen mentioned by Boschi (1963) in the Museo Bernardino Rivadavia, in Buenos Aires, labeled "North Patagonia," may possibly be a straggler from waters farther north.

*Name*: I have named this species for São Paulo State, Brazil, where it is fished commercially in large quantities offshore as well as in the estuarine waters along the coast.

*Remarks*: *P. paulensis* is closely allied to *P. aztecus aztecus* from northern waters and *Penaeus aztecus subtilis* (see below) from the Caribbean Sea and the Atlantic off northern-eastern South America. It differs from both by the narrower dorsolateral sulcus in which both lips are sharp and by the external genitalia. Females have the apical process and the posterior protuberance of the thelycum much narrower than in *P. a. aztecus* and *P. a. subtilis*, and in the males the ventral costa of the petasma is almost straight or only slightly curved rather than markedly convex distally; and also is armed close to the apex with a group of teeth of moderate size and irregularly set, instead of a compact, elongated patch of small teeth on the attached edge of the ventral costa as is typical of the two subspecies of *P. aztecus*. It also differs from *P. a. aztecus* by the shorter, shallower, and often interrupted median sulcus, and shorter third pereopod; and from *P. aztecus subtilis* by the broader adrostral sulci.

Burkenroad (1939) referred to this shrimp as *Penaeus aztecus* Ives "Form C," which he distinguished from the typical *P. aztecus* by characters other than the external genitalia; however, both the thelycum and particularly the petasma are characteristic. Consequently, I consider this southern *Penaeus* a distinct species. The female *P. aztecus* "Form C" recorded by Burkenroad from Pernambuco is most likely a specimen of *P. a. subtilis* in which the adrostral sulcus is narrow, the width at the lowest limit of its range of variation.

#### ***Penaeus aztecus subtilis* new subspecies**

(Fig. 2 a-b; Fig. 3 a-c)

Langostino amarillo, ("yellow shrimp"); camarón marrón ("brown shrimp"); short feelered prawn; sara-sara; camarão lixo, ("dark shrimp"); camarão branco ("white shrimp").



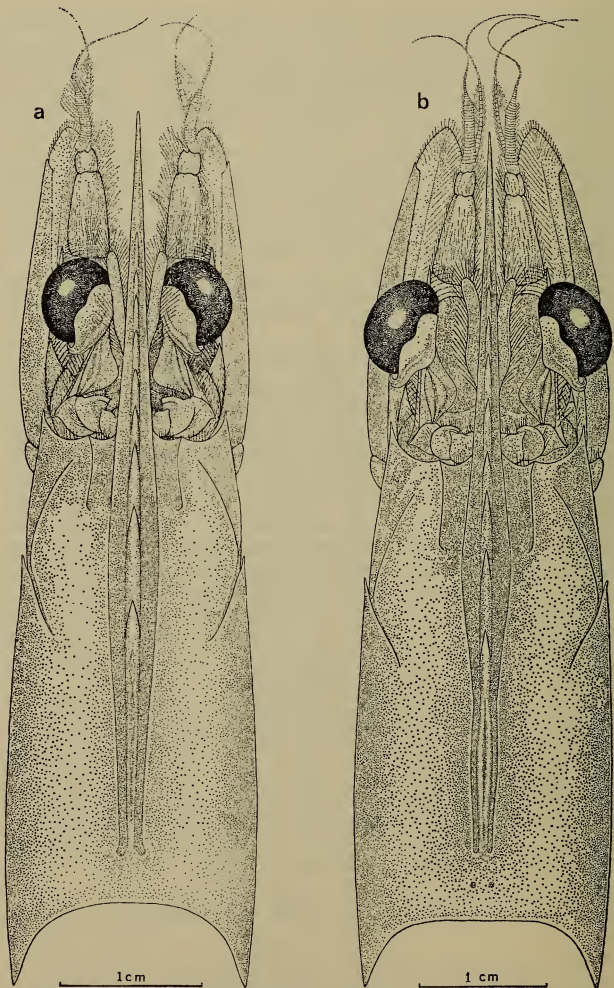
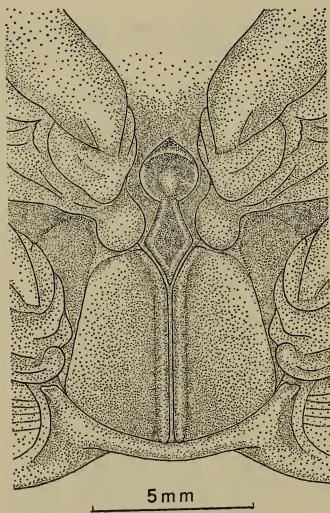


FIG. 2. *Penaeus aztecus subtilis* n. subsp. *a*, Carapace, ♀ 36 mm c.l., Gulf of Venezuela. *b*, Carapace, ♀ 35 mm c.l., off mouth Surinam River, Surinam.

*Penaeus aztecus* Ives, Burkenroad in part ("Form B"), 1939. Bull. Bingham Oceanogr. Coll. 6: 34-52 Figs. 28, 29.

*Holotype*: ♂, USNM 119130, off Gallinas Point, Departamento de la Guajira, Colombia, 95 fms, 9 October 1965, *Oregon* Sta. 5685, 12°29' NL, 71°54' WL.

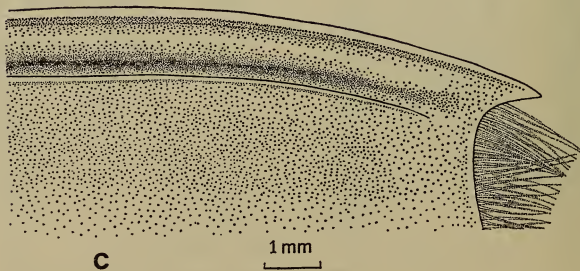
*Paratypes*: CUBA: 1 ♀, USNM, Doctor Lagoon, Baracoa Beach, Havana, 1958, G. Mayor. 1 ♂, 2 ♀, USNM, Canímar River, Matanzas, 1954, C. Sánchez. 1 ♂, USNM, Key Francés, Caibarién, 300 fms [?], M. S. Roig. JAMAICA: 3 ♂, 1 ♀, YPM, western end Kingston Harbor, 4 feet, 1 February 1934. 5 ♂, 4 ♀, YPM, Kingston Market, 1 February 1934. 16 ♂, 11 ♀, USNM, 1-11 March 1884, *Albatross*. 1 ♂, 1 ♀, USNM, Montego River (1 mile from sea), 11 July 1916, C. B. Wilson. HAITI: 1 ♂, USNM, Port au Prince, 8 November 1965, A. Curtis. SANTO DOMINGO: 1 ♀, USNM, Puerto Plata, Ch. H. Fraser. PUERTO RICO: 3 ♂, 1 ♀, USNM, Mayagüez Harbor, 75-76 fms, 19-20 January 1899, *Fish Hawk*. 1 ♂, 4 ♀, USNM, Puerto Real, 26 January 1899, *Fish Hawk*. 1 ♂, 4 ♀, USNM, Hucares, 13-14 February 1899, *Fish Hawk*. VIRGIN ISLANDS: ST. CROIX: 12 ♂, 11 ♀, USNM, 27 January 1937, H. A. Beatty. 5 ♂, 3 ♀, USNM, Envy Bay, January 1938, H. A. Beatty. ST. JOHNS: 5 ♂, 2 ♀, AMNH, *Antares* Expedition, W. Beebe. LESSER ANTILLES: ANTIGUA: 1 ♂, USNM, English Harbor, 4-9 April 1956, Smithsonian Bredin Expedition, Sta. 83-56, F. A. Chace and D. V. Nicholson. 1 ♀, USNM, Tank Bay, English Harbor, 3 April 1956, Smithsonian Bredin Expedition, Schmitt, Chace, Nicholson and Jackson. ST. LUCIA: 3 ♂, 7 ♀, USNM, Port Castries, 2 December 1887. ARUBA-CURAÇAO: 1 ♂, USNM, off Aruba, 40 fms, 3 October 1965, *Oregon* Sta. 5656. Curaçao: 1 ♂, 2 ♀, USNM, 10-18 February 1884, *Albatross*. NICARAGUA: 1 ♂, USNM, Bluefields, 1965, A. Flores. PANAMA: 5 ♂, 6 ♀, USNM, Fox Bay, Colón, 3 January 1911, S. E. Meek and S. F. Hildebrand. COLOMBIA: OLD PROVIDENCE ISLAND: 1 ♂, USNM, 4-9 April 1884, *Albatross* Sta. 2149-2150. 31 ♂, 23 ♀, YPM, Sabanilla, 16-22 March 1884, *Albatross*. 3 ♂, 7 ♀, USNM, off Puerto Colombia, 8-9 fms, 3 May 1964, *Oregon* Sta. 4867. 1 ♂, USNM, off Barranquilla, 75 fms, 17 May 1964, *Oregon* Sta. 4845. 2 ♂, 2 ♀, USNM, off Barranquilla, 40 fms, 18 May 1964, *Oregon* Sta. 4851. 1 ♀, USNM, off Faro Point, 13-14 fms, 18 May 1964, *Oregon* Sta. 4849. 7 ♂, 3 ♀, USNM, off Faro Point, 60-65 fms, 18 May 1964, *Oregon* Sta. 4852. 1 ♂, 7 ♀, USNM, off Ciénaga, 50 fms, 17 May 1964, *Oregon* Sta. 4846. 1 ♀, USNM, off Cape la Vela, 100 fms, 1 June 1964, *Oregon* Sta. 4913. 2 ♂, 1 ♀, USNM, off Departamento de la Guajira, 105 fms, 8 October 1965, *Oregon* Sta. 5684. 1 ♂, 5 ♀, USNM, off Gallinas Point, Departamento de la Guajira, 95 fms, 9 October 1965, *Oregon* Sta. 5685. VENEZUELA: 27 ♂, 28 ♀, USNM, Barranquita, Lake of Maracaibo, 23 April 1964, J. J. Ewald. 8 ♀, USNM, Gulf of Venezuela, 12 June 1964, *Fioveca*, J. J. Ewald. 3 ♂, 6 ♀, USNM, off Las Piedras, Gulf of Venezuela, 26 fms, 5 October 1965,



a



b



c



Oregon Sta. 5664. 1 ♀, USNM, off Mariusa Island, 13–15 fms, 26 August 1958, Oregon Sta. 2211. 5 ♀, USNM, off Boca Araguao, 9–10 fms, 27 August 1958, Oregon Sta. 2215. TRINIDAD: 1 ♀, USNM, off Casa Cruz, 20–22 fms, 26 August 1958, Oregon Sta. 2207. 1 ♂, 1 ♀, UMML, Icacos Point, March 1951, Antilles. 1 ♂, 1 ♀, UMML, Icacos Point, 19 January 1953, Antilles. 5 ♀, USNM, Gulf of Paria, February–October 1944, Anglo-American Caribbean Comm., R. T. Whiteleather and H. H. Brown. 2 ♀, USNM, Maturin Bar, off Point Barrial, Gulf of Paria, 26 April 1944, Anglo-American Caribbean Comm., R. T. Whiteleather and H. H. Brown. GUYANA: 1 ♂, USNM, off Marlborough, 20–25 fms, 30 August 1958, Oregon Sta. 2215. 3 ♂, 6 ♀, USNM, off Demerara Beacon, 11–22 July 1944, R. T. Whiteleather and H. H. Brown. SURINAM: 4 ♂, 7 ♀, USNM, off mouth Surinam River, 15 fms, 11 May 1957, Coquette Sta. 2. 1 ♂, 1 ♀, USNM, NE of mouth Surinam River, 30 fms, 30 May 1957, Coquette Sta. 36. 4 ♂, 1 ♀, USNM, NE of mouth Surinam River, 14 fms, 30 May 1957, Coquette Sta. 144. 1 ♂, USNM, between mouths of Coppename and Surinam Rivers, 15 fms, 6 June 1957, Coquette Sta. 172. 7 ♂, 13 ♀, USNM, off Surinam, 50 fms, 2 November 1957, Oregon Sta. 2016. FRENCH GUIANA: 2 ♂, 11 ♀, USNM, off Isère Point, 34 fms, 14 September 1958, Oregon Sta. 2322. BRAZIL: AMAPÁ: 4 ♀, USNM, Cape do Norte, 30 fms, J. F. Filho. PARÁ: 1 ♀, USNM, 100 miles off Cape Magari, 4 July 1965, J. F. Filho. 3 ♂, 25 ♀, USNM, off Salinópolis, 12 fms, 8 March 1963, Oregon Sta. 4215. PARÁ-MARANHÃO: 1 ♂, 1 ♀, USNM, June–July 1965, J. F. Filho. MARANHÃO: 2 ♂, 2 ♀, USNM, 27 June 1965, J. F. Filho. 1 ♀, USNM, off Paulino Neves, 20 fms, 11 March 1963, Oregon Sta. 4236. 12 ♂, 20 ♀, USNM, F. E. Sawyer. CEARÁ: 1 ♀, USNM, off Melancia, 20 fms, 16 March 1963, Oregon Sta. 4171. 1 ♂, 1 ♀, USNM, off Camocim, 15 fms, 12 March 1963, Oregon Sta. 4247. 1 ♂, USNM, off Camocim, 18 fms, 12 March 1963, Oregon Sta. 4250. 1 ♂, 1 ♀, USNM, Fortaleza, J. F. Filho. RIO GRANDE DO NORTE: 2 ♀, USNM, 1 February 1965, C. C. Neto. PERNAMBUCO: 10 ♂, 8 ♀, USNM, Public Market, San José, Recife, 10 August 1964, Ex. P. Alves Coêlho. ALAGOAS: 2 ♂, 2 ♀, MNHNP, Maceió, 2 $\frac{1}{2}$ –3 $\frac{1}{4}$  fms, 22 November 1961, Calypso Sta. 35. SERGIPE: 2 ♂, 6 ♀, MNHNP–USNM, off Aracajú, 26 $\frac{1}{2}$ –31 $\frac{1}{2}$  fms, 23 November 1961, Calypso Sta. 42. 6 ♂, 14 ♀, USNM, mouth Agua Azeda River, Nossa Senhora do Socorro, 9 March 1966. BAHIA: 22 ♂, 18 ♀, USNM, Itaparica, 11 March 1966, A. Barreto. 6 ♂, MNHNP–

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FIG. 3. *Penaeus aztecus subtilis* n. subsp. *a*, Thelycum, ♀ 45.5 mm c.l., off Isère Point, French Guiana. *b*, Petasma, ♂ 34 mm c.l., off Gallinas Point, Departamento de la Guajira, Colombia. *c*, Sixth abdominal somite (posterodorsal portion), ♀ 36 mm c.l., Gulf of Venezuela.

USNM, off Bahia, 27–28 fms 24 November 1961, *Calypso* Sta. 35. ESPIRITO SANTO: 6 ♂, 10 ♀, MNHNP–USNM, Anchieta, 30 November 1961, *Calypso* Sta. 92. UNITED STATES: FLORIDA: 1 ♂, YPM, Key Largo, 19 March 1934, M. B. Bishop, *Atlantis* [?].

*Description:* Rostrum long, reaching at least to distal end on antennular peduncle and at most to distal third of thickened portion of antennular flagellum, sinuous in shape, with apical portion markedly upturned. Adrostral sulcus (Figs. 2 a–b) narrow, width  $\frac{1}{5}$ – $\frac{3}{4}$  postrostral carina width, either tapering to a point posteriorly or turning laterally and broadening slightly at end, and usually short, ending  $\frac{1}{6}$ – $\frac{1}{15}$  of carapace length from posterior margin of carapace. Median sulcus shallow, often interrupted, ending well anterior to posterior end of adrostral sulcus.

Dorsolateral sulcus (Fig. 3 c) variable in width, usually narrow; relation between keel height and sulcus width 2 to 8, modally 3.5.

Third pereopod relatively short, reaching only distal half of second antennular segment, at most exceeding peduncle by entire dactyl length.

Petasma (Fig. 3 b): Ventral costa curving proximally in gentle arc with distal portion unarmed along free border, two to three series of small teeth arranged in compact patch on attached border. Membranous portion of ventrolateral lobule extensively covered with spines. Distal fold of free margin of lateral lobe small, plain or armed with numerous spinules.

Thelycum (Fig. 3 a): Apical process projecting ventrally in sharp, broad, low-arched ridge which surrounds moderately concave surface with small knob usually present at center; posterior protuberance wide, with anteriorly bifurcate median carina, resulting ribs turning medially and converging at apical process, giving rise to diamondlike structure; surface enclosed by this structure plain or bearing median rib anteriorly, posteriorly or along entire length. Lateral plates with anteromedian angles divergent, leaving posterior protuberance exposed.

*Color:* *P. aztecus subtilis*, although of variable color, is most often brown, thus the name camarón marrón (“brown shrimp”) in Venezuela, and camarão lixo (“dark shrimp”) in Brazil. Yellowish specimens are rather common, and in some localities individuals are translucent pale yellow and are called camarão branco (“white shrimp”) in Brazil.

*Size:* The largest female examined was 55 mm c.l., 205 mm t.l., and the largest male 36 mm c.l., 152 mm t.l. Holthius (1959) reported a larger male, 187 mm t.l.

*Distribution:* This subspecies ranges from Cuba along the arc of the Antilles, and from south of Cape Catoche throughout the Caribbean coast of Central and South America, and along the northern and eastern coast of South America, to at least Cape Frio, Brazil. Burkenroad (1939) identified and illustrated some specimens from “Rio de Janeiro.”

*Name:* The name *subtilis* was suggested by the narrow and shallow adrostral sulci and the delicate, often indistinct and interrupted median sulcus.

*Remarks:* This subspecies differs rather strikingly from typical *P. aztecus*, the brown shrimp from the western Atlantic and the Gulf of Mexico. *P. a. subtilis* has a shallow, often interrupted and short median sulcus, instead of a deep, continuous, and long one as in *P. a. aztecus*; the adrostral sulci are very narrow and are either tapering or turned laterally posteriorly, rather than deep, long, broad, and of rather uniform width as they are on *P. a. aztecus*. The dorsolateral sulcus, although of variable width, is usually narrow, with a modal relation K/S of 3.5, whereas in *P. a. aztecus* it is wide, K/S modal 1.25. Finally, the third pereopod of *P. a. subtilis* is much shorter than that of *P. a. aztecus*.

*P. a. subtilis* may be separated from its close relative *P. paulensis* by the longer, sinuous rostrum and by the narrow adrostral sulcus. In males of *P. a. subtilis* the distal portion of the ventral costa of the petasma is strongly convex and armed with an elongated patch of closely set small teeth, very different from the almost straight costa provided with irregularly set, moderately strong apical teeth of *P. paulensis*. In females of *P. a. subtilis* the apical process and diamond-like structure on the posterior protuberance are much wider.

Burkenroad (1939) referred to this subspecies as *P. aztecus* "Form B." The study of extensive collections from throughout its range has indicated that it differs from *P. aztecus* from northern waters by constant characteristics; consequently I consider each population a geographical subspecies. Burkenroad, in the same publication, recorded one specimen of *P. aztecus* "Form B" from the Atlantic of "North America" and another (at Yale Peabody Museum of Natural History) from Key Largo, Florida. I have examined the latter, and it undoubtedly belongs to the southern subspecies; however, the accompanying label reads "*Atlantis*, March 19, 1934," and William C. Schroeder, from the Woods Hole Oceanographic Institute, has kindly informed me that the *Atlantis* was at Woods Hole on that date. It seems most unlikely that the error can ever be rectified. I strongly doubt that either of the North American specimens has been labeled correctly, because in the enormous collections from the northwestern Atlantic examined, I have not found the southern subspecies nor is there any reference in the literature other than Burkenroad's to its presence in northern waters.

The population of *P. a. subtilis* extending from the Gulf of Paria approximately to off Camocim, Brazil, shows some characteristics by which it can usually be distinguished from the population of this subspecies from the Caribbean region and that from northern South America and eastern Brazil. The former has the adrostral sulcus shorter (ending  $\frac{1}{6}$  to  $\frac{1}{11}$  of the carapace length from the posterior margin of the carapace), much shallower, and more tapering posteriorly; also the

rostrum is longer and more distinctly sinuous. Many individuals, however, have a faint linear indication of the posterior portion of a longer adrostral sulcus. In addition, at both ends of the range of this population (in the Gulf of Paria and off Camocim), specimens showing the above characters are intermingled with specimens that have a longer and wider adrostral sulcus and a slightly shorter and less sinuous rostrum. Furthermore, in Colombia and Venezuela, the ranges of variation of the length and width of the adrostral sulcus and the length of the rostrum intergrade with those characters in specimens from the Gulf of Paria to northeastern Brazil. Too, the relation K/S ranges to a higher value in the latter population (2-8) than in the former (2-5); K/S modal value is almost the same, however, in both: 3 and 3.5, respectively. It thus seems that these are different populations of *P. a. subtilis* and that environmental conditions might be acting to produce the characters observed.

***Penaeus duorarum notialis* new subspecies**

Fig. 4 a-d

Camarón acaramelado ("candied shrimp"); langostino amarillo ("yellow shrimp"); camarón rosado sin mancha ("pink spotless shrimp"); camarón cocinero ("cook shrimp"); camarón carbonero, ("coal carrying shrimp"); langostino or camarón rosado ("pink shrimp").

*Penaeus brasiliensis*: auct. in part; not *Penaeus brasiliensis* Latreille, 1817.

*Penaeus duorarum* Burkenroad in part ("Form B"), 1939. Bull. Bingham Oceanogr. Coll. 6, art. 6: 31-52, Figs. 18, 19, 26, 27.

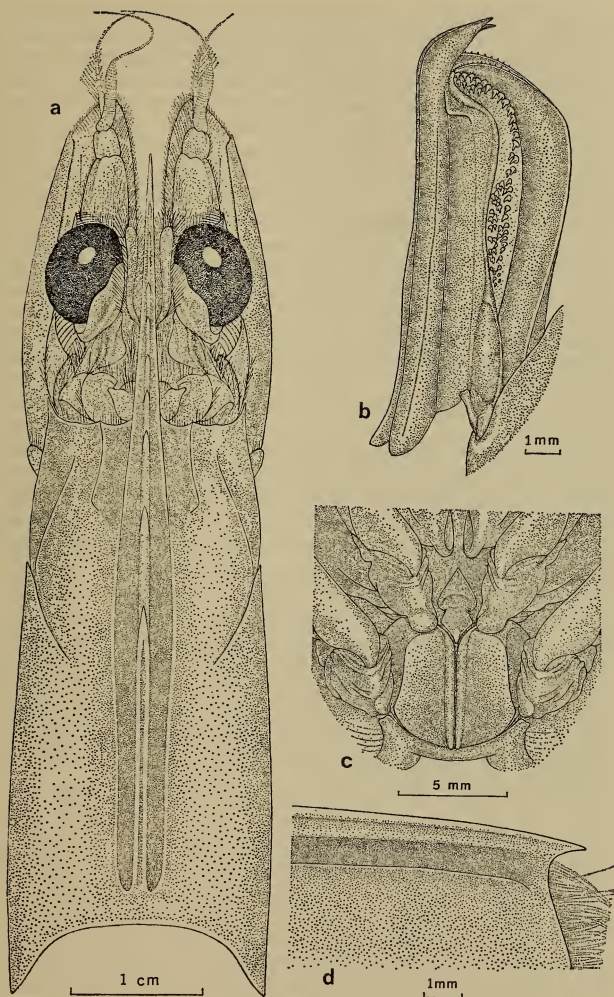
*Holotype*: 1 ♂, USNM 119132, off Las Piedras, Gulf of Venezuela, 26 fms, 5 October 1965, Oregon Sta. 5664, 11°44'N, 70°22'W.

*Paratypes*: CUBA: 2 ♂, 3 ♀, CIP, Mariel, 17 November 1953, I. Pérez Farfante. 1 ♂, USNM, Cape San Antonio-Cape Cajón, 2-12 fms, 24 May 1914, Thomas Barrera. 3 ♂, 3 ♀, USNM, Doctor Lagoon, Baracoa Beach, 1952, J. Mayor. 1 ♂, YPM, Siguanea Bay, Island of Pines, 6 April 1925, Pawnee. 1 ♂, 1 ♀, USNM, Siguanea Bay, Island of Pines, 1954, G. Canet and I. Pérez Farfante. 23 ♂, 28 ♀, CIP, Gulf of Batabanó, 2-6 fms, December 1954, Aida, G. Canet and I. Pérez Farfante. 5 ♂, 7 ♀, CIP, Mouth Yumurí River, Matanzas Bay, 1954, C. Sánchez. 10 ♂,

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FIG. 4. *Penaeus duorarum notialis* n. subsp. *a*, Carapace, holotype ♂ 41.5 mm c.l., off Las Piedras, Gulf of Venezuela. *b*, Petasma, ♂ 34 mm c.l., off Las Piedras, Gulf of Venezuela. *c*, Thelycum, ♀ 38 mm c.l., off Las Piedras, Gulf of Venezuela. *d*, Sixth abdominal somite (posterodorsal portion), ♀ 42 mm c.l., off Great Pedro Bluff, Jamaica.





38 ♀, CIP, Tunas de Zaza, 17 June 1954, *Camarón II*, G. Canet and T. Sánchez. 3 ♂, 2 ♀, USNM, Cienfuegos Bay, 1954, G. Canet and I. Pérez Farfante. 1 ♂, 4 ♀, CIP, Nuevitas, 1954, J. Suárez Caabro. 6 ♂, 22 ♀, CIP, Sevilla Keys, August 1955, *Camarón II*, G. Canet and I. Pérez Farfante. 1 ♂, YPM, Guantánamo Bay, 22 April 1933, *Atlantis*. JAMAICA: 21 ♂, 31 ♀, USNM, 1–11 March 1884, *Albatross*. 1 ♂, YPM, 1–11 March 1884, *Albatross*. 1 ♂, 6 ♀, YPM, Kingston Market, 1 February 1934. 4 ♂, YPM, Kingston, 26 February 1937, I. H. Olsen. 9 ♂, 5 ♀, USNM, 22 fms, 15 May 1962, *Oregon Sta.* 3545. 8 ♂, 5 ♀, USNM, off Great Pedro Bluff, 11–12 fms, 18 May 1965, *Oregon Sta.* 5395. 141 ♂, 71 ♀, USNM, off Great Pedro Bluff, 12–13 fms, 18 May 1965, *Oregon Sta.* 5396. HAITI: 12 ♂, 6 ♀, AMNH, Bizeton, 1 March 1927, W. Beebe. 1 ♂, 1 ♀, AMNH, Port au Prince, 1927, W. Beebe. PUERTO RICO: 2 ♀, USNM, off San Juan, 40 fms, 29 September 1959, *Oregon Sta.* 2625. 1 ♀, USNM, Mayagüez Bay, winter 1965, *Carite*, P. W. Glynn. VIRGIN ISLANDS: TÓRTOLA: 1 ♂, 3 ♀, USNM, 27 fms, 27 September 1959, *Oregon Sta.* 2612. St. CROIX: 2 ♂, 4 ♀, USNM, Kranse lagoon, H. A. Beatty. St. JOHNS: 1 ♂, 1 ♀, AMNH, 1932, *Antares Expedition*, W. Beebe. ARUBA-CURAÇAO: 4 ♂, 2 ♀, USNM, 1937, P. W. Hummelinck. HONDURAS: 22 ♂, 20 ♀, USNM, off Ceiba, May 1966, R. Flores. 2 ♂, 1 ♀, YPM, Turneffe Cay, Gulf of Honduras, 21 April 1925, *Pawnee II*. 9 ♂, 12 ♀, USNM, Caratasca, May 1966, R. Flores. NICARAGUA: 2 ♀, USNM, Bluefields, 1965, A. Flores. PANAMA: 3 ♂, 3 ♀, USNM, Bocas del Toro, 15 fms, 28 April 1963, *Pelican Sta.* 800. 1 ♀, USNM, Fox Bay, Colón, 31 March 1911, S. E. Meek and S. F. Hildebrand. 3 ♂, 2 ♀, USNM, Fox Bay, Colón, 22 January 1912, S. E. Meek and S. F. Hildebrand. 6 ♂, 12 ♀, USNM, Fox Bay, Colón, 22 March 1912. 9 ♂, 1 ♀, YPM, Sweetwater River, Limón Bay, Canal Zone, 12 February 1934. COLOMBIA: 14 ♂, 23 ♀, USNM, Gulf of Urabá, 34 fms, 17 October 1965, *Oregon Sta.* 5728. 6 ♂, 6 ♀, USNM, off Cape Tiburón, Gulf of Darién, 43 fms, 18 October 1965, *Oregon Sta.* 5731. 6 ♂, 13 ♀, USNM, Gulf of Morrosquillo, 23 fms, 25 May 1964, *Oregon Sta.* 4886. 1 ♀, YPM, Sabanilla, 16–22 March 1884, *Albatross*. 10 ♂, 6 ♀, USNM, off Barranquilla, 40–50 fms, 19 May 1964, *Oregon Sta.* 4857. 1 ♂, 2 ♀, USNM, off Ciénaga, 50 fms, 17 May 1964, *Oregon Sta.* 4846. 1 ♀, USNM, off Departamento de la Guajira, 40 fms, 25 September 1963, *Oregon Sta.* 4395. VENEZUELA: 9 ♂, 10 ♀, USNM, off Las Piedras, Gulf of Venezuela, 26 fms, 5 October 1965, *Oregon Sta.* 5684. 10 ♂, 2 ♀, USNM, Gulf of Venezuela, 12 June 1964, *Fioveca*, J. J. Ewald. 1 ♀, UMML, off Boca Tuy, 1962, Tovar. 1 ♀, USNM, off Araguapiche Point, 2–22 fms, 26 August 1958, *Oregon Sta.* 2207. GUYANA: 1 ♀, USNM, off Demerara, 11–22 July 1944, Anglo-American Caribbean Comm., R. J. Whiteleather and H. H. Brown. SURINAM: 1 ♂, USNM, off westernmost end Surinam, 21 fms, 19 February 1963, *Oregon Sta.* 4169. 1 ♀, USNM, NE mouth Surinam River, 23 fms, 12 May 1957, *Coquette Sta.* 27. BRAZIL: MARANHÃO: 1 ♀, USNM, F. E. Sawyer.

*Description:* Rostrum relatively short, reaching at least distal third of second and at most distal end of third antennular segment, high and straight apically. Adrostral sulcus (Fig. 4 a) broad,  $\frac{4}{5}$  to  $1\frac{1}{2}$  postrostral carina width, wider at level of epigastric spine, width either uniform or slightly narrowing at posterior end, and long, ending  $\frac{1}{4}$  to  $\frac{1}{20}$  carapace length from posterior margin of carapace. Median sulcus deep along entire length, and long, ending immediately anterior to posterior end of adrostral sulcus.

Dorsolateral sulcus (Fig. 4 d) broad, relation between keel height and sulcus width ranging from 0.25 to 3, modally 1.75.

Third pereopod relatively long, exceeding antennular peduncle by half length of dactyl to  $\frac{1}{8}$  length of carpus.

Petasma (Fig. 4 b): Ventral costa broadening and turning proximally abruptly, distal portion armed with minute spines along free border and compact group of large teeth on attached border. Membranous portion of ventrolateral lobule with narrow band of spines, consisting of single series distally and three or four rows abreast proximally. Distal fold of free margin of lateral lobe small, either unarmed or with few marginal spinules.

*Thelycum* (Fig. 4 c): Apical process bordered by strongly convex, sharp ridge, surrounding rather strongly concave ventral surface. Posterior protuberance bearing single, prominent median carina, extending anteriorly toward apical process. Lateral plates with anteromedian corners slightly divergent, leaving median carina exposed.

*Color:* Although variable in color, *P. d. notialis* is most frequently light brown, thus the name langostino amarillo in Venezuela, and camarón acaramelado ("candied shrimp") in Cuba. In certain areas it is pink and is known as camarón rosado ("pink shrimp") and in others it is very dark brown and is called camarón carbonero ("coal carrying shrimp"), or camarón cocinero ("cook shrimp").

In the West Indies this subspecies, like the typical *P. duorarum* from northern waters, usually has a dark, reddish brown spot on each side at the juncture of the third and fourth abdominal somites. In northern South America, however, *P. d. notialis* consistently seems to lack these lateral spots.

*Size:* The largest female examined was 48 mm c.l., 192 mm t.l., and the largest male 41 mm c.l., 175 mm t.l.

*Distribution:* *P. d. notialis* ranges from Cuba throughout the Greater Antilles to the Virgin Islands, and from Belize, British Honduras, along the Caribbean coast of Central and South America, and the Atlantic coast of northern South America to São Luis, Brazil. It seems to be absent from northeastern Brazil, because it has not been reported nor have I found it in the series examined from Parnaíba to Bahia. *P. d. notialis* appears again in Ilheus and extends south to Cape Frio. There thus seem to be two discrete populations of "candied shrimp," one in



the Caribbean Sea and Atlantic coast of northern South America, and another along the coast of eastern Brazil, from Ilheus to Cape Frio.

This subspecies is very abundant in some areas in the Caribbean region, apparently is extremely scarce along the Guianas and northern Brazil, but becomes abundant again in the southernmost portion of its range.

*Name:* The name is from the Latin *notialis*, meaning *southern*, and refers to its distribution in relation to typical *P. duorarum*.

*Remarks:* The dorsolateral sulcus of *P. d. notialis* is wider than that of *P. d. duorarum* from the northwestern Atlantic and the Gulf of Mexico. Burkenroad (1939) pointed out this difference between the two stocks and called the latter "Form A" and the former "Form B." The biometric studies I made have indicated a highly significant statistical difference in the relation between the height of the keel and the width of the adrostral sulcus: in *P. d. notialis* K/S ranges from 0.25 to 3, modally 1.75, in *P. d. duorarum* K/S ranges from 2.5 to 15, modally 4.5. In addition, overlapping is very limited; in only a few specimens of *P. d. notialis* from south Cuba does K/S reach 3, and in all the rest of the numerous specimens examined by me, including those from north Cuba, K/S is less than 2.5. *P. duorarum* from the Caribbean region and northern and middle portions of South America is distinct from *P. duorarum* from northern waters. It should be emphasized that the two stocks, each with a long pelagic larval phase, do not seem to mix across the Gulf Stream.

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PROCEEDINGS  
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A NEW INSULAR SUBSPECIES OF SPINY POCKET  
MOUSE (MAMMALIA; RODENTIA)

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Recent work on islands in the northern part of the Gulf of California, Baja California, Mexico, has revealed the presence of two previously unreported populations of Spiny Pocket Mouse, *Perognathus spinatus* Merriam. These populations seem not to differ from one another, but they are recognizably distinct from others on nearby islands and on the peninsula of Baja California.

*Perognathus spinatus lorenzi* new subspecies

*Holotype*: Adult male, San Diego Natural History Museum no. 19901, collected on South San Lorenzo Island (28° 36' N lat., 112° 51' W long.), Gulf of California, Baja California, Mexico, 22 October 1964, by Richard C. Banks; original number 2366.

*Diagnosis*: Similar in size to *P. s. guardia* Burt of Angel de la Guarda Island to the north, but darker in color and with a shorter, shallower skull. Lighter in color and much smaller than *P. s. prietae* Huey of the nearby mainland of Baja California. Somewhat larger than *P. s. evermanni* Nelson and Goldman of Mejía Island and brownish rather than gray in overall coloration. Distinguished from all these populations by the extremely dark dorsal tail stripe and by the shorter, shallower skull.

*Measurements of holotype in mm*: Total length, 169; tail length, 93; hind foot, 20; ear, 8; skull length, 23.9; length of nasals, 9.4; skull width, 12.2; skull depth, 7.7; interorbital width, 6.1; length of maxillary tooth row, 3.5; weight, 13.4 grams; testes 2 × 4 mm.

*Range*: South San Lorenzo Island and North San Lorenzo Island (28° 42' N lat., 112° 57' W long.), Gulf of California, Baja California, Mexico. Only three specimens are available from North San Lorenzo, but these appear to differ in no way from the large series from the other island.

*Comments*: The four populations of *P. spinatus* considered here may be characterized briefly as follows. *P. s. evermanni* is a small, short-



TABLE 1. Measurements (in mm) of four subspecies of *Perognathus spinatus*. Sexes are combined except for external measurements of *P. s. prietae*, the only instance where sexual dimorphism is significant. (M = mean; R = range; N = number in sample)

		<i>evermanni</i>	<i>guardia</i>	<i>lorenzi</i>	<i>prietae</i>
Total length	M	152.5	160.5	160.4	♂ 186.6 ♀ 174.9
	R	142-160	155-175	152-169	♂ 179-195 ♀ 165-186
	N	23	11	18	♂ 10 ♀ 8
Tail length	M	77.7	85.5	88.5	♂ 108.0 ♀ 99.6
	R	68-86	79-95	80-98	♂ 105-112 ♀ 91-108
	N	23	11	18	♂ 10 ♀ 8
Skull length	M	23.8	24.3	22.8	24.6
	R	23.0-24.6	23.0-25.7	21.5-24.0	23.8-25.8
	N	26	12	19	22
Skull width	M	11.7	12.0	11.6	12.6
	R	11.3-12.0	11.4-12.5	10.8-12.2	12.1-13.1
	N	27	12	20	22
Skull depth	M	8.0	8.0	7.7	8.3
	R	7.7-8.4	7.6-8.2	7.4-7.9	7.7-8.6
	N	27	12	21	22
Length of nasals	M	9.1	9.5	8.8	9.3
	R	8.7-9.7	9.0-10.5	8.1-9.7	8.5-10.3
	N	25	11	19	22

tailed, dark gray mouse; *P. s. prietae* is large, with a long tail and a large skull, and is dark brown in color. *P. s. guardia* is intermediate in most features of size, but is the palest of the populations, and is brown rather than gray. The newly described *P. s. lorenzi* is similar to *guardia* in external measurements of size (total length and tail length), and in color is between the pale *guardia* and dark *prietae*. The dark dorsal tail stripe of *lorenzi* is particularly distinctive.

The skull of *P. s. prietae* is larger than the others in all dimensions, approached most closely by *P. s. guardia*. The skull is shortest (in greatest length of skull), narrowest (in width of braincase) and shallowest (in depth of skull and auditory bullae) in *P. s. lorenzi*; *P. s. evermanni* is intermediate in length of the skull, but very close to

*lorenzi* in skull width and to *guardia* in skull depth. Much, but not all, of the variation in skull length is a correlate of variation in the length of the nasals; these bones are longest in *guardia* and shortest in *lorenzi*. The measurements from which the above characterizations were drawn are summarized in Table 1. The San Lorenzo Island population is, in the features of length and width of the skull and length of nasals, the smallest of all of the Gulf of California insular populations (cf. Burt, 1932:170). There seem to be no meaningful differences between *lorenzi* and the nearby populations in length of the maxillary tooth row or in the interorbital width, which were also measured.

The two San Lorenzo Islands are at the southern end of a submerged ridge trending generally southeastward from Mejía and Angel de la Guarda islands, roughly parallel to the east coast of the peninsula of Baja California. This chain of islands is separated from the peninsula by the extremely deep Salsipuedes Basin. No pocket mice have been taken from the other, smaller islands in the chain (Partida, Raza, and Salsipuedes), although what may have been pocket mouse sign was noted on Partida Island.

*Specimens examined:* Twenty-seven *P. s. evermanni* from Mejía Island (25, San Diego Natural History Museum; 2, Dirección General de la Fauna Silvestre, Mexico); 13 *P. s. guardia* (12, SDNHM; 1, U.S. National Museum); 21 *P. s. lorenzi* from South San Lorenzo Island (20, SDNHM; 1, DGFS) and 3 from North San Lorenzo Island (2, SDNHM; 1, DGFS); 22 *P. s. prietae* from 25 mi. N Punta Prieta and Barril, Baja California (SDNHM).

*Acknowledgments:* Collecting in Baja California was done under permit from the Dirección General de la Fauna Silvestre; I appreciate the cooperation of the Mexican authorities in this and other projects in their country. This work was done under the auspices of the San Diego Natural History Museum and was supported in part by a National Science Foundation grant (GB-2317) for the operation of the museum's field station at Bahía de los Angeles.

*Dedication:* This paper is dedicated to the memory of E. Yale Dawson, former Director of the San Diego Natural History Museum and a companion in the field work from which this paper results.

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PROCEEDINGS  
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THE GENERIC ALLOCATION OF THE FROG  
*CERATOPHRYS STOLZMANNI* STEINDACHNER,  
WITH THE DESCRIPTION OF A NEW  
SUBSPECIES FROM ECUADOR

By JAMES A. PETERS

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The name *Ceratophrys stolzmanni* Steindachner (1882) was based on three frogs from Tumbes, a locality in the coastal desert of northwestern Peru. No additional specimens have been taken. A series of specimens of a *Ceratophrys* that is clearly closely related to *stolzmanni* has been taken over the past twenty years in the coastal plain of Pacific Ecuador. Although there is a considerable distance between the localities in Ecuador and Tumbes, and there are no specimens from intermediate areas that indicate genetic exchange can take place between the isolated populations, I describe the Ecuadorian material as a new subspecies, because I wish to emphasize the similarities, and because I suspect that the relationship is on the subspecific level.

*Ceratophrys stolzmanni scaphiopeza* new subspecies

Figs. 1-3

*Holotype*: USNM 160970, male, from Cuatro Hermanitos, an experimental farm approximately 4 km WNW of Guayaquil, Guayas Province, Ecuador, altitude approximately 50 m, collected 17 June 1954 by James A. Peters (field no. JAP 1744).

*Paratypes*: USNM 118268-77, Salinas, Guayas Province, Ecuador, collected by Lt. J. Hamilton; UCMVZ 77182, Playas, Guayas Province, Ecuador, collected by T. Papenfuss.

*Diagnosis*: A *Ceratophrys* lacking a bony shield on dorsum; no horn on upper eyelid; skin of dorsum smooth except within areas of dark spots; skin of sides and belly smooth, with faint granulation; tympanum distinct; prominent black edged metatarsal shovel, tarsal fold present. This combination of characters, plus others mentioned below in the description, suffice to distinguish this subspecies from all other members of the genus, including *C. stolzmanni*.



FIG. 1. *Ceratophrys stolzmanni scaphiopeza*, holotype, dorsal view.

*Description:* Vomerine teeth in two small, widely separated, ovate series between choanae; tongue ovate, not or very slightly notched posteriorly; snout short, sharply declivous, rounded from above, with upper jaw slightly protrusive above lower. Nostrils directed posteriorly, with distinct flap of skin at anterior margin; situated at point of snout where angle of declivity increases sharply; distance between nostrils less than distance from nostril to corner of eye which in turn is less than distance from nostril to snout tip. Distinct ridge from nostril to snout tip; second, less distinct ridge across loreal region from nostril, and third ridge forming curve around anterior eye margin across cheek to slightly above lip line, where third ridge and nostril ridge merge with ridge that arises in temporal region and passes below eye. Horizontal ridge around upper margin of upper lid. Canthus rostralis forms distinct ridge; less pro-



Figs. 2 and 3. *Ceratophrys stolzmanni scaphiopeza*, holotype. 2, lateral view of head. 3, ventral view.

nounced postorbital ridge curving over and ending in weak boss or knob slightly behind tympanum; a weak subtympanic ridge. All ridges speckled with minute tubercles in holotype; tubercles do not appear distinctly in juvenile paratypes. Eyelid, without dermal horn, extends over eye, forming wide flap more heavy and glandular along outer margin than



elsewhere. Tympanum visible, vertically ovate, diameter about one-half eye diameter.

Body very short, rather stubby; body skin lying in several folds over forelimb, which is covered by skin to level of elbow, skinfolds extend from there to about mid-thigh, forming baggy flap along sides; skin of lower sides and belly faintly granulate in holotype, slightly more prominent in paratypes. Forelimbs short, stubby, usually only lower part not enfolded in skin; granulate and pustulate in dark spots; each finger fleshy, free, with indistinct, flattened dermal ridge laterally; first finger distinctly longer than second; tubercle at base of first finger prominent, elongate, ovate, or kidneyshaped, appears heavier in males than females, tubercle at base of third and fourth fingers well developed; subarticular tubercles strong. Hind legs short; heel reaches to between axilla and posterior margin of tympanum, heels do not touch when hind legs are held at right angles to body; thighs heavily pustulate, particularly on ventral and posterior faces, tibia-fibula with pustules in dark spots; each toe fleshy, webbed at base, with dermal ridge laterally, extending to tip; pronounced, blackedged, keratinized shovel on inner margin of foot, with tarsal fold from shovel to heel; no outer metatarsal tubercle; subarticular tubercles only on basal joints of toes.

*Measurements:* The measurements of the holotype and paratypes of the new subspecies, as well as the syntypes of *C. stolzmanni stolzmanni*, are given in Table 1.

*Color in alcohol:* Dorsal ground color brown, with darker brown to black spots and blotches. A broad dark stripe from eyelid to eyelid across occiput, another from eye along canthus to snout tip, third from eye vertically or slightly diagonally posteriorly to lip. Usually one small dark spot, which may extend to nostril, on loreal region and lip, between canthal stripe and stripe below eye; second, diffuse, widening spot behind eye, usually extending across tympanum to shoulder. Spots on body generally irregularly paired and elongate anteroposteriorly; spots on sides smaller and more numerous. Belly almost immaculate dirty-white, a few spots laterally in some individuals; chin heavily spotted and streaked with dark brown. Legs as body, with prominent spots dorsally to base of digits. Hind foot blackish both dorsally and ventrally; fore-foot light.

*Color in life:* (from holotype) General ground color grayish-green; all darker areas dark reddish-brown or black. Lighter areas on back with faint greenish tinge; middle of lighter areas often with light orange streak. These orange streaks more prominent on head, where one runs from corner of eye to snout tip, and another from posterior corner of eye to lip, at slight angle. Eye with fairly obvious golden ring. Legs greenish-gray above, with definite orange tint below. Stripes on chin light chocolate brown; rest of venter white.

*Comparisons:* I have compared the type series with two of the three syntypes (Vienna Mus. 4631) of *Ceratophrys stolzmanni* Steindachner. The primary difference between the nominate form and *scaphiopeza* lies

in the degree of wartiness and pustulation on the body. In *s. stolzmanni* the areas of ground color on the dorsum are studded with pustules; in *s. scaphiopeza* there are practically no pustules in the ground color areas. The sides and belly of *s. stolzmanni* are thickly granular and in part pustulate; in *s. scaphiopeza* these areas are either quite smooth or lightly granular. The skin in *s. stolzmanni* is thicker and heavier than in *scaphiopeza*, and is perhaps less permeable to water. The skin in *scaphiopeza* is quite thin and delicate for an animal inhabiting a desert area. Although it is difficult to know what effect different preservation techniques may have had on skin folds, it appears that the body skin is more sacklike in *scaphiopeza*, extending to the elbows on the forearms and to the knees on the hind limbs; in *s. stolzmanni* it extends only slightly below the axilla and the groin.

Both the holotype and the specimen from Playas are dark, with a dark brown ground color and much darker blotches. The paratypes from Salinas are much lighter brown, with almost tan ground color, and slightly darker blotches, and resemble very closely the pattern of the syntypes of *s. stolzmanni*. It would seem either that there is strong dichromatism or even polychromatism in *scaphiopeza* or that both the series of Salinas paratypes of *scaphiopeza* and the syntypes of *s. stolzmanni* have been badly faded in preservative.

*Generic allocation:* The published distinctions between the genera *Ceratophrys* Boie and *Odontophrynus* Reinhardt and Lütken have been so slight in the past that some authors have synonymized them, following Boulenger (1882, p. 221). The principal character used to separate them has been the horn on the upper eyelid in *Ceratophrys*, which is lacking in *Odontophrynus*. On this basis, *C. stolzmanni* should be assigned to *Odontophrynus*. Recently, however, Reig and Limeses (1963) have reviewed the frog genera related to *Ceratophrys*, and have found several additional differences. They point out that each tooth in *Odontophrynus* is small and blunt, and is made up of a short pedicel and equally short crown, with the tooth length less than its anteroposterior diameter. On the other hand, a tooth in *Ceratophrys* is long, sharp and needlelike, considerably longer than wide, with a distinct posteriorly directed curve, and, according to Reig and Limeses, no distinction between the crown and the pedicel. *Ceratophrys*, however, does have a crown and pedicel. The crown is formed first, with the pedicel appearing at about the time the crown has moved into its permanent position from its "seed-tooth" location. The two fuse completely, and the mature tooth is firmly ankylosed to the jaw, with the boundary between the crown and pedicel visible only under high magnification. The teeth in *Odontophrynus* are much more similar to the typical salientian tooth, as described and figured by Parsons and Williams (1962), with an open root on the parapet of the jaw, and rapid loss and replacement of the crown. The teeth in *Ceratophrys stolzmanni scaphiopeza* are long, recurved, and sharp, appearing to be very similar to other members of the same genus, but, unfortunately, the only adult specimen available is the holotype, and it is not possible

TABLE 1. Measurement of all measurable specimens of *Ceratophrys stolzmanni*. All measurements are to the nearest tenth of a millimeter. Two paratypes of *scaphiopeza* are too contorted to measure accurately.

	Holotype			Paratypes						Syntype		Syntype
	USNM 160970	USNM 118268	USNM 118269	USNM 118270	USNM 118271	USNM 118272	USNM 118273	USNM 118275	USNM 118276	UCMVZ 77182	VM 4631:1	VM 4631:2
Snout to vent length	65.5	47.7	52.2	52.4	54.0	54.1	49.8	—	46.4	32.6	60.1	51.6
Snout to end of coccyx length	60.6	45.8	47.7	48.8	50.0	49.8	47.7	—	42.1	29.7	58.3	49.3
Snout to corner of jaw	31.9	22.7	24.9	24.6	26.1	24.1	21.3	21.5	21.8	15.0	27.5	24.9
Greatest head width	34.1	25.5	26.3	27.2	27.7	26.8	24.7	22.1	23.6	16.9	31.9	27.8
Knee to knee when perpendicular to body	47.1	34.0	33.5	—	35.1	36.8	31.2	28.7	30.5	21.5	42.9	34.2
Tibia-fibula,—knee to joint	22.7	16.5	16.9	17.1	16.4	17.1	15.2	14.3	15.3	9.7	20.3	16.7
Eye diameter	8.3	5.7	6.2	6.0	5.5	6.2	5.8	5.1	5.5	3.7	7.2	6.5
Snout to eye	16.2	13.1	12.5	12.4	13.7	12.2	11.3	11.6	12.1	7.8	14.2	14.4
Interorbital distance	5.6	4.5	4.8	3.8	4.9	4.9	3.8	4.1	3.8	3.0	4.8	4.2
Width of eyelid	6.1	4.5	6.0	5.7	4.6	4.8	5.1	4.3	3.8	3.3	5.1	4.2

to determine the tooth condition satisfactorily without mutilating the specimen. In the juvenile paratypes, the teeth are still in such an early stage of development that the ankylosis is not clear.

In her paper on the thigh musculature of ceratophrynid frogs, Limeses (1964) discussed a series of characters that more or less distinguish between *Ceratophrys* and *Odontophrynus*. It is difficult, if not impossible, to evaluate these characters adequately without comparative material in each genus. Comparison of the subspecies of *C. stolzmanni* with the material used and described by Limeses will provide further clues on the relationships.

*Habitat*: The type-locality is clearly in a marginal habitat for the subspecies. The holotype was collected on the experimental farm "Cuatro Hermanitos," near Guayaquil, where I also collected the lizard *Ophryoesoides iridescens* Günther, the toad *Bufo marinus* Linnaeus, and the frog *Rana palmipes* Spix. The *R. palmipes* and the new *Ceratophrys* were found together in a barrel sunken into the ground and covered with boards, less than half full of water.

Guayaquil is on the eastern margin of the coastal desert, but both of the other localities for the new subspecies lie well within it. The vegetation around Guayaquil and the experimental farm can be described as tropical scrub, which is usually fairly open with few trees, but remains green during about half of the year. The desert around Playas and Salinas, on the other hand, is open and sandy, with scattered, low, desert vegetation, and trees are absent except near temporary stream beds. Rainfall is very scanty, as it is in most of that part of the western coast of South America lying under the influence of the Humboldt Current. Occasionally rain falls heavily in the area.

The genus *Ceratophrys* includes several species that are good burrowers, even in more equable environments, but in this case I believe the digging ability has permitted the species access to the coastal deserts. Although data are not available to verify it, my conjecture is that this species occupies the same niche here as do the toads of the genus *Scaphiopus* in southwestern United States, living deep in the ground during long dry periods, perhaps for several years at a time. This conjecture is strengthened by the occurrence of a heavy, cornified, shovel-like structure on the hind foot, very similar to that of *Scaphiopus*. In *Scaphiopus* the adults come to the surface in response to a soaking rainfall, breed, and disappear. The eggs and larvae have an accelerated developmental period. I predict that *C. stolzmanni* will be found to have a similar life cycle.

*Acknowledgments*: Dr. Robert Stebbins, of the University of California at Berkeley, Museum of Vertebrate Zoology (abbreviated UCMVZ) made available the paratype in his collection, and Ted Papenfuss, of the same institution, sent me added information on the habitat where the specimen was collected. Dr. Osvaldo Reig, now of the Universidad Central, Caracas, Venezuela, made it possible for me to see the syntypes of *C. stolzmanni* Steindachner. Dr. Doris Cochran, of the United

States National Museum (abbreviated USNM), recognized the novelty of the specimens from Salinas, and called them to my attention many years ago. To each I express my thanks for their aid.

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PROCEEDINGS  
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POTAMOCYPRIS BOWMANI, A NEW FRESHWATER  
OSTRACOD FROM WASHINGTON, D.C.<sup>1</sup>

BY EDWARD FERGUSON, JR.  
*Lincoln University of Missouri, Jefferson City*

A new species of freshwater ostracod from the vicinity of Washington, D.C., is described. *Potamocypris bowmani*, new species brings to 10 the number of species of the genus *Potamocypris* recorded from North America.

Genus *Potamocypris* Brady, 1870

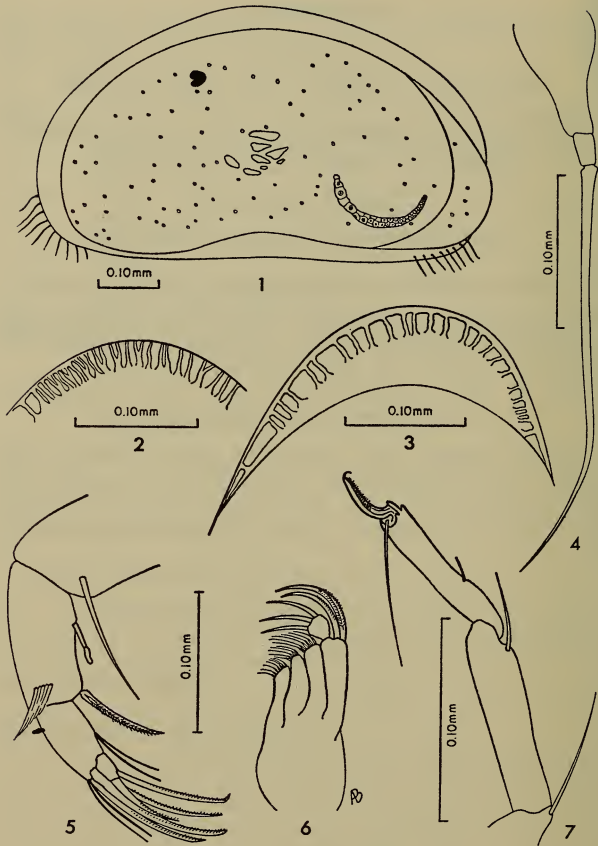
Cyprid ostracods with compressed valves; natatory setae usually well developed, but frequently few in number and not reaching tips of claws. Furcal ramus reduced to a flagellum. Ultimate podomere of maxillary palp broadened distally.

KEY TO THE KNOWN SPECIES OF *Potamocypris* FROM NORTH AMERICA

- 1. Maximum length of valves of female greater than 0.55 mm ..... 3
- 1'. Maximum length of valves of female 0.55 mm ..... 2
- 2. Valves with two dark-green dorsolateral stripes .....  
..... *P. elegantula* Furtos, 1933
- 2'. Valves without dorsolateral dark-green stripes .....  
..... *P. variegata* (Brady and Norman, 1889)
- 3. Maximum length of valves of female 0.56-0.68 mm ..... 7
- 3'. Maximum length of valves of female greater than 0.68 mm ..... 4
- 4. Length of valves of female 0.70-0.71 mm ..... 5
- 4'. Length of valves of female greater than 0.71 mm ..... 6
- 5. Flagellum of furca with length twice that of base .....  
..... *P. hyboforma* Dobbin, 1941
- 5'. Flagellum of furca with length three times that of base .....  
..... *P. pallida* Alm, 1914
- 6. Maximum length of valves 0.77 mm; color light brown with scattered patches of green near middle ..... *P. bowmani*, new species
- 6'. Maximum length of valves 0.81 mm; color green with concentra-

<sup>1</sup> This study was supported by National Science Foundation Grant GB-5553.





FIGS. 1-7. *Potamocypris bowmani*. 1, Lateral view from left side of female holotype. 2, Radial pore canals from anterior margin of female paratype. 3, Pore canals along posterior margin of valve of female paratype. 4, furca of female paratype. 5, Second antenna of female paratype. 6, Maxilla and maxillary palp of female paratype. 7, Third thoracic appendage of female paratype.

- tion of pigment in ocular region .....  
 ..... *P. saskatchewanensis* Ferguson, 1959
7. Natatory setae of antennae greatly reduced, not reaching tips of  
 claws ..... 8
- 7'. Natatory setae extend beyond tips of claws ..... 9
8. Length of valves 0.56 mm ..... *P. illinoisensis* Hoff, 1943
- 8'. Length of valves 0.68 mm ..... *P. comosa* Furtos, 1933
9. Right and left valves of approximately equal length .....  
 ..... *P. islandgrandensis* Hoff, 1943
- 9'. Left valve distinctly longer than right .....  
 ..... *P. smaragdina* (Vávra, 1891)

***Potamocypris bowmani* new species**

(Figs. 1-7)

*Female*: Eye prominent. Valves compressed; dorsum broadly and uniformly arched, sloping gently anteriorly and posteriorly; ventral margin of left valve with a distinct sinuation, ventral margin of right valve almost straight; anterior and posterior margins rounded, anterior more broadly so; anteroventral margin with nine or 10 long hairs, posteroventral margin with eight hairs; margins of valves except dorsally with radial pore canals; surface of valve with numerous puncta, but without other ornamentation; right valve overlaps left; length of right valve 0.77 mm, height 0.42 mm; length of left valve 0.74 mm, height 0.34 mm; color of valves light brown with scattered patches of green near middle of valve. Natatory setae of antenna poorly developed, not reaching tips of claws; claws pectinated. Spines of maxillary processes smooth; proximal podomere of palp with a length three and one-half times that of terminal podomere and having denticles on spines; ultimate podomere triangular, broadened distally. Ultimate podomere of third thoracic appendage with a long reflexed seta and a short, curved pectinated one. Furca having a long tapering flagellum separated from broad base, flagellum with a length three times that of base; dorsal seta appears to be absent.

*Male*: Unknown.

*Type-locality*: *Potamocypris bowmani* was collected from a small spring in Rock Creek Park, Washington, D.C., by Dr. Thomas E. Bowman of the United States National Museum.

*Type-specimens*: An unstained microscopic mount of the female holotype, USNM catalogue no. 119638, a stained microscopic mount of a female paratype, USNM cat. no. 119639, and two unstained female paratypes, USNM cat. nos. 119641 and 119642 respectively, are deposited in the United States National Museum.

*Remarks*: The new species is named in honor of Dr. Thomas E. Bowman. In size *P. bowmani* comes within the range of *P. saskatchewanensis* Ferguson, 1959, but differs from the latter in the absence of the strong,

backwardly directed spines covering the surface of the valves; the valves of the new species are light brown, those of *P. saskatchewanensis* are green with a heavy concentration of pigment in the ocular region. *P. bowmani* differs from all other North American species of the genus in the apparent absence of the dorsal seta of the furca.

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*Explanation of figures:* All drawings, except Figs. 2 and 3, were made from unstained specimens mounted in glycerin and prepared by Louis S. Kornicker of the United States National Museum. Figs. 2 and 3 were made from a specimen stained with a 1% alcoholic solution of eosin Y and mounted in Canada balsam.

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*TRICHOPETALUM SUBTERRANEUM*, NEW SPECIES  
FROM KENTUCKY, NEW RECORDS AND A KEY TO  
THE GENUS (DIPLOPODA; CHORDEUMIDA;  
TRICHOPETALIDAE)

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The margins of the range of the family Trichopetalidae pass through Nova Scotia, Colorado, and San Luis Potosí (Causey, 1963). The greatest number of taxa are in northeastern North America, where there are both epigeal and troglobitic representatives. *Trichopetalum* Harger, the most widely distributed genus, is unusual in that its range is relatively large for a millipede genus and the number of species is small. It is probably ancestral to the troglobitic genera *Scoterpes* Packard and *Zygonopus* Ryder.

Genus *Trichopetalum* Harger

*Trichopetalum* Harger, 1872, Amer. Jour. Sci. Arts 4: 117. Cook and Collins, 1895, Ann. New York Acad. Sci. 9: 62-63. Chamberlin and Hoffman, 1958, U. S. Nat. Mus. Bull. 212: 102.

*Type-species: Trichopetalum lunatum* Harger.

*Range:* North America from Nova Scotia west to Wisconsin, Missouri, and Louisiana; absent from the Southeastern States.

*Species:* 4. This omits *T. montis* Chamberlin, which I believe referable to *Tynopus*.

*Diagnosis:* Depigmented trichopetalids 5 to 8 mm long, with 28 body segments, pigmented ocelli in lunate arrangement of one long and one short series or (rarely) of one series, and small square keels on which long, fine segmental setae are arranged in small triangle. Anterior gonopods consist of large coxal region with conspicuous mesial coxite and sometimes ectal coxite, and telopodite with pseudoflagellum and thin lamella; sternum is X-shaped. Posterior gonopods consist of 2 elongated articles which articulate at about a right angle and are seldom thicker than walking legs; gland opening on mesial surface of basal

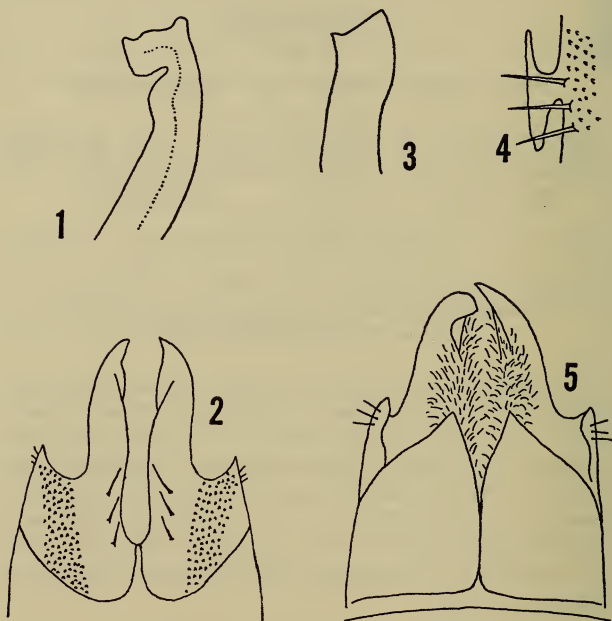


FIG. 1. *Trichopetalum lunatum*, apex of coxite of anterior gonopod of topotype. FIGS. 2-5. *T. subterraneum*, paratype. 2, anterior gonopods, anterior view. 3, apex of main coxite of anterior gonopod, ectal view. 4, ectal coxite of anterior gonopod, subectal view. 5, anterior gonopods, caudal view.

article; distal article usually ends in spine. Pregonopodal legs bear no special lobes. Coxae of legpairs 10 and 11 have gland openings.

KEY TO SPECIES OF *Trichopetalum* BASED ON ANTERIOR GONOPODS

1. With 2 coxites, of which mesial is much larger than ectal ..... 2
- With only 1 coxite, which is in mesial position ..... 3
2. Apex of main coxite divided into 2 long, subequal prongs; ectal coxite long, resembling prong of main coxite ..... *uncum*
- Apex of main coxite ends in 2 angles (Fig. 3); ectal coxite short, acute, attached by short band, and turned caudad (Fig. 4) ..... *subterraneum*, n. sp.

3. Apex of coxite varied, with 2 or 3 minute shallow emarginations (Fig. 1) ..... *lunatum*  
 Apex of coxite conspicuously U-shaped, with one prong wider than other ..... *cornutum*

*Trichopetalum cornutum* Cook and Collins

*Trichopetalum cornutum* Cook and Collins, 1895, Ann. New York Acad. Sci. 9: 66, Figs. 46-49. Causey, 1961, Proc. Biol. Soc. Washington 64: 119.

*New records*: INDIANA. Porter Co., Dune Acres, Cowles Bog, 16 April 1960, W. Suter. KENTUCKY. Wolfe Co., Pineville, 12 March 1966, B. Branson. MICHIGAN. Berrien Co., Lakeside, Warren Woods, 14 January 1960, W. Suter. TENNESSEE. Blount Co., Cades Cove, 1 April 1960, W. Suter.

*Trichopetalum lunatum* Harger

Fig. 1

*Trichopetalum lunatum* Harger, 1872, Amer. Jour. Sci. Arts 4: 118, pl. 11, Figs. 1-4. Cook and Collins, 1895, Ann. New York Acad. Sci. 9: 63, Figs. 52, 53. Jawlowski, 1939, Frag. Faun, Mus. Zool. Pol., Warszawa 4: 151-152, Fig. 1. Causey, 1951, Proc. Biol. Soc. Washington 64: 119, Figs. 6-8. Chamberlin and Hoffman, 1958, U. S. Nat. Mus. Bull. 212, p. 102.

*Trichopetalum* ? *lunatum*, Palmen, 1952, Ann. Zool. Soc. Vanamo 15: 8-11, Figs. 10-17.

*Trichopetalum album* Cook and Collins, 1895, Ann. New York Acad. Sci. 9: 64-66, pls. 11-111, Figs. 22-29, 36-45. Chamberlin and Hoffman, 1958, U. S. Nat. Mus. Bull. 212, p. 102. NEW SYNONYMY.

*Holotype*: Peabody Museum of Natural History, Yale University, if extant.

*Type-locality*: New Haven, New Haven Co., Connecticut.

*Range*: Southwestern Newfoundland to northeastern Wisconsin and south to Pennsylvania.

I have examined specimens from the type-locality, eastern Pennsylvania, and Wisconsin and have found no reason for maintaining *lunatum* and *album* as separate species. The apical region of the coxite (erroneously referred to as the telopodite by some authors) of the anterior gonopods of a topotype is shown in Fig. 1; it varies minutely, as shown by Cook and Collins (*op. cit.*, Figs. 36-41). Likewise, the uneven margin of the denticulate lamella varies. This lamella, which was erroneously shown by Cook and Collins (*op. cit.*, Fig. 43) on the sternum of the posterior gonopods, always comes out with the anterior gonopods and appears to be part of the telopodite. As in other members of the family, there is no coxite on the posterior gonopods.



*Trichopetalum subterraneum* new species

Figs. 2-5

*Diagnosis:* Near *T. lunatum*, differing especially in that the anterior gonopods have a short, acute, ectal coxite.

*Holotype:* Male. Length about 6 mm Ocelli black, 6, 2 in lunate arrangement. Article 5 of antennae thickest and longest. Legpairs 3 through 7 not thickened; 10 and 11 have coxal glands. Shoulders of most body segments square, with 2 setae on ectal margin and a third seta just mesiad of more anterior of marginal setae, forming a right triangle.

Mesial coxite of anterior gonopods long and gently curved caudad; apex, viewed ventrally, acute and twisted slightly toward homologue (Fig. 2); viewed laterally, apex is squarish (Fig. 3). Ectal coxite (Fig. 4) short, attached by narrow band, turned caudad; 3 large setae and numerous minute setae near coxite. 3 stout setae in vertical series on mesial region of coxa; broad band of minute setae ectad of stout setae. Telopodite, viewed caudally (Fig. 5), consists of simple, thickly branched pseudoflagellum almost as long as main coxite and of wide, thin lamella acute at apex and even along margins.

Posterior gonopods consist of 2 long articles about as thick as walking legs; basal article has conspicuous pore on mesial surface and is well separated from homologue; distal article ends in long, slender spine.

*Variations:* Several paratypes differ from the holotype in the arrangement and number of ocelli. 6, 2 is the most frequent number of ocelli. I have also found 6, 1, only 6, and only 5. If there is only one row of ocelli, 2 in middle are large, suggesting fusion with short row.

*Type-locality and deposition of specimens:* Slacks (= Bryants) Cave, Scott Co., Kentucky. 9 males, including holotype, and 11 females, collected 18 January 1963 and 1 February 1965 by T. C. Barr, Jr., and John R. Holsinger, respectively. Holotype and 4 paratypes of each sex are in U. S. Nat. Mus. and remaining specimens are in my collection.

*Ecology:* All known specimens are from a cave in northcentral Kentucky about 15 miles north of Lexington. They were found up to a mile from the entrance, principally on rotting wood in a log jam. Both troglobites (*Islandiana* Braendergaard, spiders; *Pseudanophthalmus* Jeannele, beetles) and troglaphiles (*Linopodes* Koch), as well as a number of troglonexes and accidentals were found in the same area of the cave. I suspect that this species is a troglaphile. The collectors have carefully searched for millipedes in numerous caves in Kentucky and adjacent states and found many of these caves with *Scoterpes* and *Zygonopus* (all troglobites) and a few with *Trichopetalum unicum* (a troglaphile). Unfortunately, the epigean sites in this area have not been collected as assiduously for millipedes as the caves have been.

*Trichopetalum unicum* Cook and Collins

*Trichopetalum unicum* Cook and Collins, 1895, Ann. New York Acad. Sci. 9: 66, Fig. 51. Causey, 1951, Proc. Biol. Soc. Washington 64: 119.

*New records*: OKLAHOMA. Muscogee Co., Ft. Gibson, Dresser Cave. MISSOURI. Dade Co., Carrico Cave, 31 March 1965. Stone Co., Marvel Cave, 2 April 1959, T. C. Barr, Jr. KENTUCKY. Edmonson Co., Mammoth Cave Nat. Pk., Mammoth Cave Hollow, 25 November 1960, D. Reichle.

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PROCEEDINGS  
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THE SYSTEMATIC POSITION OF *AMPHILIMNA*  
(ECHINODERMATA; OPHIUROIDEA)<sup>1</sup>

BY LOWELL P. THOMAS  
*Institute of Marine Science*  
*University of Miami*

Until recently most brittlestars have been assigned to families on the basis of easily seen external characters. The characters considered diagnostic of the family Amphiuridae (paired infradental papillae, one to four distal oral papillae, slender arms, and short arm spines) are, however, not always reliable. Paired infradental papillae, in combination with other systematic characters associated with amphiuroids, may occur in ophiacanthids, ophiocomids (*Ophiopsila* Forbes, 1843), ophiichitonids, and amphilepidids; and systematists have occasionally mistaken members of these families for amphiuroids.

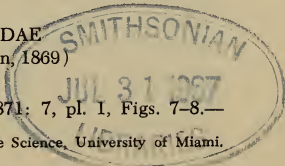
Shiro Murakami's (1963) detailed study of the dental and oral plates of brittlestars now provides a basis for comparisons of internal skeletal structure, and gives the systematist a test for his analysis of external characters. Examination of the internal structure of *Amphilimna olivacea* (Lyman, 1869), in the light of Murakami's findings, has convinced me that *Amphilimna* (Verrill, 1899a) belongs in the family Ophiacanthidae. Furthermore, one of its two species is an ophiocomid. The reasons for these conclusions are the subject of this paper.

I wish to thank Roy Oleröd, of the Stockholm Museum, for allowing me to examine the holotype of *Amphilimna caribea* (Ljungman, 1871). I also acknowledge, with gratitude, the National Science Foundation, which has supported this work under grants G-23649 and GB-4936.

Family OPHIACANTHIDAE  
*Amphilimna olivacea* (Lyman, 1869)  
Figs. 1-6

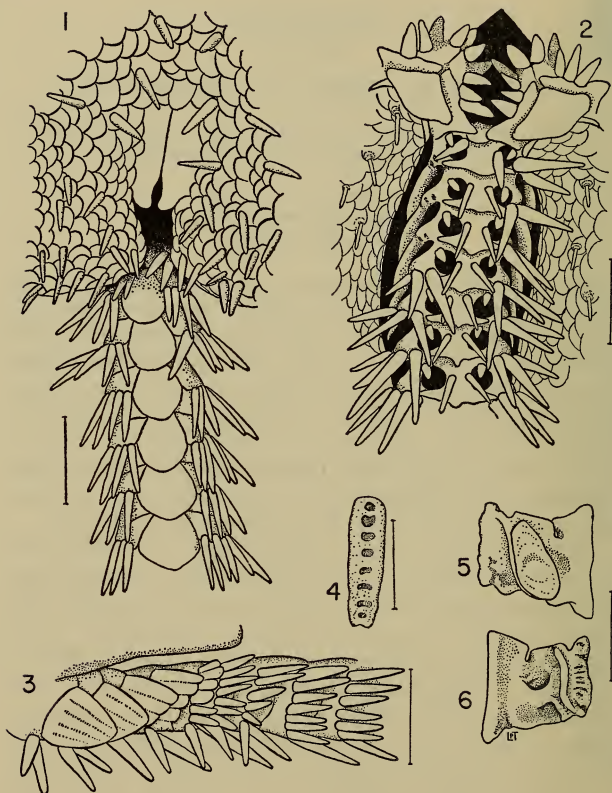
*Ophiocnida olivacea* Lyman, 1869: 340; 1871: 7, pl. 1, Figs. 7-8.—

<sup>1</sup> Contribution No. 809 from the Institute of Marine Science, University of Miami.



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FIGS. 1-6. *Amphilimna olivacea* (Lyman). 1, base of arm and adjacent disc, dorsal view; 2, base of arm and adjacent disc, ventral view, some spines removed from left side of arm; 3, base of arm, lateral view with disc cut away; 4, dental plate; 5, oral plate, adradial view; 6, oral plate, abradial view. Scale equals 1 mm.

Ljungman, 1871: 637, 657.—Lyman, 1875: 5; 1878: 227; 1882: 156, 314; 1883: 253.—Verrill, 1882: 219; 1884: 661; 1885: 549.—Koehler, 1907: 312.

*Amphilimna olivacea* Verrill, 1899a: 30; 1899b: 318, 377, pl. 42, Figs. 1, 1a.—Koehler, 1914: 2, 43.—H. L. Clark, 1915: 258.—A. H. Clark,

1921: 42.—Mortensen, 1933: 116.—Cherbonnier, 1962: 12, pl. 4, Figs. a-d.

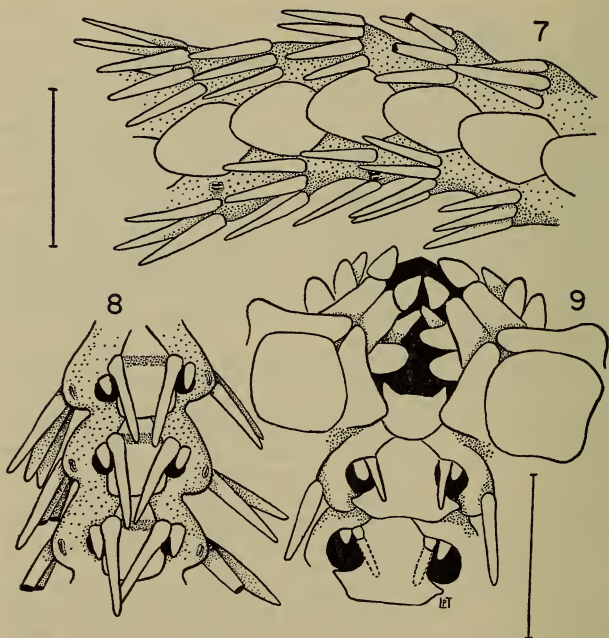
*Diagnosis:* Jaws with two or three infradental papillae at apex, two or three slender, pointed oral papillae bordering each adoral plate; two oral tentacle scales in each oral slit. Arms slender, length six times disc diameter; tentacle pores large; eight to ten proximal ventral arm plates with two tentacle scales on each side, innermost attenuated; beyond tenth ventral arm plate a single tentacle scale on each side; seven or eight slender arm spines, ventralmost longest; some arm spines of arm segments under disc greatly flattened, fused with others to form peculiar flanges occupying genital slits; dorsal arm plates slightly wider than long. Disc scaled, studded with slender spines. Radial shields narrow, joined proximally, slightly separated distally; disc deeply notched at each pair of radial shields. Color variable, disc gray, tan, or brown, arms pink or orange.

*Discussion:* *Amphilimna* Verrill, 1899a, has traditionally been placed in the family Amphiuroidae. H. L. Clark (1915) listed five species in his annotated checklist of ophiuroids: *A. olivacea* (Lyman), the type species; *A. pentacantha* H. L. Clark, 1911; *A. caribea* (Ljungman, 1871); *A. liberia* (Koehler, 1907); and *A. sexradia* (Duncan, 1887). Of these five, *A. pentacantha* is a synonym of *Amphiacantha amphiacantha* (McClendon, 1909) (see Nielsen, 1932: 296), and *A. sexradia* and *A. liberia* were assigned to the genus *Amphiacantha* by Matsumoto (1917: 178). Transferral of *Amphilimna caribea* to *Ophiopsila* (below) reduces *Amphilimna* to monotypic status.

*Amphilimna olivacea* has been considered an amphiuroid *prima facie*, probably because of its long arms and amphiuroid-like infradental papillae; but amphiuroids have perforated dental plates (Murakami, 1963), while the dental plates of *A. olivacea* are imperforate (Fig. 4) and resemble the plates of the ophiacanthid genera *Ophiacantha* Müller and Troschel, 1842, *Ophiothamus* Lyman, 1869, and *Ophiomitrella* Verrill, 1899a. The oral plates of *A. olivacea* lack the well-developed lateral wings typical of the Amphiuroidae (Amphiurinae of Murakami, 1963), and the peristomal plates, though divided, are large. Except for the rather long, S-shaped, adradial muscle scar (Fig. 6), the oral plates are similar to those figured by Murakami for ophiacanthids.

Despite a superficial similarity to some amphiuroids, *A. olivacea* has external features decidedly indicative of an ophiacanthid relationship. The arm spines are attenuate and hollow, the tentacle pores are large and are bordered by slender tentacle scales, the oral papillae are long and slender, and the disc is covered by spines. Infradental papillae are present, but they are spinous and there are frequently three rather than the two characteristic of amphiuroids.

*Ophioprium cervicornae* (Lyman, 1883), an ophiacanthid collected by the BLAKE in 381 and 1049 m in the Lesser Antilles, is the only brittlestar that appears closely related to *A. olivacea*. The illustration of *O.*



FIGS. 7-9. *Ophiopsila caribea* (Ljungman), new combination. 7, base of arm, dorsal view; 8, middle of arm, ventral view; 9, two jaws and base of arm, ventral view. Scale equals 1 mm.

*cervicorne* in Lyman's report (op. cit., Pl. 5, Figs. 75-77) shows an ophiuroid which resembles *A. olivacea* except in having the radial shields covered by scales. These two species may be congeners, but I have not yet had the opportunity to examine *O. cervicorne*.

A peculiarity of *A. olivacea*, illustrated and briefly mentioned by Cherbonnier (1962: 13), is the fusion of arm spines on the proximal four or five arm segments. These fused spines form thin flanges which extend into the genital slits (Fig. 2). Cherbonnier erroneously refers to them as "... écailles génitales larges et minces ...". Similar fused spines occur in *Amphitarsus mirabilis* H. L. Clark, 1941, a species found in 320-430 m of water off the north and south coasts of Cuba. Clark placed *A. mirabilis* in the family Amphiuridae, but it too may be related to *Amphimlna olivacea*. Its tentacle scales and oral papillae are

rounded rather than spiniform, however the radial shields and arm spines are similar to those of *A. olivacea*.

*Amphilimna olivacea* has been collected in the western Atlantic from near Martha's Vineyard, south along the continental shelf to Florida, near Havana, Cuba, and near the mouth of the Plata River, Uruguay. Cherbonnier (1962) reported it from the Gulf of Guinea in the eastern Atlantic. Confined to the continental shelf and upper slope, *Amphilimna olivacea* is usually found between 70 and 350 m, although it may occur as deep as 487 m (Verrill, 1899b: 377).

#### Family OPHIOCOMIDAE

*Ophiopsila caribea* (Ljungman, 1871), new combination

Figs. 7-9

(*Ophiocnida*?) *caribea* Ljungman, 1871: 636, 656.

*Ophiocnida caribea* Lyman, 1882: 155, 316.

*Amphilimna caribea* Verrill, 1899a: 30.—Verrill, 1899b: 319, 377.—H.

L. Clark, 1915: 259.—A. H. Clark, 1921: 42.—Koehler, 1926: 23, 24, pl. 4, Fig. 7.

(?) *Ophiopsila vittata* H. L. Clark, 1918: 328, 330, pl. 8, Fig. 2.

*Discussion*: Originally described as an *Ophiocnida*, this species was considered an *Amphilimna* by Verrill (1899a: 30) and subsequent workers. The holotype is in poor condition but it is clearly an *Ophiopsila*. Long, inner tentacle scales are present, as are prominent, dark bands, representing ciliary tracts, which extend across the ventral arm plates and connect the bases of the tentacle scales (Fig. 8). The arm spines are long and slender. There are two dental papillae at the tip of each jaw, and the oral papillae are borne on the half jaws rather than on the adoral plate.

*Ophiopsila caribea* is probably a young specimen of *O. vittata* H. L. Clark, 1918. Both nominal species appear to have naked discs and several middle arm spines shorter than the dorsal or ventral spines. The species differ in the number of dental papillae and the placement of the oral papillae, but growth changes could account for these inconsistencies.

The holotype of *O. caribea*, the only specimen known, was collected off Anguilla, between 550 and 730 m.

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PROCEEDINGS  
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*ASELLUS KENKI*, A NEW ISOPOD CRUSTACEAN  
FROM SPRINGS IN THE EASTERN UNITED STATES

BY THOMAS E. BOWMAN

*Division of Crustacea, Smithsonian Institution,  
Washington, D. C.*

The new asellid described herein was brought to my attention by Dr. Roman Kenk, who found it in certain springs in Rock Creek Park, Washington, D. C., where he was collecting planarians. Specimens from other springs in the vicinity of Washington were given to me subsequently by Dr. Kenk and by Dr. John R. Holsinger of East Tennessee State University. Examination of unidentified material in the Division of Crustacea, Smithsonian Institution, yielded additional specimens that had been collected by W. Howard Ball, Andrew Pizzini, the late Clarence R. Shoemaker, and others. I am grateful to all these individuals for their collecting efforts. I take considerable pleasure in naming the new species in honor of my distinguished colleague, Roman Kenk, Research Associate, Division of Worms.

*Asellus kenki* new species

Figs. 1-44

*Description:* A moderately small species, largest male 14 mm in length, but most mature males considerably shorter; ovigerous females reaching 7-8 mm. Body slender, length (excluding uropods) about 4 times width; pereonites 3-7 about equal in width, pereonites 1-2 slightly narrower; lateral excavations of pereonites not pronounced. Telson slightly longer than wide, median posterior process well developed. Setae on margins of head, pereonites, and telson well developed. Dorsum sculptured into low broad tubercles bearing scattered small surface setae; parts of cuticle of body and appendages bearing minute pectinate scales. Coxal plates inconspicuous, but usually visible dorsally on most pereonites.

Eye small, slightly longer than broad, composed of few facets.  
First antenna reaching little beyond distal end of 4th segment of

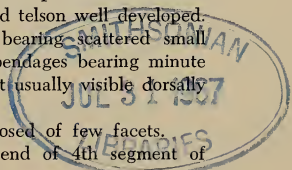
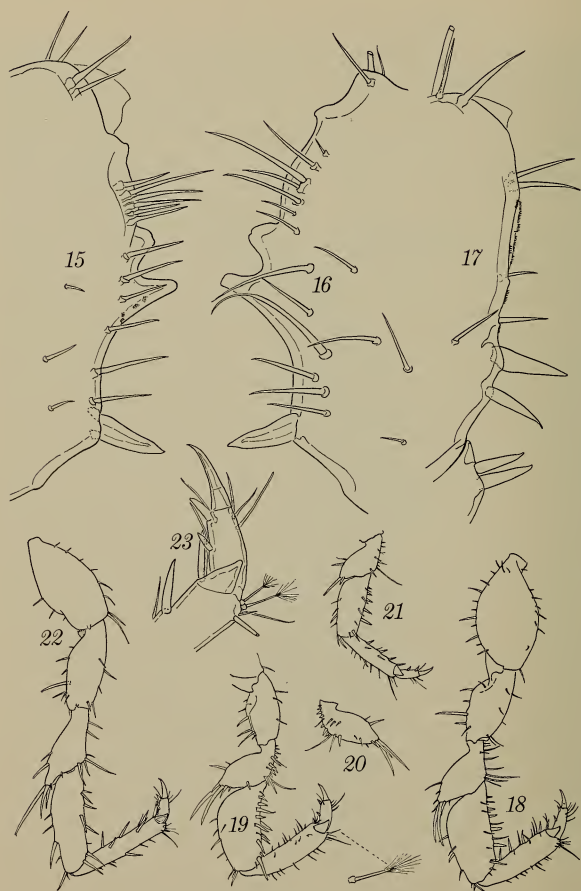




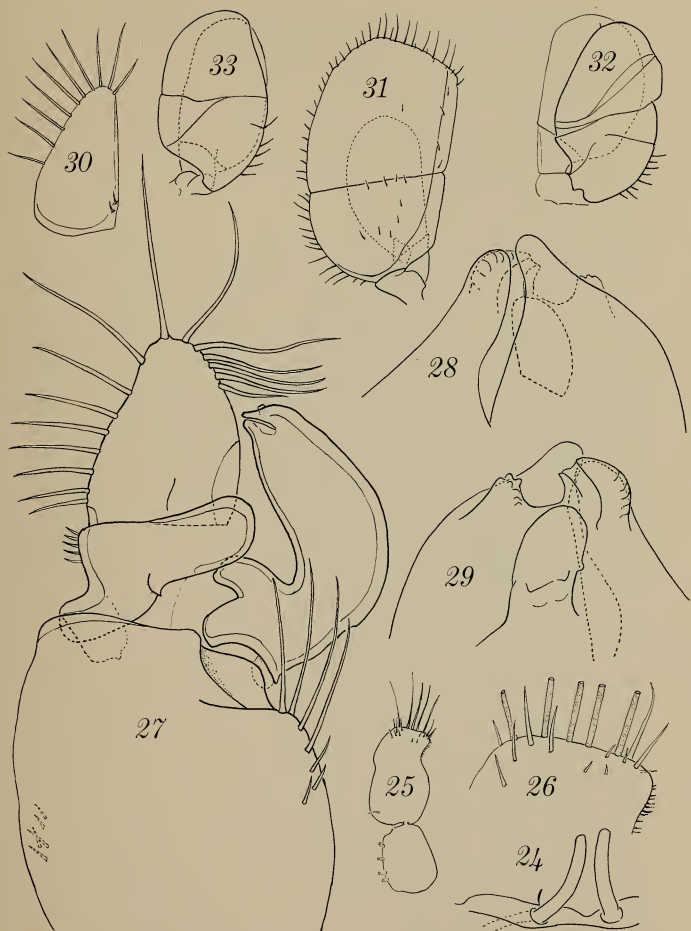
FIG. 1. *Asellus kenki*, holotype (drawn by Carolyn Gast).



FIGS. 2-14. *Asellus kenki*. 2, Left male 1st antenna, dorsal. 3, Peduncle of right male 2nd antenna, dorsal. 4, Incisor of female right mandible. 5, Incisor of female left mandible. 6, Plumose and dentate spines from spine row of female right mandible. 7, Mandibular palp. 8, Labium, female. 9, Male 1st maxilla, apex of outer ramus. 10, Same, apex of inner ramus. 11, Left maxilliped, ovigerous female. 12, Female gnathopod, medial. 13, Male gnathopod, medial. 14, Dactyl of male gnathopod, medial.



FIGS. 15-23. *Asellus kenki*. 15, Palm of left gnathopod, 6.7 mm male, medial. 16, Same, lateral. 17, Same, 5.6 mm female, medial. 18, Pereopod 2, male, medial. 19, Pereopod 4, male, lateral. 20, Merus of same, medial. 21, Distal segments of female pereopod 4, lateral. 22, Left pereopod 7, female, medial. 23, Distal end of same.



FIGS. 24-33. *Asellus kenki*. 24, Penes. 25, 1st pleopod, male. 26, Apex of same. 27, 2nd pleopod, male, anterior aspect. 28, Apex of endopod of male 2nd pleopod, anterior. 29, Same, posterior. 30, 2nd pleopod, female. 31, 3rd pleopod, male. 32, 4th pleopod, male. 33, 5th pleopod, male.





FIGS. 34-44. *Asellus kenki*. 34-38: Lateral parts of pereonites of ovigerous female, dorsal. 34, Pereonite 1. 35, Pereonite 2. 36, Pereonite 5. 37, Pereonite 6. 38, Pereonite 7. 39-43: Dorsal views of right uropods. 39, 3.5 mm male. 40, 5.0 mm male. 41, 6.5 mm male. 42, 8.2 mm male. 43, 6.5 mm ovigerous female. 44, Telson and uropods of 13 mm male, dorsal.

peduncle of 2nd antenna; flagellum 11-merous. Second antenna  $\frac{3}{4}$ – $\frac{1}{2}$  as long as body (excluding uropods); flagellum about 70-merous.

Right mandible with 4-toothed incisor; spine row of 7 dentate spines distally and 6 plumose spines proximally. Left mandible with 4-toothed incisor and 4-toothed lacinia; spine row of 10–12 plumose spines. Second segment of mandibular palp about 1.5 times as long as 3rd.

Outer ramus of 1st maxilla with 8 dentate and 3 smooth apical spines and 2 slender surface setae near apex. Inner ramus with 3 robust, circumplumose setae with denticulate apices, and 2 slender, plumose setae.

Maxilliped with 4–5 coupling spines. Apex of inner plate and inner margins of 4 distal segments of palp densely setose. First segment of palp with 2 outer setae. Maxilliped of ovigerous female with oostegite bearing about 8 apical setae.

Palmar margin of propodus of male gnathopod (pereopod 1) with 2 processes near middle: a large proximal conical process and a lower blunt process with slightly concave apex. Proximal end of palmar margin with single robust spine, directly obliquely posteriad. Setae along palmar margin arranged as shown in Figs. 15 and 16. Female gnathopod without central processes on palmar margin of propodus; proximal end of margin with 2 large spines, distal spine more robust, proximal spine with slender tip curved slightly proximad. Posterior margin of gnathopod dactyl armed with teeth in both sexes; teeth less conspicuous in large males. Posterodistal corner of carpus with 2 strong spines.

Dactyls of pereopods 2–7 bearing 2 spines. Pereopod 4 of male shorter than that of female, with more robust distal segments; merus with row of short spines on posterior margin, these spines absent in female.

Peduncle of male 1st pleopod  $\frac{3}{4}$  as long as exopod, with 3–4 coupling spines. Exopod about 1.6 times longer than wide, distal part with concave lateral margin, bent laterad, and bearing 5 long plumose setae on broad apex and several shorter setae proximal to apical setae; distal part of lateral margin with row of setules.

Peduncle of male 2nd pleopod about  $\frac{1}{3}$  longer than wide, with about 5 setae on distomedial margin and 5 short setae on posterior surface near proximolateral margin. Exopod about  $\frac{3}{4}$  as long as peduncle; proximal segment cupulate, inserted into peduncle by truncate base with heavily sclerotized lateral margin, bearing rectangular flap on posterior surface, distal part of segment widening into rounded lobes on either side; lateral lobe with sclerotized margin continuous with that of base, bearing 4–5 short setae; medial lobe produced beyond insertion of distal segment, margin sclerotized. Distal segment of exopod narrowing apically, armed with plumose setae on lateral margin and distal  $\frac{1}{3}$  of medial margin; proximal  $\frac{1}{3}$  of medial margin with broad sclerotization. Endopod shorter than exopod, with well-developed medial apophysis in proximal part; distal to apophysis endopod curves strongly laterad and ends in 5 processes: a straight rounded lateral

process, a medial process consisting of a lobe overriding medial process and a rugose lobe posterior and proximal to it, a medially curving canula posterior to lateral process, and a broadly rounded posterior process with a few rugosities.

Female 2nd pleopod subtriangular with about 10 plumose setae on lateral margin and apex. Medial margin straight, with 2 short setae near base. Pleopods 3-5 as in Figs. 31-33; "lines" on exopods of pleopods 4-5 similar to those of *A. communis* (cf. Racovitza 1920, Figs. 71-72).

Uropod of female and immature male with exopod about 1.1 times longer than peduncle; endopod 1.1 times longer than exopod; both rami linear, armed with spines on margins and at apex. Uropod of mature male modified: exopod shorter than peduncle; endopod spatulate, much longer and broader than exopod.

*Material examined:* Holotype, USNM 119808, adult male, 8.1 mm long, illustrated in Fig. 1, collected by the author in August 1966 from among leaf litter in pool into which water from a pipe above flows from spring. The spring is located about 0.9 km SSW of the Nature Center, Rock Creek Park, Washington, D. C. Numerous other specimens from the type-locality have been designated as paratypes.

In addition to the type-locality, I have identified specimens of *Asellus kenki* from the following localities:

VIRGINIA. FAUQUIER Co.: Under stones in spring on Appalachian Trail S of Paris, 22 June 1952, L. B. Holthuis. FAIRFAX Co.: Stream near Bull Neck Run, 26 February 1935, A. Pizzini. Stream near Scotts Run, 15 March 1936, A. Pizzini. Springs (3) along E side of Scotts Run, 25 May 1965, J. R. Holsinger and A. Pizzini. ARLINGTON Co.: Gencarlynn, from a spring, 7 July 1918, C. R. Shoemaker. DISTRICT OF COLUMBIA. Rock Creek Park, spring about 175 m S of North National Capital Parks Headquarters, August 1966, T. E. Bowman. Small springs, Montrose Park, Georgetown, 9 March 1938, Leslie Hubricht. Wetzels Spring, Georgetown, 5 March 1933, A. Pizzini. Spring ½ mile E and N of Wetzels Spring, 17 October 1937, A. Pizzini. Pools adjoining Foundry Branch, Burleith Woods, W of Georgetown, 26 March 1936, W. H. Ball. MARYLAND. MONTGOMERY Co.: Spring at Glen Echo, 28 June 1966, Roman Kenk. Spring, Cabin John, 15 April 1934, A. Pizzini. Spring flowing into Rock Creek near Kensington, 1 October 1933, C. R. Shoemaker. Running stream, "Miss Dean's place," Kensington, 4 May 1934, W. H. Ball. PRINCE GEORGES Co.: Stream flowing into Sligo Branch, Takoma Park, 5 April 1936, W. H. Ball. PENNSYLVANIA. INDIANA Co.: In stream passage, Strangford Cave (between Strangford and Conemaugh River), 1950, R. E. Hoffmaster. FAYETTE Co.: Dulaney's Cave, 700 ft from entrance, 20 January 1951, R. E. Hoffmaster.

*Ecology:* *Asellus kenki* is an inhabitant of springs and spring-fed streams. Large streams and ponds within its range are not occupied by *A. kenki*, but by more typically epigeic species, such as *A. communis*

Say. Hence local populations of *A. kenki* must communicate with one another by subterranean channels. As indicated below, *A. kenki* is in some respects intermediate between the epigean and troglobitic species of *Asellus*, but its pigmentation and well developed, if small, eye, suggest that its preferred habitat is springs. The ability to tolerate the groundwater environment has survival value to the species, enabling it to repopulate springs that become dry seasonally. The rather large populations in springs suggest that the species is indigenous to springs, and that spring populations are not merely stray individuals that have been carried to the surface from the groundwater by the flow of the water.

At the type-locality *A. kenki* was associated with the following: the harpacticoid copepod *Bryocamptus zschokkei alleganensis* Coker; the cyclopoid copepods *Cyclops exilis* Coker and *Paracyclops fimbriatus* (Fischer) (identifications confirmed by Dr. Harry C. Yeatman); the ostracod *Potamocypris* sp. nov. (description being prepared by Dr. Edward Ferguson); the larval trichopteran *Lepidostoma* sp. (identified by Dr. Oliver S. Flint); the planarian *Phagocata morgani* (Stevens and Boring) (identified by Dr. Roman Kenk); and a new genus and species of the gastropod family Hydrobiidae (description being prepared by Dr. J. P. E. Morrison).

Specimens of *A. kenki* from the cold and unpolluted spring water of the type-locality lived for weeks in the laboratory at room temperature in jars of rather stagnant tap water. Dead leaves (oak and ash), which appear to be their natural food, were placed in the jars and were readily eaten.

*Relationships:* In some of its characters *Asellus kenki* is intermediate between typical epigean species and the subterranean species of *Asellus* that were formerly assigned to the genus *Caecidotea* Packard. Miller (1933) has tabulated measurements of body proportions for the species of *Asellus* (including *Caecidotea*) then known. The length:width ratio of the body for 16 species having eyes ranged from 2.3 to 4.1, with a mean of 3.11; for 13 species without eyes the proportion ranged from 4.0 to 7.0, with a mean of 4.92. In *A. kenki* the ratio, about 4.0, is intermediate. The length:width ratio of the telson for 18 species with eyes ranged from 0.7 to 1.0, with a mean of 0.92; for 13 blind species this ratio ranged from 1.0 to 1.7, with a mean of 1.32. The ratio in *A. kenki*, about 1.2, is within the lower range of the blind species.

A third character which is intermediate in *A. kenki* is the shape of the uropods. In most American epigean species of *Asellus* the uropodal rami tend to taper distally. The linear or spatulate shape in *A. kenki*, especially the very long and broad endopod found in large males, is more like that of the troglobitic species, and, as in *A. californicus* (Miller, 1939), results from heterogonic growth.

This intermediate condition is what is to be expected in a species inhabiting springs and spring-fed streams. As pointed out, communica-

tion between springs is by underground passageways, and the intermediate condition may be considered an adaptation for temporary subterranean existence.

A detailed comparison of *A. kenki* with other epigeal eastern North American species of *Asellus* would require redescription of most of the other species, since their characteristics are inadequately known. However, enough is known to distinguish easily from *A. kenki* the 7 currently recognized species: *attenuatus* Richardson, *brevicauda* Forbes, *communis* Say, *dentadactylus* Mackin and Hubricht, *intermedius* Forbes, *militaris* Hay, and *montanus* Mackin and Hubricht. None of these has a long telson, the length: width being usually less than 1.0, but about equal to 1.0 in *intermedius*, *dentadactylus*, and *montanus*. None has linear or spatulate uropodal rami; the rami taper distally in all 7 species. A concave lateral margin of the male 1st pleopod is found in *A. brevicauda* and *A. dentadactylus*; in the other 5 species this margin is nearly straight or convex. Finally, the structure of the male 2nd pleopod clearly sets *A. kenki* apart from the other species.

No subgeneric allocation is given for *A. kenki*. Several subgenera have been proposed within the genus *Asellus* by various authors, but I agree with Chappuis (1953, 1955) that division into subgenera should only accompany a revision of the genus based on adequate collections. Studies such as that of Steeves (1966), which proposes evolutionary paths for several species groups of troglobitic North American asellids, based on modifications of the male second pleopod, are more likely to lead to rational subgeneric groupings than the present patchwork of subgenera.

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28 July 1967

PROCEEDINGS  
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BIOLOGICAL SOCIETY OF WASHINGTON

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A NEW BURROWING CRAYFISH FROM NORTH  
CAROLINA (DECAPODA, ASTACIDAE)

BY HORTON H. HOBBS, JR., AND FRANK O. PERKINS

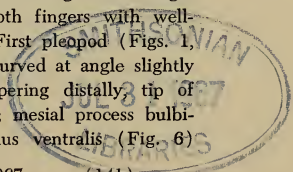
*Smithsonian Institution and Virginia Institute of  
Marine Science*

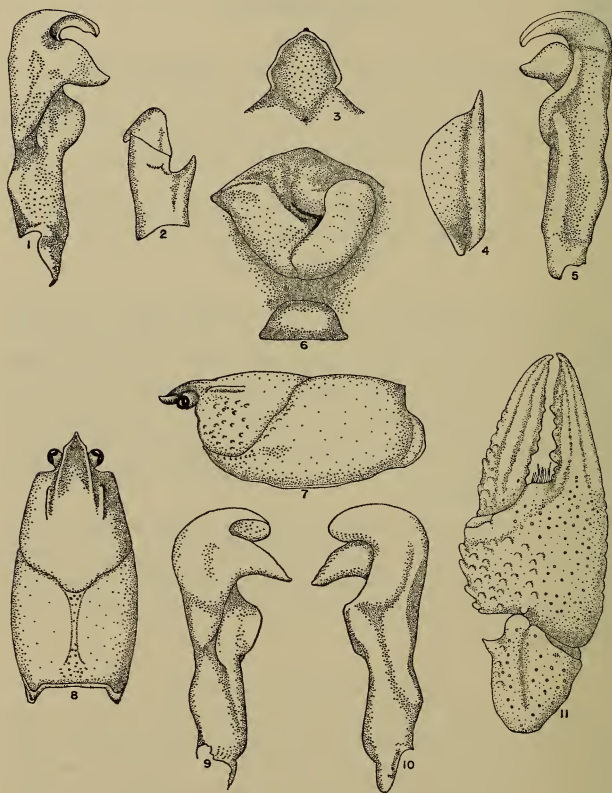
This new crayfish is known from a single locality within the city limits of Greensboro, Guilford County, North Carolina. Here, in a rolling terrain some 500 yards from the nearest creek, the members of a colony construct complex, branching burrows in a sandy-clay soil in which the water table varies from a few inches to two feet below the surface of the ground. Much of the area has been cut over and has been converted to lawns and gardens.

This locality, in the Cape Fear River system, is in the same drainage basin and is less than 30 miles north and 40 miles west of localities from which another, distantly related, burrowing species, *Cambarus reduncus* Hobbs (1956: 61), has been reported.

*Cambarus catagius* new species

*Diagnosis:* Body pigmented, eyes well developed. Rostrum with convergent lateral margins and with distinct acumen although lacking marginal spines at base of latter. Areola 17 to 23 times longer than broad and comprising 37 to 40 per cent of entire length of carapace. Lateral surface of carapace with two or three small tubercles immediately caudal to cervical groove. Suborbital angle absent. Postorbital ridges without spines or tubercles. Antennal scale less than one-half as broad as long. Chela with two rows of tubercles along inner margin of palm; outer margin of hand costate and both fingers with well-defined longitudinal ridges on upper surfaces. First pleopod (Figs. 1, 5) of first form male with central projection recurved at angle slightly greater than 90 degrees and not markedly tapering distally; tip of projection never extending proximad of its base; mesial process bulbiform, tapering distally to subacute tip. Annulus ventralis (Fig. 6)





FIGS. 1-11. *Cambarus catagius* new species. 1, Mesial view of first pleopod of first form male. 2, Basis and ischium of third pereopod of first form male. 3, Epistome. 4, Antennal scale. 5, Lateral view of first pleopod of first form male. 6, Annulus ventralis. 7, Lateral view of carapace of first form male. 8, Dorsal view of carapace of first form male. 9, Mesial view of first pleopod of second form male. 10, Lateral view of first pleopod of second form male. 11, Dorsal view of distal podomeres of cheliped of first form male.

with sclerotized caudal V-shaped portion movable and marked by a tilted L-shaped sinus.

*Holotypic male, form I:* Body subovate, slightly compressed laterally. Abdomen narrower than thorax (10.8 and 13.8 mm) in widest parts. Greatest width of carapace greater than depth at caudodorsal margin of cervical groove (13.8 and 12.2 mm). Areola narrow (22.6 times longer than wide), with widely scattered punctations, only one or two across narrowest portion. Cephalic section of carapace about 1.5 times as long as areola (length of areola about 40 per cent of entire length of carapace). Rostrum excavate above with convergent, thickened margins; acumen short, well defined and with a slightly upturned, cornuous, tuberculiform tip; marginal spines or tubercles absent. Upper surface with usual submarginal row of tubercles and with a few prominent tubercles near midbasal portion. Subrostral ridges moderately well developed and visible in dorsal aspect almost to base of acumen.

Postorbital ridges weak, grooved laterally, and terminating cephalically without spines or tubercles. Suborbital angle absent. Branchiostegal spine absent but represented by small tuberculiform prominence. Row of small tubercles on side of carapace immediately caudal to cervical groove. Carapace punctate dorsally and weakly granulate laterally; granules more prominent in lateral area cephalic to cervical groove. Abdomen shorter than carapace (24.7 and 28.1 mm). Cephalic section of telson with two spines in each caudolateral corner.

Epistome (Fig. 3) broader than long with slightly elevated margins and with small cephalomedian projection. Antennule of usual form with small spine on lower surface of basal segment. Antenna extending caudal to third abdominal segment. Antennal scale (Fig. 4) broadest slightly distal to midlength; lamellar portion distinctly broader than lateral thickened portion, latter terminating in acute spine.

Right chela somewhat depressed but with palm inflated; distal two-thirds of outer margin of hand costate. Upper and lower surfaces of palm punctate laterally and tuberculate mesially. Inner margin of palm with two rows of tubercles—more mesial row of five, lateral row of four. Lower surface of palm with four conspicuous tubercles—two on ridge at base of dactyl and two proximal to them. Fingers slightly gaping and both with well-defined longitudinal ridges above and below, flanked by grooves containing deep setiferous punctations. Opposable margins of both fingers with six tubercles along proximal two-thirds, third from base in both rows largest. Distal portion of opposable margins of both fingers with single row of minute denticles interrupted by more distal tubercles. Mesial margin of dactyl with row of six tubercles, progressively more squamous distally; proximally row flanked by other tubercles, and distally by linear arrangement of seven setiferous punctations.

Carpus of right cheliped longer than broad, with distinct, oblique longitudinal furrow above; entire podomere punctate except for mesial

TABLE 1. Measurements (mm) of *Cambarus catagius*.

	Holotype	Allotype	Morphotype
Carapace:			
Height	12.2	12.9	12.2
Width	13.8	15.1	13.8
Length	28.1	31.6	28.0
Areola:			
Width	0.5	0.7	0.5
Length	11.3	12.4	11.2
Rostrum:			
Width	4.2	5.0	4.2
Length	5.8	6.4	5.3
Chela:			
Length of inner margin of palm	5.7	6.2	5.6
Width of palm	8.6	9.9	9.4
Length of outer margin of hand	19.1	20.6	18.4
Length of dactyl	12.1	14.0	12.2

surface. Mesial surface with prominent spine and small proximal tubercle; lower distal margin with usual two tubercles.

Merus of right cheliped with mesial and lateral surfaces sparsely punctate. Upper surface with three subdistal tubercles; proximal two prominent, distal one less conspicuous. Lower lateral margin with row of five tubercles and lower mesial margin with row of ten. Row of four tubercles on ischium corresponding to mesial row on merus.

Hook on ischia of third pereopods only (Fig. 2); hooks simple and not opposed by tubercle on basis. Coxa of fourth pereopod with prominent caudomesial protuberance; that of fifth pereopod with small knoblike prominence.

Sternum moderately deep between third, fourth, and fifth pereopods and supporting heavy mat of plumose setae between bases of third and fourth pereopods.

First pleopod (Figs. 1, 5) symmetrically arranged and reaching coxa of third pereopod when abdomen is flexed. (See diagnosis for description.)

*Morphotypic male, form II*: Differs from holotype in following respects: areola without punctations in middle third of its length; branchiostegal spines obsolete; only one or two tubercles on sides of carapace immediately caudal to cervical groove; cephalic section of telson with only one spine in caudodextral corner; epistome proportionately slightly longer than in holotype; antennae extending caudad only to second abdominal segment; mesial row of tubercles on palm consisting of five on right and seven on left chela, and respective lateral rows of three and four (right chela atypical, perhaps regenerated); opposable margin

of fingers of left chela with five tubercles; opposable margin of dactyl of right chela with eight tubercles; lower lateral margin of merus of left cheliped with row of three tubercles and mesial margin with row of eight; ischia of both chelipeds with only two tubercles on lower margin; hooks on ischia of third pereopods and prominences on coxae of fourth and fifth reduced in size but similar to those of holotype. First pleopod (Figs. 9, 10) without corneous elements; central projection rounded distally and broader and shorter than in holotype; mesial process elongate, tapering, and its axis forming angle of about 50 degrees with that of main shaft of appendage.

*Allotypic female:* Differs from holotype in following respects: rostrum narrower, except at base, and more acuminate; right branchiostegal spine absent; antennal scale less rounded mesially with inner and outer margins subparallel for greater part of length; palm of both chelae with mesial row of six tubercles; opposable margin of dactyl of chela with row of seven tubercles; mesial margin of carpus of cheliped with only one large tubercle, smaller proximal tubercle almost obsolete; lower lateral margin of carpus of both chelipeds with row of four tubercles and lower mesial margin of right with row of ten, that of left with only eight; no hooks on ischia of third pereopods and no prominences on coxae of fourth and fifth. Annulus ventralis (Fig. 6), more flexible than in most members of *Cambarus*, with heavily sclerotized caudal V-shaped sclerite marked by caudomedian, tilted, L-shaped sinus; fossa dipping below sinistral arm of V.

*Color notes:* Dorsal portion of carapace and abdomen dark brown, with very small cream or light tan flecks, fading ventrolaterally to grayish mauve; poorly-defined pinkish-tan patch immediately cephalic to cervical groove on each side, and caudoventral to it, short cream-colored bar just posteroventral to groove. Margins of rostrum and postorbital ridges orange. Caudal margins and epimera of abdominal segments pinkish mauve. Chelipeds greenish tan above, pale pink below; tips of tubercles on chela pale orange to cream and lateral costae of propodus and tips of fingers orange. Remaining pereopods mostly pinkish mauve but upper margins greenish-tan.

A green phase, instead of the brown one, also occurs in this species. The only differences are in substitution of olive to dark green in the brown areas described above; in these specimens, the orange markings are also decidedly more conspicuous.

*Measurements:* See Table 1.

*Type-locality:* Burrows in lawn at East Whittington Street, in the southeastern section of Greensboro, Guilford County, North Carolina (see above). This species is known only from the type locality.

*Disposition of types:* The holotypic male, form I, allotypic female, and morphotypic male, from II, are deposited in the United States National Museum (nos. 117779, 117780, 117781, respectively). Of the 19 paratypes, one male, form I, and one female are deposited in the



Museum of Comparative Zoology, and five males, form I, one male, form II, ten females, and one juvenile male are in the United States National Museum.

*Life history notes:* The three collections available were made in February, May, and June. First form males were collected in February and June, and a single female carrying eggs was found in June.

*Relationships:* *Cambarus catagius* is a member of the Bartonii Section of the genus and apparently is as closely related to *Cambarus latimanus* (LeConte, 1856: 402) as to any other species. Like *C. latimanus* and *C. reduncus*, the chela bears two rows of tubercles along the inner margin of the palm. The width of the areola approaches that of *C. reduncus*, being narrower than that of *C. latimanus*, but the first pleopod is similar to that of *C. latimanus* and markedly different from that of *C. reduncus*.

*Etymology:* The name *catagius* is derived from Greek, meaning underground, and refers to the burrowing habit of this crayfish.

*Remark:* This new crayfish was infested with two entocytherid ostracods, *Entocythere dentata* Crawford and *Ankylocythere ancyla* Crawford.

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NANNOSQUILLA ANOMALA, A NEW STOMATOPOD  
CRUSTACEAN FROM CALIFORNIA

BY RAYMOND B. MANNING  
*Smithsonian Institution*

The species described below was first brought to my attention in 1965 when John S. Garth, Allan Hancock Foundation, forwarded five specimens to me which had been collected off San Clemente Island by Earl E. Ebert. A second series of specimens from the same area was received from Charles H. Turner of the California Department of Fish and Game. It was my intention to include an account of this species in a review of the eastern Pacific stomatopods, but delays in the progress of that study lead me to publish a preliminary account of the species at this time.

All measurements are in mm. Total length (TL) and carapace length (CL) are both measured on the midline. The holotype and a series of paratypes have been deposited in the Allan Hancock Foundation (AHF); a series of paratypes is in the U. S. National Museum (USNM).

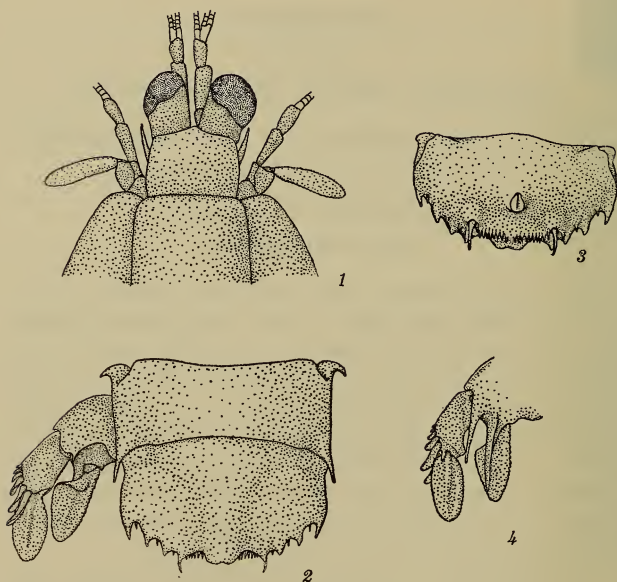
I thank Earl E. Ebert, Charles H. Turner, and John S. Garth for making these specimens available for study. The illustrations were prepared by my wife Lilly, with the support of the Smithsonian Institution through its Research Awards Program.

**Nannosquilla anomala** new species

Figs. 1-4

*Holotype*: 1 ♂, TL 36.4; Northwest Harbor, San Clemente Island, California; 15 ft; 22 June 1965; AHF.

*Paratypes*: 3 ♀ (2 broken, CL 5.8-6.5), TL 41.2; data as for holotype; AHF.—1 ♀, TL 34.0; same; USNM 120331.—3 broken ♂, CL 5.3-6.7; 2 broken ♀, CL 5.4-5.5; Wilson's Cove, San Clemente Island, California; sand, 25-70 ft; 25 October 1966; USNM 120330.



FIGS. 1-4. *Nannosquilla anomala*. 1, male paratype, CL 5.4, anterior portion of body. 2-4, female paratype, TL 34.0: 2, last abdominal somite, telson, and uropod; 3, ventral surface of telson; 4, ventral view of uropod (setae omitted in all figures).

*Description:* Eye small, not extending beyond end of antennular peduncle; cornea set obliquely on stalk, overhanging stalk laterally; ocular scales small, fused along midline.

Antennular peduncle short, but more than half as long as carapace; dorsal processes of antennular somite visible in dorsal view as anteriorly directed spines lateral to rostral plate.

Antennal scales small, less than one-third as long as carapace; antennal peduncle not extending beyond eye; antennal papillae absent.

Rostral plate broader than long, subquadrate or pentagonal; lateral margins straight or convex; anterolateral angles obtuse, rounded; anterior margin straight or with obtuse apical prominence.

Dactylus of claw with 10-14 teeth, outer margin of dactylus rounded, with proximal basal notch flanked proximally and distally by small lobe; dorsal ridge of carpus terminating in single spine.

Mandibular palp absent; 4 epipods present.

Sixth abdominal somite with slender posterolateral spines.

Telson broader than long; false eave with broad median projection, medially emarginate, overhanging submedian denticles; four lateral projections present on either side of midline, second obtuse, fourth spinous; submedian projections above marginal armature, outer three projections on margin proper; marginal armature consisting of, on either side of midline, a row of 7-10 slender, fixed, submedian denticles, outermost curving ventrally, 1 movable submedian tooth, and 3 fixed denticles, 1 between each of the four fixed posterior projections.

Outer margin of proximal segment of uropodal exopod with 5-7 movable, spatulate spines, last short, not extending beyond midlength of distal segment; inner distal lobe of proximal segment of exopod with 3-5 slender, non-plumose setae; inner spine of basal prolongation longer than outer.

*Color:* Body covered with dark chromatophores, aggregated along midline in some specimens; eyestalks with large black chromatophores; each gastric groove with a dark spot near anterior margin of carapace; anterior portion of carapace and anterior appendages darker than dorsum of body; lateral margin of sixth abdominal somite and all but median margin of telson black; margin of proximal segment of uropod black.

*Size:* TL 34.0-41.2 mm. Most specimens damaged, CL ranging from 5.3-7.0 mm. Other measurements of male holotype, TL 36.4: carapace length, 6.0; rostral plate length, width, 1.5, 2.3; telson length, width, 3.3, 5.3.

*Name:* The name is from the Greek, *anomala*, irregular or abnormal, referring to variation in the shape of the rostral plate.

*Discussion:* *N. anomala* is the fourth species of *Nannosquilla* recorded from the eastern Pacific. Both *N. californiensis* (Manning, 1961) from the Gulf of California and *N. decemspinosa* (Rathbun, 1910) from Peru and Costa Rica have acute anterolateral angles on the rostral plate. *N. californiensis* has more projections on the false eave of the telson, whereas in *N. decemspinosa* the eave is not subdivided. *N. chilensis* (Dahl, 1954), from Chile, also has rounded anterolateral angles on the rostral plate, but the plate is much broader in the southern species which also differs in having the false eave almost entire and in having subequal spines on the basal prolongation of the uropod.

*Remarks:* Ebert informed Garth that the specimens collected by him were found in vertical burrows, 4 to 6 per square meter, adjacent to kelp beds. The burrows, mucoid lined with packed sand grains, were 10 inches deep and one-half inch wide. The entrances to the burrows lacked shelly debris. Eggs were found in some of the burrows; solitary eggs in the jar with the first lot were 0.8 mm in diameter. Turner found an amphipod, *Ampelisca cristata* Holmes, living with the stomatopods,



and noted that they were of the same general color as the *Nannosquilla*. A note on the biology and life history of *N. anomala* is being prepared by Turner and his co-workers.

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*PROTANKYRA GRAYI* NEW SPECIES AND  
*LABIDOPLAX BUSKII* (McINTOSH) FROM OFF  
NORTH CAROLINA (HOLOTHUROIDEA; SYNAPTIDAE)BY DAVID L. PAWSON  
*Smithsonian Institution*

Since October 1964, the R/V *Eastward* of the Duke University Marine Laboratory has conducted qualitative and quantitative investigations of the continental shelf and slope to the north and south of Cape Hatteras, North Carolina. I have identified the holothurians collected during these surveys and two specimens of synaptid holothurians are described below. One, collected by I. E. Gray, is a new species of the genus *Protankyra*, apparently related to *P. benedeni* (Ludwig) from Brazil. The other, collected by J. Frederick Grassle, is *Labidoplax buskii* (McIntosh), a common Northern European species of a genus hitherto unknown from the Americas. The synaptid holothurian fauna of the Western Atlantic now comprises 14 of the 140 known species.

I am grateful to the staff and students of the Duke University Marine Laboratory for sending me holothurians for study, and to Miss Ailsa M. Clark and Mr. F. W. E. Rowe of the British Museum (Natural History) for making available comparative material of *Labidoplax buskii*. The investigations of R/V *Eastward* are supported by NSF Grant G-17669; those of Dr. I. E. Gray are supported by NSF Grant G-25128.

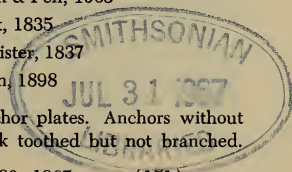
Subclass APODACEA Pawson &amp; Fell, 1965

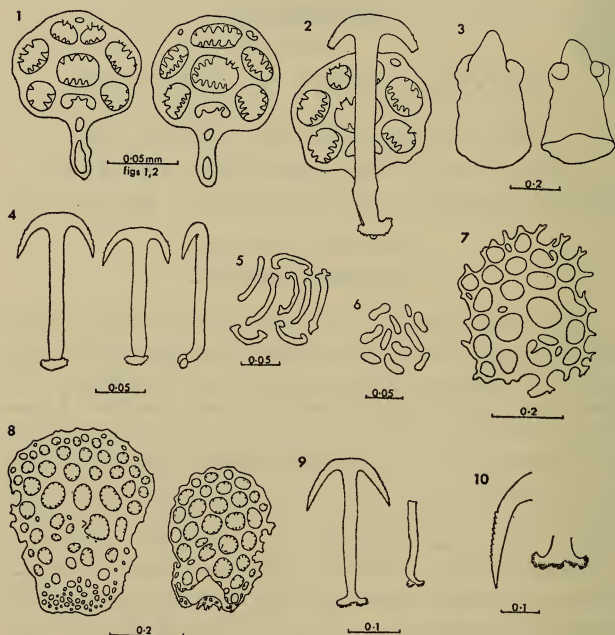
Order APODIDA Brandt, 1835

Family Synaptidae Burmeister, 1837

*Labidoplax* Oerstergren, 1898

*Diagnosis:* Deposits are anchors and anchor plates. Anchors without knobbed vertices, arms usually serrate, stock toothed but not branched.





FIGS. 1-4. *Labidoplax buskii* (McIntosh). 1, anchor plates, showing typical *Labidoplax* form; 2, anchor plate with anchor *in situ*; 3, tentacle, outer (left) and inner (right) aspects, showing two short and one long digits; 4, anchors, profile view showing curve near stock.

FIGS. 5-10. *Protankyra grayi* new species. 5, curved rods from anterior body wall; 6, miliary granules; 7, developing anchor plate; 8, anchor plates, internal (left) and external (right) view; 9, anchors; profile view shows curve near stock; 10, details of anchor arm and stock.

Anchor plates abruptly narrowed posteriorly forming handle; bridge rudimentary or absent. Tentacles digitate, 11 or 12, with 3-5 digits.

*Type-species: Synapta buskii* McIntosh.

*Remarks: Labidoplax* comprises seven species with wide distribution in the Northern Hemisphere. Representatives are known from northern Europe (two species), the Mediterranean and Adriatic seas, the Philippines, Indonesia, and North Carolina, U.S.A. (one species each). One species occurs in the Southern Hemisphere, in the Gulf of Guinea. Bathymetric range of the genus is 0-450 m.

*Labidoplax buskii* (McIntosh)

*Labidoplax buskii*: Clark, 1908, p. 94, pl. 5 Fig. 23 (synonymy to 1905); Becher, 1912, p. 290, Figs. 1-5, pl. 19; Clark, 1924, p. 492, pl. 4, Fig. 10, pl. 8, Figs. 8-10; Hedging, 1931, p. 669.

*Material examined*: Cruise E-14-65, 13 March 1965, 34°17.5'N, 75°49'W, 445 m, VanVeen Grab, foraminiferan sand, annual average bottom temperature 7.0°C, collected by F. Grassle, 1 specimen (U.S.N.M. catalogue no. E10715).

*Description*: Total length of specimen 8.5 mm. Body cylindrical; body wall semitransparent with numerous calcareous deposits. Color in alcohol, white. Tentacles 11, expanded, each with three digits, of which central digit is largest (Fig. 3). Smaller lateral digits arising in distal one-third of tentacle. Tentacles transparent, lacking calcareous deposits.

Deposits are anchors and anchor plates, which vary little in size between anterior and posterior ends of body. Stock unbranched, but with numerous fine serrations. Each arm with 2-4 distal serrations. Shaft of anchor curved near stock (Figs. 2, 4). Anchor length 0.12-0.16 mm, average 0.14 mm; breadth 0.07-0.09 mm, average 0.08. Anchor perforations (Figs. 1, 2) each with seven or eight large oval to elongate perforations with strong marginal teeth. Often one or more smaller perforations around margin of plate. Handle with two perforations. Length of plate 0.10-0.14 mm, average 0.11 mm; breadth 0.09-0.11 mm, average 0.10 mm. Numerous anchors and plates scattered in body wall.

*Remarks*: The specimen is obviously a member of the genus *Labidoplax* because of the nature of its anchor plates. The shape of the plates indicates that the specimen represents one of two species, *L. buskii* or *L. media* Oerstergren. Clark (1908) noted that *L. media* differs from *L. buskii* in having 12 tentacles with four digits while *L. buskii* has 11 tentacles with three digits.

For comparative purposes I borrowed two specimens of *L. buskii* from the British Museum (Natural History). These were collected from Harris Sound in the Outer Hebrides, near the type-locality of the species. One is a complete specimen 21 mm in total length. It has 12 tentacles, ten with four digits, one with three and one with five. The other specimen is a fragment 10 mm in total length with 11 tentacles, nine with four digits and two with three each. Mr. F. W. E. Rowe of the British Museum noted (personal communication) that two other specimens from the same locality each have 12 tentacles, one specimen with four digits on each tentacle, the other with four digits on each of ten tentacles, one tentacle with three digits and one with five. In two other lots of smaller specimens, from Bohuslan, Sweden, and Clyde, Scotland, each specimen had 11 tentacles with three digits.

It is evident from the foregoing discussion that probably the number

of digits on each tentacle of *L. buskii* is a variable character, the number of digits per tentacle increasing with growth of the animal. If this is true, then the validity of *L. media* is doubtful. The North Carolina specimen is here referred to *L. buskii*, which is the older name. Re-examination of comprehensive collections of European material of both of these species is required before the problem of tentacle digit numbers can be resolved.

*Distribution:* *L. buskii* is known from the coasts of Northern Europe, where it occurs at the Outer Hebrides, British Isles, west coast of Sweden and coast of Scandinavia from Kattegat to Porsanger Fiord, at depths of 18–405 m (Clark, 1908). The present new record increases the bathymetric range to 18–445 m.

*Protankyra* Oerstergren, 1898

*Diagnosis:* Deposits are anchors and anchor plates. Anchors with stock more or less branched or finely toothed; arms serrate, vertex without knobs. Anchor plates with numerous perforations; plates not abruptly narrowed posteriorly. Tentacles 10–12, digitate, with two digits on each side of distal extremity.

*Type-species:* *Synapta abyssicola* (Theel) (= *Synapta brychia* Verrill).

*Remarks:* Madsen (1953) regards *P. abyssicola* (Theel) as a junior subjective synonym of *P. brychia* (Verrill). *Protankyra* embraces about 35 nominal species, of which 22 occur in the Japan-New Zealand arc of the Indo-Pacific region. Only five species, *P. brychia*, *P. benedeni* (Ludwig), *P. ramiurna* Heding, *P. panningi* Heding and *P. grayi* new species are known to occur in the Western Atlantic. These species may be distinguished by means of the following key.

KEY TO THE WESTERN ATLANTIC SPECIES OF *Protankyra*

1. (8) Perforations of anchor plates with marginal teeth.
2. (3) Anchors 0.35–0.40 mm long, plates 0.27–0.30 mm long .....  
..... *P. ramiurna* Heding
3. (2) Anchors exceed 0.6 mm in length; plates exceed 0.40 mm in length.
4. (5) Stock of anchor branched. Anchor plates generally longer than 0.70 mm ..... *P. brychia* (Verrill)
5. (4) Stock of anchor not branched. Anchor plates less than 0.60 mm long.
6. (7) Anchor arms with 5–6 serrations. Perforations in plates with few teeth ..... *P. benedeni* (Ludwig)
7. (6) Anchor arms with up to 12 or more serrations. Perforations in plates with several teeth ..... *P. grayi* new species
8. (1) Perforations of anchor plates without teeth. Anchors 0.30–0.40 mm long ..... *P. panningi* Heding

**Protankyra grayi** new species

*Material examined:* Cruise E-28-65, 22 May 1965, 35°18.5'N, 74°58'W, 325 meters, Cape Town (Zoutendyk) Dredge, collected by I. E. Gray, 1 specimen.

*Description:* Specimen a fragment; extreme anterior end absent. Body contracted, contorted, total length 43 mm. Body wall prickly, due to presence of numerous large projecting anchors. Color in alcohol uniform dark brown.

Anchors and anchor plates occur throughout body wall, those from posterior end only slightly smaller than others. Anchors and plates essentially of one type; possibly two distinct sizes occur.

Anchors (Figs. 9, 10) symmetrical, arms narrow, each with approximately 12 serrations; some have fewer serrations; few have none. Stock with numerous small unbranched spines, but with tendency toward branching. Shaft of anchor curved near stock. Length 0.68–0.81 mm, average 0.73 mm; breadth across arms 0.35–0.57 mm, average 0.44 mm. Two considerably smaller anchors found, one 0.25 mm long and 0.11 mm wide in anterior part of body, the other 0.33 mm long and 0.18 mm wide in posterior.

Anchor plates (Figs. 7, 8) oval to rectangular, with well-defined bridge for anchor support. Plates generally broadest near end opposite bridge. Margin of plate smooth or with few small projecting spines. Fully developed plate with numerous (usually more than 50) perforations, most having marginal teeth. Perforations increase in size toward center of plate. Simple small perforations with no marginal teeth occur under bridge. Developing plates lack both indentations and bridge; these acquired late in development. Length 0.34–0.52 mm, average 0.43 mm. Width 0.21–0.38 mm, average 0.32 mm. Plates usually less than 0.40 mm long and 0.30 mm wide in posterior of body, thus smaller than plates from elsewhere. Developmental stages of plates common posteriorly. One small plate 0.38 mm long and 0.29 mm wide found in anterior end.

Small curved rods (Fig. 5) scattered in body wall at anterior end only. Rods with enlarged ends tending to bifurcate; some rods C-shaped. Ends of rods eroded, therefore impossible to tell whether or not they carried minute spines. Length 0.05–0.08 mm, average 0.06 mm. Radial muscles with numerous miliary granules (Fig. 6) of varying shape, most being oval to elongate.

*Holotype:* The holotype (catalogue no. E10716) is in the collections of the Museum of Natural History, Smithsonian Institution.

*Etymology:* It is a pleasure to name this species for Dr. I. E. Gray, Department of Zoology, Duke University.

*Remarks:* It was at first thought that this specimen represented *P. brychia* (Verrill), which has been collected from off Cape Hatteras at 1,688 m, and elsewhere in the Atlantic, but examination of type ma-



terial of that species and of descriptions by Clark (1908, 1924), Deichmann (1940) and Madsen (1953) convinced me that the present species bears no close relationship to *P. brychia*. The most consistent differences exist in the anchors and anchor plates. In *P. brychia* the plates are larger (generally exceeding 0.7 mm in length) than those in *P. grayi* (averaging 0.43 mm in length), and have more numerous small spines scattered about the plate surface. Perforations in the plates of *P. grayi* are, on the whole, less numerous than those in *P. brychia*. The anchor stock is conspicuously branched in *P. brychia*, but not in *P. grayi*, and the former species has 5-6 spines on the flukes while the latter has up to 12 or more. Furthermore, *P. brychia* does not possess curved rods in the anterior body wall.

*P. grayi* shares some features with *P. benedeni* (Ludwig) from Brazil, but differs in having generally larger anchors, smaller plates, more numerous teeth on the perforations of the plates and more numerous serrations on the anchor flukes. *P. grayi* does not appear to be closely related to any other species in the genus.

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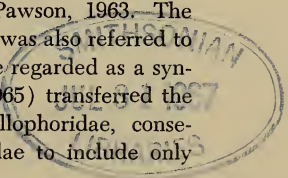
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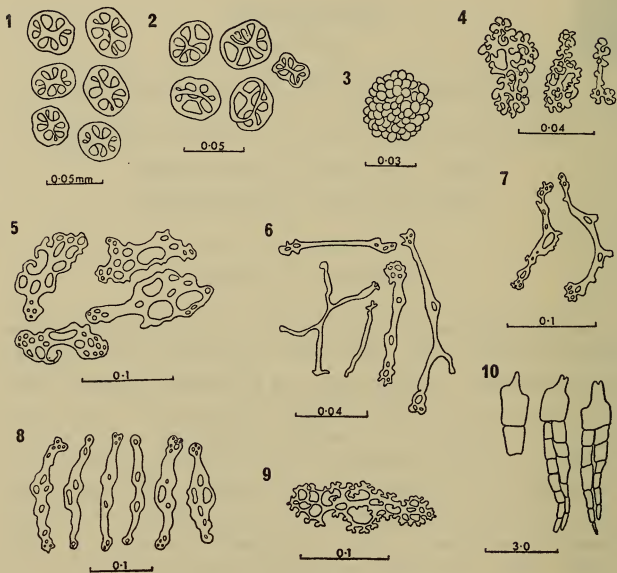
REDESCRIPTION OF *CUCUMARIA SEMPERI*  
BELL, AN INDO-WEST-PACIFIC  
HOLOTHURIAN ECHINODERM

BY DAVID L. PAWSON  
*Smithsonian Institution*

In his report on the echinoderms collected from Melanesia by the H.M.S. "Alert," Bell (1884) described six new species of holothurians. Among these was *Cucumaria semperi*, based on specimens from Port Denison (Queensland) and Torres Straits in Australia. The original description was brief and inaccurate in some important respects, but the species is recognizable by its unique calcareous deposits. The species has subsequently been reported by Vaney (1912) who briefly noted its occurrence at the Aru Islands and by H. L. Clark (1938, 1946), who found numerous specimens at Broome in northwestern Australia.

In a revision of the family Cucumariidae Panning (1949) referred *C. semperi* to the genus *Heterothyone*, subfamily Thyoninae. Pawson (1963) found that the calcareous ring of *H. alba* (Hutton) from New Zealand, the type-species of *Heterothyone*, is of a completely different type from that of *C. semperi*. In *H. alba* the ring is composed of ten solid pieces, and in *C. semperi* it is composed of a mosaic of numerous pieces. This difference necessitated the transfer of *H. alba* (and thus also *Heterothyone*) to the subfamily Colochirinae. However, *C. semperi* was retained in the subfamily Thyoninae and referred to the genus *Hemithyone* Pawson, 1963. The Indian species *C. pigra* Koehler and Vaney was also referred to *Hemithyone* by Pawson (1963), but is here regarded as a synonym of *H. semperi*. Pawson and Fell (1965) transferred the subfamily Thyoninae to the family Phyllophoridae, consequently restricting the family Cucumariidae to include only





FIGS. 1-10. *Hemithyone semperi*. 1, normal deposits from body wall; 2, deformed deposits from body wall; 3, spherical rosettes; 4, small rosettes; 5, plates from tube feet; 6, smaller tentacle rods from tentacle; 7, larger rods from tentacle; 8, rods from tube feet; 9, large rosette; 10, one radial and two interradial pieces of calcareous ring.

those soft-bodied holothurians which lack long posterior processes on the calcareous ring.

When these nomenclatural changes were made, I had had no opportunity to examine specimens of *H. semperi*, but later I was able to examine all the British Museum holdings of *H. semperi* including the type series. A revised description of the species, together with new data on its distribution, is given here.

I am grateful to Miss Ailsa M. Clark, Curator of Echinoderms at the British Museum (Natural History), for allowing me access to the collections of holothurians at that institution.

Family PHYLLOPHORIDAE Östergren, 1907, emend.

Pawson and Fell, 1965

Subfamily THYONINAE Panning, 1949

*Hemithyone* Pawson, 1963

*Diagnosis*: Calcareous deposits of body wall circular to oval bodies with two sets of transverse and longitudinal bars, one set on each side of deposit. Average greatest length of body wall deposits 0.4 mm. Tentacles with minute rods and rosettes. Tube feet with plates and perforated rods.

*Type-species*: *Cucumaria semperi* Bell, 1884.

*Remarks*: As I regard *Cucumaria pigra* Koehler & Vaney a synonym of *C. semperi*, *Hemithyone* is monotypic. It is readily distinguishable from other genera in the subfamily Thyoninae by its calcareous deposits.

*Hemithyone semperi* (Bell)

*Cucumaria semperi* Bell, 1884, p. 147, pl. 9, Fig. A; Theel, 1886, p.

104; Vaney, 1912, p. 290; Clark, 1938, p. 445; 1946, p. 388.

*Cucumaria pigra* Koehler & Vaney, 1908, p. 38, pl. 3, Figs. 13-16.

*Heterothyone semperi*: Panning, 1949, p. 464.

*Heterothyone pigra*: Panning, 1949, p. 464.

*Hemithyone semperi*: Pawson, 1963, p. 28.

*Hemithyone pigra*: Pawson, 1963, p. 28.

*Material examined*: 14 specimens in the British Museum from the following localities: Port Denison, Queensland, "Alert" Collection, 2 specimens (SYNTYPES) 81.10.26.43-45; Torres Straits, "Alert" Collection, 4 specimens (SYNTYPES), 82.2.22.116; Gulf of Manaar, Rameswaram, S. India, collected by E. Thurston, 1 specimen, 1888.11.15.13; Cape Boileau, northern Australia, collected by Mrs. B. Grey, 1 specimen, 1938.4.3.4; off La Grange, northwestern Australia, 19°15'S, 120°10'E, collected by Mrs. B. Grey, 6 specimens, 1938.4.3.5-7.

*Description*: Body elongate, fusiform, sometimes U-shaped, total length 23-50 mm. Tube feet strongly retractile, generally restricted to double rows in ventral radii; double row arrangement often obscured in contracted material. Dorsal tube feet in double rows in radii, sometimes restricted to radii, but often few to many tube feet also scattered in middorsal interradius. Body approximately pentagonal in cross section. Color in alcohol whitish to light brown, tube feet slightly darker. Invert translucent pink, stem of tentacles off-white, digits light to dark brown. Tentacles richly branched, ventral pair considerably smaller than others.

Calcareous ring tubular, long. Radials with weak anterior notch for attachment of retractor muscle; posterior projections paired, each composed of several rectangular pieces (Fig. 10). Interradials with short anterior projection; each interradiol made up of two pieces, posterior piece being almost rectangular.



Body wall with immense numbers of calcareous deposits, generally of one type, a circular to oval outer ring with transverse and longitudinal connecting bars. Typical deposit with two bars at right angles on one side of deposit and on other side a central longitudinal bar bearing at each end two oblique transverse bars (Fig. 2). Average greatest length of deposits 0.04 mm.

Tube feet with well-developed end plates. Simple plates with large and small perforations (Fig. 5) near end plates. Perforated rods of average length 0.18 mm with few scattered central perforations and smaller terminal perforations (Fig. 8) also present in feet. Tentacles filled with minute rods and rosettes, latter especially numerous. Rods apparently of two sizes, averaging 0.07 mm and 0.13 mm in total length, often branched, with or without perforations (Figs. 6, 7). Rosettes also of two sizes (Figs. 4, 9), varying greatly in degree of complexity. Some rosettes spherical; (Fig. 3), others resemble flat plates. Rosettes also numerous in bases of tentacles, skin around mouth, and in introvert.

*Remarks:* Bell (1884) described two specimens of 36 and 25 mm total length. He did not examine the characteristic deposits in the tentacles which are a striking feature of this species. In referring to the deposits in the tube feet, Bell described the rods as ". . . not unlike folding eyeglasses in form . . ." and his illustration of a rod certainly conveys that impression. However, Bell has illustrated a broken rod which showed only two perforations. As shown in Fig. 8, the central portions of some rods do resemble eyeglasses, but complete rods do not.

In the original description of *Cucumaria pigra*, Koehler and Vaney stated that their specimens closely resembled *H. semperi* in most features, differing only in that the deposits of the tube feet did not resemble folding eyeglasses which, as indicated above, was based on an erroneous observation. The illustrations of the deposits of *C. pigra* are closely similar in size and shape to those of *H. semperi*. The type of large elongate plate from the body wall of *C. pigra* was not found in material of *H. semperi* I examined, but a photograph of the deposits from the body wall of a specimen from the original type-series of *H. semperi* kindly given to me by F. W. E. Rowe of the British Museum shows one of these plates. It appears that such plates are rare in the body wall. The calcareous ring of *C. pigra*, as illustrated by Koehler and Vaney, differs in some respects from that of *H. semperi*, the most notable difference being that in the former the ring appears to be composed of rather more numerous and smaller pieces than that of the latter. This difference is probably an artifact of preservation or an inaccurate illustration.

There appears to be no good reason for regarding the two species as distinct, and the unique nature of the calcareous deposits argues most strongly for synonymizing them.

*Lectotype:* I have selected as the lectotype of *Cucumaria semperi*

Bell the largest specimen (total length 36 mm) of the series of four collected from Torres Straits by the "Alert" (BMNH 82.2.22.116).

*Distribution*: In Australia *H. semperi* is known from Port Denison and Torres Straits (Bell, 1884), Broome (Clark, 1938), and from Cape Boileau and off La Grange. The species appears to range from Queensland in the east through Torres Strait to the vicinity of Broome in the northwest. It has been found at the Aru Islands in the Arafura Sea (Vaney, 1912), and at India, where it has been collected at Karachi (type-locality of *Cucumaria pigra* Koehler & Vaney) and from the Gulf of Manaar. The known bathymetric range is from low tide level to about 13 meters. Clark (1946) noted that at Broome the species appeared to be most common at a depth of about 13 meters.

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A NEW CRAWFISH OF THE CRISTATUS SECTION  
OF THE GENUS *CAMBARUS* FROM MISSISSIPPI  
(DECAPODA, ASTACIDAE)<sup>1</sup>

BY J. F. FITZPATRICK, JR.

*Mississippi State University, State College, Mississippi 39762*

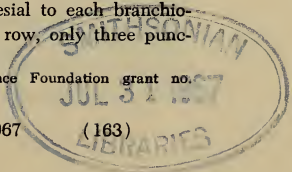
The species described below is assigned to the *Cristatus* Section (Hobbs, 1955: 98) of the crawfish genus *Cambarus*. It is compatible with the diagnosis of the Section as given by Hobbs (1966: 109), except that the areola is longer (upper limits: Hobbs, 1966, 35.5% length of carapace; *valleculus*, 38.7%). The other two species in the Section are in the Tombigbee River watershed; the new species is in the upper Pearl River watershed.

***Cambarus valleculus* new species**

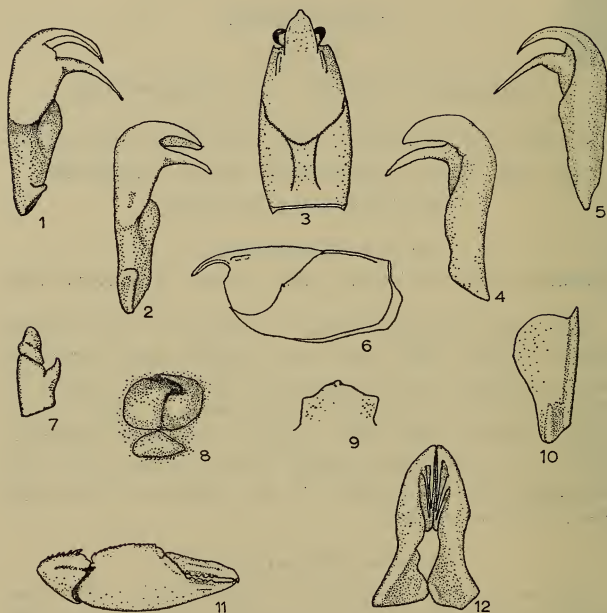
*Diagnosis:* Rostrum subplane or slightly excavate, subspatulate, without marginal spines or tubercles. Areola 4.75-3.31 (avg. 4.20) times longer than broad, constituting 32.2-28.7 (avg. 34.2) per cent of entire carapace length. Suborbital angle much reduced. Antennal scale more than one-half as broad as long. Chela with cristiform row of tubercles along mesial margin of palm. First pleopod of male with central projection directed at approximately 105-degree angle to main shaft of appendage; mesial process slender, directed at 120-degree angle (approximately), extending caudad almost half its length beyond tip of central projection. Pleopods slightly asymmetrical (Fig. 12). Annulus ventralis subovoid with deep cephalic sinus that disappears in caudal half. (Fig. 8).

*Holotypic male, Form I:* Body subovate, compressed laterally. Abdomen narrower than cephalothorax (8.0; 9.8 mm, respectively). Width of carapace less than depth in region of caudodorsal margin of cervical groove (9.8; 10.0 mm). Areola moderately broad (4.1 times longer than wide) with irregular row of punctations mesial to each branchio-cardiac groove and irregular median longitudinal row, only three punc-

<sup>1</sup>This study is supported in part by National Science Foundation grant no. GB-4719.







FIGS. 1-12. *Cambarus valleculeus*. 1, Mesial view of first pleopod of holotype; 2, Mesial view of first pleopod of morphotype; 3, Dorsal view of carapace of holotype; 4, Lateral view of first pleopod of morphotype; 5, Lateral view of first pleopod of holotype; 6, Lateral view of carapace of holotype; 7, Ischiopodite and basipodite of third pereopod of holotype; 8, Annulus ventralis of allotype; 9, Epistome of holotype; 10, Antennal scale of holotype; 11, Distal podomeres of cheliped of holotype; 12, Caudal view of first pleopods of paratypic first form male. (Setation and punctations removed from all figures.)

tations across narrowest part. Cephalic section of carapace 2.1 times as long as areola; areola 32.2 per cent of total length of cephalothorax. Rostrum 1.2 times longer than wide, subspatulate with tuberculate acumen, but lacking marginal spines, tubercles or angles, margins only slightly elevated; tip of rostrum reaching tip of distal end of peduncle of antennule; upper surface only slightly depressed, with few setiferous punctations; rostrum depressed cephalically (Fig. 6). Subrostral ridges weak, barely evident in dorsal aspect.

Postorbital ridges well developed; cephalic ends lacking tubercles or spines. Suborbital angle much reduced. Branchiostegal spine small but acute. Cervical spines and tubercles absent. Carapace moderately punctate dorsally and cephalolaterally. Abdomen longer than carapace (22.0, 20.5 mm). Cephalic section of telson with two acute spines in each caudolateral corner.

Epistome (Fig. 9) broader than long, subplane, with small cephalo-median tubercle. Antennules normal with small spine on lower surface of basal segment. Antennae reaching third abdominal segment. Antennal scale (Fig. 10) broadest near distal end, 1.75 times longer than wide, terminating distally in strong spine.

Chela (Fig. 11) with palm broad, only slightly inflated and somewhat depressed, length of inner margin of palm longer than width; upper surface of palmar area with scant scattered setiferous squamous tubercles; inner margin with cristiform row of 13 tubercles; lower surface punctate; fingers not gaping; upper and lower surfaces of both fingers with submedian ridge flanked by setiferous punctations, ridges of upper surfaces more prominent; tubercle on lower surface at base of dactyl; opposable margin of dactyl with four subequal tubercles along proximal three-fifths and crowded minute denticles in distal two-fifths; opposable margin of immovable finger with three subequal tubercles along proximal three-fifths and one smaller tubercle in penultimate position, distal two-fifths with crowded minute denticles; tubercles of immovable finger overlying tubercles of dactyl when margins opposed, but tip of dactyl overlying tip of immovable finger.

Carpus of cheliped longer than broad; grooved dorsally, with few setiferous punctations; inner margin with two proximomedian acute spines, two ventromedian acute spines at about one-third length distally; single strong acute spine at two-thirds length, and with two acute spines, one each just proximoventral and proximodorsal to aforementioned spine; lower surface with only stout tubercle on proximo-lateral margin. Merus with row of 13 small acute spines spaced equidistantly along entire lower mesial margin; lower lateral margin with irregularly spaced row of six subacute spines; all spines subequal in size; upper surface with row of eight small acute setiferous spines along proximal eight-tenths, and three larger subacute spines distally. Ischiopodite with cristiform row of three small tubercles.

Maxillipeds and coxae of third through fifth pereopods heavily setose. Ischiopodites of third pereopods with strong simple hooks; hooks extending proximally beyond bases of ischiopodites (Fig. 7). Sternal projections setiferous at bases of coxopodites as in other members of Section.

First pleopods slightly asymmetrical (Fig. 12), reaching to coxopodites of third pereopods when abdomen is flexed, lying deeply embedded between ventrally projecting sternal projections; distal portion terminating in two parts; central projection corneous, tip subacute, bent caudally

at angle of approximately 105 degrees to main shaft of appendage; mesial process non-corneous, slender, tapering from base to tip, directed caudad at angle of approximately 120 degrees, tip blunt, sub-parallel to central projection; mesial process markedly longer than central projection and extending beyond it at least half length of mesial process (Figs. 1, 5). Tips of pleopods directed slightly mesiad, in close approximation to tips of other pleopod when in normal position.

*Morphotypic male, Form II*: Differs from holotype in following respects: inner margin of palm equal in length to dactyl; carpus lacking spines just proximal to stout acute spine and with only one spine between acute spine and proximomedian pair; lower lateral margin of carpus with strong acute spine; areola 3.6 times longer than wide and 33.8 per cent of total length of cephalothorax; length of inner margin of palm equal to length of palm. First pleopod with both tips non-corneous, stouter, shorter, and less bent caudally; mesial process proportionally shorter; inobtrusive process at caudolateral base of central projection (Figs. 2, 4).

*Allotypic female*: Differs from holotype in following respects: carpus lacking spines just proximal to strong spine; lower lateral margin of carpus with strong acute spine.

Annulus ventralis movable, subovate; deep depression in cephalomedian portion extending obliquely in cephalic third; sinus originating in depression, extending across midline, recurving sharply to midline and there caudally, becoming shallower to become trough in caudal half; trough broadening in caudal portion and extending to caudal margin (Fig. 8).

*Measurements*: As follows (in mm):

	Holotype	Allotype	Morphotype
Carapace			
Height	10.0	10.2	9.6
Width	9.8	9.4	9.1
Length	20.5	22.3	21.0
Areola			
Length	6.6	7.2	7.1
Width	1.6	1.8	2.0
Rostrum			
Length	5.3	6.1	5.6
Width	4.4	4.4	4.3
Chela			
Palm length (inner margin)	7.7	5.1	6.5
Palm width	7.1	5.6	6.5
Palm length (outer margin)	16.5	11.6	14.0
Dactyl length	8.7	6.4	7.6

*Type-locality*: Small creek, 6.8 mi. S junction of State Routes 15 & 12 (Ackerman) on State Route 15, Choctaw County, Mississippi. This

creek flows through typical woodlands on the ridge dividing the Pearl and Tombigbee River drainages, and eventually flows into the former. The creek was about 4 feet wide and did not exceed 2 feet in depth; the banks were elevated about 20 inches above water level and were slightly undercut; the bottom was composed of sand, silt and small gravel, with sparse detritus and leaf litter; the flow was strong for a stream in this section of the state. Crawfishes were collected from the litter and from beneath the undercut banks. No burrows were observed.

Other crawfishes collected with *C. valleculus* at the type locality were immature specimens belonging to a species of the Blandingii Section of the genus *Procambarus*, possibly *P. a. acutus* (Girard, 1852). At other localities, the associates were *P. a. acutus*.

*Disposition of types:* The holotype, allotype, and morphotype are deposited in the United States National Museum (nos. 117963, 117964, and 117965, respectively). Topoparatypes are in the Museum of Comparative Zoology (1♂ I, 2♂♂ II; 2♀♀, 1♂ imm., 1♀ imm.), Tulane University (2♂♂ II; 2♀♀, 1♂ imm., 1♀ imm.), and the Mississippi State University Collections (1♂ I, 7♂♂ II, 8♀♀, 6♂♂ imm., 7♀♀ imm.). Other paratypes are deposited in the Ohio State Museum (1♂ II, 2♀♀, 2♂♂ imm., 2♀♀ imm.), and the M. S. U. Collections (2♂♂ II, 4♀♀, 11♂♂ imm.; 12♀♀ imm.).

*Variations:* Only slight variations in tubercular and spinose ornamentation of the cheliped were observed. The acumen was not present on a few specimens, but in these the rostrum seems damaged.

*Relationships:* *C. valleculus* is related most closely to *C. cristatus* Hobbs (1955: 95) and *C. prominens* Hobbs (1966: 110). It is similar to the latter in the degree of flexion of the tips of the first pleopod. The epistome and chela of *C. valleculus* differ from the other two species. The most distinguishing characteristics of the new species, however, are the unique annulus ventralis and the male first pleopod. The tips of the pleopod are longer and even more sharply bent caudad than in *C. prominens*. Too, the bend of the central projection is less sharp cephalically than in either of the other species, making the cephalic margin a smoother curve. In this latter respect *C. valleculus* is more similar to *C. cristatus* than *C. prominens*, but it is easily distinguished from the former by the greater bend of its tips and their greater length.

*Etymology:* The name of this species is taken from the Latin *vallecula*, a small valley; it is so named because of the "small valley" formed by sternal and pereopod modifications in which the pleopods of *Cristatus* Section crawfishes are carried.

*Remarks:* The slightly asymmetric pleopods of *C. valleculus* (Fig. 12) is an uncommon condition in *Cambarus*. This condition, however, is common in the Blandingii Section of *Procambarus*, from which genus *Cambarus* possibly arose.

*Acknowledgments:* I am grateful to Dr. Horton H. Hobbs, Jr., of

the USNM who helped me with my comparison of this species with other *Cristatus* Section crawfishes and Messrs. James F. Payne and Shih-ming Chien who assisted in field collections.

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A NEW SPECIES OF *QUEMAYA* FROM THE  
COLORADO DESERT OF CALIFORNIA  
(HYMENOPTERA; TIPHIIDAE)

BY MARIUS S. WASBAUER

*California Department of Agriculture, Sacramento*

The genus *Quemaya* is a group of primarily nocturnal brachycistidine wasps consisting entirely of small to minute forms which are brown or black. At least some of the species are abundant in nature but all are poorly represented in collections. Because of their nocturnal habits, small size and dull coloration they are often overlooked by the general collector.

Ultra violet light is a strong attractant for these wasps, and various black light sources such as argon or fluorescent tubes attract much larger numbers than do conventional incandescent lamps. The species described in this paper was first collected on a recent trip to California's Imperial County Sand Hills by use of a 15 watt fluorescent tube<sup>1</sup> housed in a standard transistorized inverter unit<sup>2</sup> and powered by a 12 volt automobile battery. The light unit was placed over a funnel trap, designed by W. R. Bauer, California Department of Agriculture, and allowed to run continuously through the night.

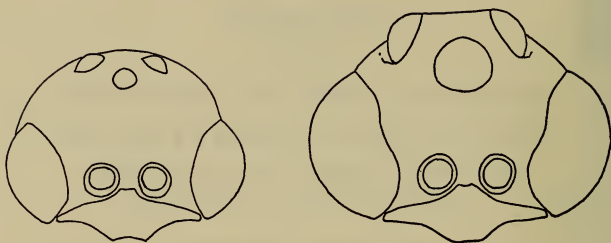
Abbreviations used in the following description are explained elsewhere (Wasbauer, 1966:6) with the exception of UID, the upper interocular distance, which is the distance between the tops of the compound eyes measured with the head in full frontal view.

***Quemaya arenicola* new species**

*Description of male holotype:* Head, mesosoma and first metasomal segment medium mahogany brown, remainder of metasoma nearly

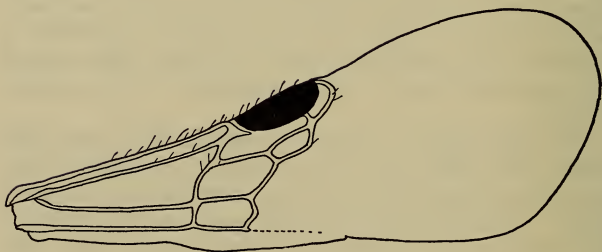
<sup>1</sup> General Electric F15T8.BL

<sup>2</sup> Econo Light, Model E.C.F. 20. E.C.F. Electronics, Inc., 748 Peter Road, Wheaton, Illinois 60187.



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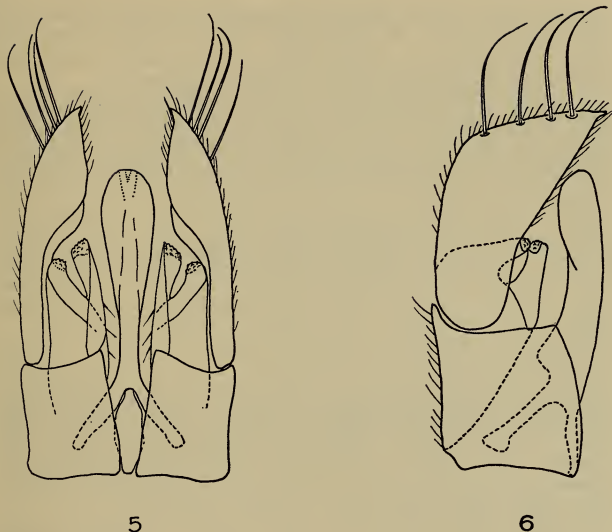


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FIGS. 1-4. *Quemaya* spp. 1, frontal view of head of *Q. perpunctata*. 2, frontal view of head of holotype of *Q. arenicola*. 3-4, anterior and posterior wings of paratype of *Q. arenicola*.



FIGS. 5-6. *Quemaya arenicola*, holotype. 5, dorsal view of genitalia. 6, lateral view of genitalia.

black; antennae, mandibles and legs straw yellow. Vestiture moderately abundant, consisting of short fine to long stout pellucid hairs, pale straw colored on head and mesosoma, becoming very long, brownish on apical metasomal segments. Body strongly impunctured, punctures deep and well defined; small second degree density on clypeus; larger, second degree density on face above antennal sockets and vertex between lateral ocelli; second degree density on pronotum medially; first degree density on posterolateral angles; second degree density on mesonotum and scutellum; first degree density on mesepisternum anteriorly, becoming second degree density posteriorly; first degree density on dorsolateral, posterolateral and posterodorsal angles of propodeum; first degree density on first metasomal tergum; first degree density on second metasomal tergum, becoming second degree posteriorly; second degree density on remaining metasomal terga except for row of larger closely set punctures before apex of each segment.

*Head:* Compound eyes strongly enlarged and convergent below (Fig. 2) EH  $1.15 \times$  LID; LID/TFD .45; UID/LID 1.6; ocelli greatly enlarged, nearer to compound eyes than to each other, OOL/POL .60; clypeus with distinct preapical raised area that is narrower than space

between antennal sockets, median section of apical edge thin, lamellate, narrow,  $0.39 \times$  length of lateral apical section; mandibles with two teeth, apical tooth long and acute, subapical tooth shorter, more blunt; gular carina not raised anteriorly into tooth or elevation.

*Mesosoma*: Pronotum rather long, in lateral view with strong posterior slope dorsally; mesonotum rising sharply above level of pronotum, thus not forming even curve with posterior edge of pronotum; propodeum with dorsal surface margined posteriorly by broad, shallow, irregular sulcus, curving anteriorly at sides; posterior face with broad shallow median longitudinal sulcus; anterior wing (Fig. 3) with two submarginal cells, second completely underlying first; first discoidal cell 1.23 times as high as second, 2.12 times as long as high; stigma black; veins lightly pigmented, straw colored; posterior wing (Fig. 4) with veins nearly colorless; jugal lobe not strongly surpassing apex of submedian cell.

*Metasoma*: Genitalia as in Figs. 5 and 6.

*Length*: 5.7 mm.

*Type material*: 6 miles west of Glamis, Imperial County, California, at fluorescent black light; holotype and 30 paratypes, 5 August 1966, M. S. Wasbauer collector, 14 paratypes, 19 September 1966, R. A. Flock collector. The holotype (no. 9306) and 22 paratypes have been deposited in the collection of the California Academy of Sciences, and 22 paratypes with the United States National Museum.

*Variation*: The paratype series varies in length from 3.3 to 6.5 mm. There is little variation in color or other morphological features.

*Remarks*: Individuals of *arenicola* are the largest in size now known for the genus *Quemaya*. Their large size, heavy punctation and certain structural features (presence of two submarginal cells in the anterior wing and the sulcus on the posterior face of the propodeum) indicate that this species is closely related to *Q. perpunctata* (Cockerell). It can be separated from *perpunctata* by the enlarged ocelli (OOL/POL *arenicola* less than 1.0; *perpunctata* more than 1.0) and very large strongly convergent compound eyes (Figs. 1, 2).

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A NEW CRAWFISH OF THE GENUS *CAMBARUS* FROM  
SOUTHWEST LOUISIANA (DECAPODA; ASTACIDAE)

BY JOE B. BLACK

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The species herein described first came to my attention when I noticed an unidentified crawfish in the McNeese invertebrate collection bearing an aberrant right chela, the immovable finger of which was inflated into a palm with five fingers. Other specimens were later added from the Lake Charles and Carlyss, Louisiana areas.

To my knowledge, this is the third species of *Cambarus* to be described in which the first form males bear three distinct elements on the terminal end of the first pleopod, rather than the usual two. Both of the previous descriptions are recent: *C. pristinus* Hobbs (1965) and *C. strawni* Reimer (1966).

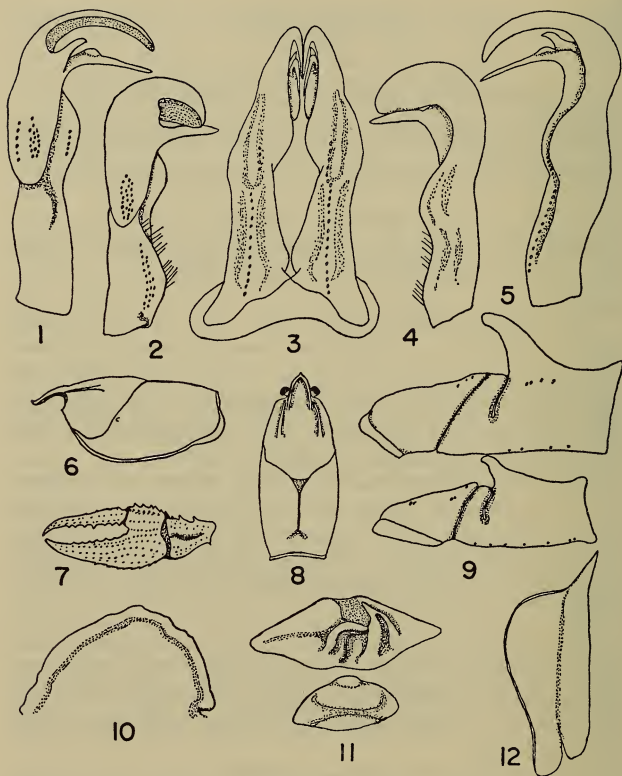
This crawfish is also unusual in that the ischiopodites of both the third and fourth pereopods of first form males bear hooks. Males of other known species of *Cambarus*, with the exception of *C. dissitus* Penn (1955), bear hooks on the third pereopod only.

I wish to thank Dr. Horton H. Hobbs, Jr., United States National Museum for his constructive criticism of the manuscript. I also wish to thank Mr. Jerry Walls, my wife, Marilyn and daughter, Ruth Anne for help with the collections. Most helpful were several collections given to me by Mr. L. R. Ford, biology teacher at Sulphur High School.

***Cambarus macneesei* new species**

*Diagnosis:* Body pigmented; eyes well developed and pigmented; rostrum without marginal spines; antennal scale extending slightly beyond tip of rostrum. Rostrum directed cephaloventrad; upper surface deeply excavate; margins converging slightly from base and turning





FIGS. 1-12. *Cambarus macneesei* new species. 1, mesial view of first pleopod of holotype; 2, mesial view of first pleopod of morphotype; 3, caudal view of first pleopods of holotype; 4, lateral view of first pleopod of morphotype; 5, lateral view of first pleopod of holotype; 6, lateral view of carapace of holotype; 7, chela and carpus of holotype; 8, dorsal view of carapace of holotype; 9, basipodite and ischiopodite of third and fourth pereopods of holotype; 10, epistome of holotype; 11, annulus ventralis of allotype; 12, antennal scale of holotype.

mesiad abruptly toward tip, giving practically no acumen. Areola obliterated or very narrow in middle. Chela depressed apically, palm inflated; hooks on ischiopodites of third and fourth pereopods. First pleopod of first form male reaching base of third pereopod, when

abdomen is flexed, and terminating in three parts: mesial process (Figs. 1, 5) inflated near base, non-corneous and directed caudoproximad at slightly more than right angle to main shaft of appendage; central projection (Figs. 1, 5) bladelike, corneous, with entire tip, and recurved caudomesiad so that right and left central projections are in contact *in situ* (Fig. 3); cephalic process (Fig. 1) short, corneous and directed caudomesiad at about 75 degree angle to main shaft. Annulus ventralis as figured (Fig. 11).

*Holotype male, form I:* Pigmented, eyes normal; body ovate; abdomen narrower than cephalothorax. Carapace (Figs. 6, 8) deeper than wide (12.5 and 12.3 mm) in region of caudodorsal margin of cervical groove; carapace widest slightly caudal of caudodorsal margin of cervical groove.

Areola (Fig. 8) obliterated in middle; cephalic section of cephalothorax 1.6 times longer than areola; length of areola 38.3 percent of entire length of carapace. Rostrum with thickened, elevated, convergent margins; short acumen, not distinctly delimited at base, terminating apically in upturned tubercle. Upper surface of rostrum strongly excavate, with row of setiferous punctations mesial to elevated margins. Postorbital ridges low and terminating anteriorly without spines. Branchiostegal spines minute. Surface of carapace sparsely punctate dorsally and slightly granulate laterally. Carapace slightly longer than abdomen (26.6 and 25.5 mm).

Cephalic section of telson with two spines in each caudolateral corner. Epistome (Fig. 10) wider than long with no cephalomedian projection; ventrolateral margin slightly crenulated. Antennules of usual form with spine on ventral surface of basal segment. Antennae extending caudad to middle of second abdominal segment. Antennal scale (Fig. 12) short, reaching only slightly beyond tip of rostrum, 3.0 times longer than broad with greatest width slightly distal to midlength. Lateral margin terminating in strong spine.

Left chela (right missing) depressed; palm inflated; thickness of palm about 60 percent of its width. (16.2 and 7.3 mm); fingers and palm and adjacent upper surface with row of six tubercles and a few scattered tubercles distally (Fig. 7). Opposable margins of both dactyl and immovable finger with row of seven larger tubercles with numerous smaller tubercles distally, third tubercle from base larger on immovable finger, fourth tubercle from base larger on dactyl. Carpus (Fig. 7) longer than wide, slightly longer than mesial margin of palm, with a well-defined longitudinal furrow above. Mesial margin with two major tubercles, distal one larger. Upper surface punctate; lower surface sparsely punctate with two prominent distal tubercles.

Hooks (Fig. 9) on ischiopodites of third and fourth pereopods. Hooks simple; length of hook on third pereopod about 60 percent of greatest width of ischiopodite; length of hook on fourth pereopod about one half greatest width of ischiopodite.

Coxopodite of fourth pereopod with prominent, flattened, ventro-

caudally projecting prominence abutting cephalic margin of coxopodite of fifth pereopod.

First pleopods (Figs. 1, 3, 5) symmetrical. See diagnosis for description.

*Allotypic female*: Excluding sexual dimorphism, differing from holotype in following respects; crenulation of ventrolateral margin of epistome more pronounced; chela slightly reduced but with similar sculpture. Annulus ventralis (Fig. 11) immovable, about 2.4 times wider than long; cephalomedian trough flanked by longitudinal ridges, narrowing near midlength with cephalic curve of trough directed caudosinistrally and caudal portion of trough directed caudodextrally; sinus originating sinistral to midventral line slightly caudal to midlength, extending dextrally across median line before curving caudally to end on caudal wall of annulus. Sternal sclerite immediately caudal to annulus rounded ventrally and about twice as broad as long. The sternite of fourth thoracic segment smooth and not encroaching on annulus.

*Morphotypic male, form II*: Differs from holotype in following respects: areola depressed forming shallow trough; antennal scale reaching only to tip of rostrum; chela proportionately narrower and less thick; hooks on ischiopodites of third and fourth pereopods reduced, although still easily discernable; prominence on coxopodite of fourth pereopod only slightly less developed than in holotype. First pleopods (Figs. 2, 4) reaching to caudal margin of coxopodites of third pereopods when abdomen is flexed; all processes reduced and non-corneous; cephalic process appearing only as slight elevation to central projection.

*Measurements*: see Table 1.

*Type-locality*: Roadside ditches along East McNeese Road, 1.8 miles west of intersection of East McNeese Road and Louisiana Highway 14, Lake Charles, Calcasieu Parish, Louisiana. The ditches are adjacent to pastures and drain into Calcasieu River, which is some four miles to the west. All specimens were taken from flooded ditches following heavy rains. The ditches are dry at other times and it is assumed that the crawfishes burrow. Several simple burrows with low chimneys were noted, but it was not determined whether these burrows were occupied by *C. macneesei* or by other species. *C. macneesei* shares these ditches with *C. hedgepethi* Hobbs, *C. diogenes ludovicianus* Faxon and *Procambarus blandingii acutus* (Girard).

*Disposition of types*: The holotypic male, form I, allotypic female, and morphotypic male, form II are deposited in the United States National Museum (nos. 117681, 117682 and 117683, respectively). Paratypic series consisting of one male, form I, one female and one male form II are deposited in the invertebrate collections of Mississippi State University, Tulane University and the Museum of Comparative Zoology. The remaining paratypes are in my personal collection.

*Geographic distribution*: The type series of *Cambarus macneesei* were collected from four localities in southwest Louisiana. All known localities are within the drainage of the Calcasieu River, Calcasieu

TABLE 1. Measurements (in mm) of *Cambarus macneesei*.

		Holotype	Allotype	Morpho- type
Carapace	Length	26.6	26.0	24.8
	Width (greatest)	12.3	11.5	11.4
	Depth (greatest)	12.5	11.3	11.2
Rostrum	Length	5.0	5.0	4.5
	Width (at base)	4.0	4.0	3.5
Antennal scale	Length	3.6	broken	3.3
	Width (greatest)	1.2	1.2	1.2
Epistome	Width (at base)	2.2	2.3	2.2
	Length	1.1	1.1	1.1
Length of abdomen		24.0	24.1	23.0
Areola	Length	10.2	10.4	10.1
	Width (least)	0.0	0.0	0.0
Chela	Length (outer margin)	16.2	14.4	15.7
	Length of dactyl	9.5	8.6	9.3
	Width of palm	7.3	6.4	6.8
	Thickness of palm	4.4	4.0	4.2

Parish, Louisiana. These records are as follows: one male, form I, Maplewood, collector unknown (JBB 88); four males, form I, two males, form II, type locality, J. Black and J. Walls (JBB 99); one male, form I, four males, form II, two females, three juvenile males and four juvenile females, backyard of residence, 4422 Sarver Street, Lake Charles, J. and R. A. Black (JBB 117); three males, form I, one male, form II, one female, Carlyss, L. R. Ford (JBB 193); one male, form I, one male, form II, three females, type locality, J., M. and R. A. Black (JBB 196); four males, form I, one female, Carlyss, L. R. Ford (JBB 204); one male, form I, Carlyss, L. R. Ford (JBB 212).

*Ecological and life history notes:* All collections have come from pools and roadside ditches which are wet only following rains. The soil is poorly drained, heavy alluvial clay. Form I males and mature females were collected in January, July and August. Young juveniles were taken in late January, following a heavy rain which flooded the burrows, suggesting a winter reproductive season. Very likely eggs were laid while the females were in burrows. One female had a few juveniles still attached to her swimmerets.

*Color notes:* Primary background color for the carapace and dorsal aspect of the pereopods is olive green. Dorsal surface of abdomen is olive brown. Ventral surfaces of cephalothorax, including pereopods and first pleopods of males are cream colored. Articulating surfaces between palm and carpus and between carpus and merus of first

pereiopod are red. Prominent tubercles on first pereiopod are tipped with cream. About 60 percent of specimens examined showed a prominent, cream-colored, mid-dorsal stripe commencing just caudal to the base of the rostrum and terminating at the caudal end of the last abdominal segment. This stripe does not appear to be a sexual dimorphic character. Both males and females were observed with and without the stripe. Width of the stripe is variable on the carapace but is of uniform width (one mm) on the abdomen.

*Variation:* Body ratios, tubercles and processes show little variation. The mesial process of several of the preserved form I males is collapsed so that the process is oriented parallel with the main shaft of the pleopod. This is a tendency which could cause confusion in identification in the future.

*Relationships:* *Cambarus macneesei* appears to be closely related to *C. dissitus* Penn (1955), thus placing it in the Diogenes Section as defined by Ortmann (1931:146). Both have hooks on the ischiopodites of both the third and fourth pereiopods. The appearance of the first pleopod, with the exception of the unusual cephalic process in *C. macneesei*, is very similar. Penn (*op. cit.*) discussed the superficial similarity of the first pleopod of *C. dissitus* to that of *Procambarus tenuis* Hobbs (1950:194). The resemblance is more striking in the case of *C. macneesei* because of the similarity of the cephalic processes of the males and annuli ventrales of the females.

*C. macneesei* shares its cephalic process with only one other known species of *Cambarus*, *C. strawni* Reimer (1966:12). It is distinguished from this species by the presence of hooks on the ischiopodite of the fourth pereiopod of males, also by differences in the epistome, annulus ventralis, antennal scale and mesial process.

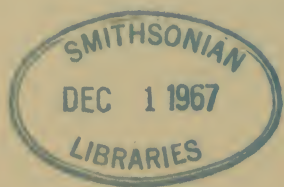
*Etymology:* I take pleasure in naming this species in honor of John McNeese (1844-1914) pioneer teacher, Federal soldier, Calcasieu Parish Superintendent of Education, and often referred to as "Father of Public Education in Southwest Louisiana."

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A NEW SPECIES OF *RHADINOPSYLLA* FROM THE  
REPUBLIC OF LEBANON (SIPHONAPTERA;  
HYSTRICHOPSYLLIDAE)<sup>1</sup>

BY ROBERT E. LEWIS  
*Iowa State University, Ames, Iowa*

Recent collecting activities at higher elevations in the Lebanon Mountains have yielded a single specimen of a new species of *Rhadinopsylla* (*Actenophthalmus* C. Fox, 1925) from the vole *Microtus guentheri* (Danford and Alston, 1880). Attempts to obtain additional specimens were unsuccessful. A description of this new species follows. Attention is called to the excellent treatments of *Rhadinopsylla* by Smit (1957a) and Hopkins and Rothschild (1962) for additional information concerning relationships of this species to previously known forms.

***Rhadinopsylla* (*Actenophthalmus*) *hoogstraali* new species**

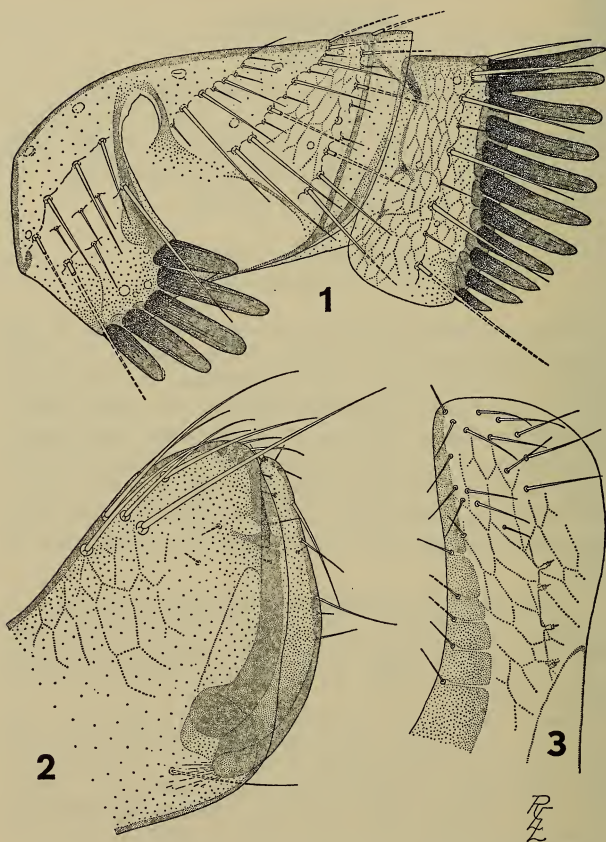
*Material*: Male holotype from south slope of Mount Sannine, about 1800 m, Republic of Lebanon, from *Microtus guentheri*, 9 May 1965, R. E. Lewis and S. I. Atallah. Deposited in the United States National Museum (USNM).

*Diagnosis*: Similar to *R. (Actenophthalmus) strouhali* Smit, 1957, from lower Austria and *R. (Actenophthalmus) bureschi* Jordan, 1929, from Bulgaria but differing from both in contours of st. VIII and IX and caudal margin of fixed process, shorter movable process, absence of acetabular bristle (possibly an abnormal condition but there is no evidence of a bristle on either side), and blunt spines of genal comb.

*Description*:

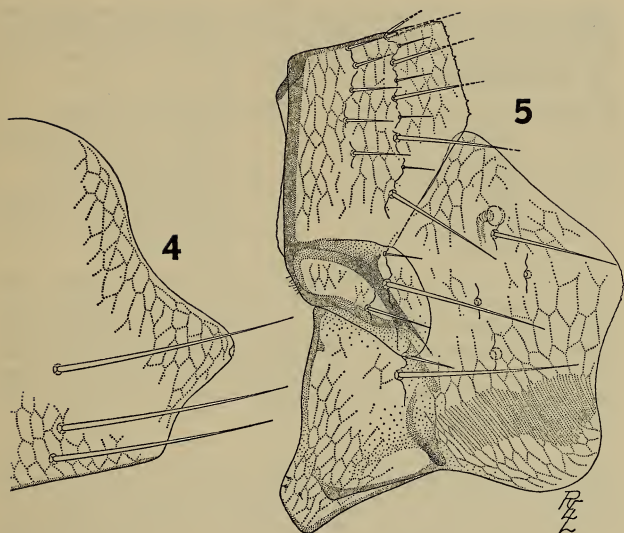
**HEAD** (Fig. 1).—Distinct frontal tubercle absent but with more or less distinct frontal angle. Genal comb of five blunt spines, uppermost broader in middle than its neighbor and extending about  $\frac{5}{8}$  length of latter. Labial palpus of five segments, extending about  $\frac{2}{3}$  length of fore coxa. Chaetotaxy as illustrated. **THORAX** (Figs. 1 and 5).—Pronotal comb of 21 spines, most slightly longer than width of pronotum.

<sup>1</sup> Portions of this work were supported by United States Public Health Service grant number AI-05512.



FIGS. 1-3. *Rhadinopsylla (Actenophthalmus) hoogstraali* new species, holotype. 1, head. 2, clasper. 3, sternum IX.

Sclerotized vertical ridge under main setal row of metanotum absent; short seta above long seta of metasternum; suture between ventral margin of metanotal collar and dorso-cephalic margin of metepimeron extending about half distance to dorso-caudal angle of metepisternum but continuing as faint, thin line. LEGS.—One seta on apex of inner side of hind femur and one on proximal end of inner side of hind tibia;



FIGS. 4-5. *Rhadinopsylla (Actenophthalmus) hoogstraali* new species, holotype. 4, sternum VIII. 5, metanotum.

longest apical seta of hind tarsal segment II extending beyond apex of segment III but not reaching middle of segment IV; fifth tarsal segment of all legs with four pairs of lateral plantar setae. ABDOMEN.—Spinelets on t. I-VI: 3/4, 3/3, 3/3, 3/3, 2/2, 1/1; one seta below spiracle on t. III-VI. MODIFIED SEGMENTS OF MALE (Figs. 2, 3 and 4).—T. VIII without bristles; st. VIII with well-developed apical lobe on caudal margin, with 3-4 long setae. Clasper, measured from tip of manubrium to apex of fixed process,  $2\frac{3}{8}$  as long as movable process. Caudal margin of fixed process convex, lacking acetabular seta (see note above). Distal arm of st. IX about  $2\frac{3}{4}$  as long as wide, apex broadly rounded caudally. Movable process not extending to apex of fixed process. Fovea of movable process situated in apical  $\frac{1}{3}$  of process. LENGTH.—2 mm.

*Remarks:* This new species is named in honor of Dr. Harry Hoogstraal, Director of Medical Zoology, United States Naval Medical Research Unit No. 3, in recognition of his major contribution to our knowledge of the fauna of Egypt and the eastern Mediterranean region.

*Discussion:* A review of the recent literature (Ioff and Scalon, 1954; Ioff, Mikulin and Scalon, 1965; Hopkins and Rothschild, 1962; Smit,

1957a and b; Peus, 1958 and Ioff and Tiflov, 1950) indicates that there are seven previously known species of the subgenus *Actenophthalmus* in the area from Lower Austria to the Volga, south to the Mediterranean Sea. Listed alphabetically they are:

R. ( <i>Act.</i> ) <i>acuminata</i>	Ioff and Tiflov, 1946	from Stavropol, Caucasus
" "	<i>buresschi</i> Jordan, 1929	" Ryla Mountains, Bulgaria
" "	<i>dolomydis</i> Smit, 1957	" Trebevic, Yugoslavia
" "	<i>mesoides</i> Smit, 1957	" Mt. Olympus, Greece
" "	<i>pilosa</i> Ioff and Tiflov, 1946	" Petrovsk District, Volga
" "	<i>sobrina</i> Peus, 1958	" Oiti Mountains, Greece
" "	<i>strouhali</i> Smit, 1957	" Lower Austria

Of these only *acuminata* and *dolomydis* are known from both sexes and at least four of the seven are known from only a single specimen. It is apparent therefore that the validity of most of these species cannot be accurately appraised until more material can be collected. It is also apparent that one of the most potentially fruitful areas, Turkey, has not yet been well investigated faunistically and is likely to yield additional new species.

In spite of the lack of material and the rather cryptic differences between the presently recognized species from southern Europe and the eastern Mediterranean region, it is still possible to construct a key, to at least the males, which should be useful to workers in this area. The following is an attempt to do so, with the full knowledge that our present lack of information about individual variation in these poorly known species imposes rather severe limitations on such an effort.

KEY TO THE SPECIES OF *RHADINOPSYLLA*  
(*ACTENOPHTHALMUS*) OF SOUTHEASTERN  
EUROPE, SOUTHWESTERN ASIA AND THE  
EASTERN MEDITERRANEAN COUNTRIES

1. Apex of st. IX of male acuminate ..... 2
- 1'. Apex of st. IX of male blunt and lobed ..... 3
2. Longest apical seta of hind tarsal segment II extending about to apex of segment IV; upper spine of genal comb broader than its lower neighbor, extending about  $\frac{2}{3}$  length of latter; pronotal comb of 20-22 spines ..... *acuminata*

*R. acuminata* also possesses one seta on the inner surface of the hind tibia. There is one bristle below the spiracle of t. III-VI. St. VIII of the male has a distinct lobe subtended by a sinus and bears an irregular row of 5-7 bristles. An acetabular seta is present and arises at the lower angle of the articulation of the movable process with the fixed process. Information is not available on the presence of the sclerotized metanotal ridge, the extent of development of the metanotal-metepimeral suture or the number of setae on the metasternum.

2. Longest apical seta of hind tarsal segment II extending almost to the apex of segment III; upper spine of genal comb equal in width to its lower neighbor, extending about  $\frac{3}{8}$  length of latter; genal spines very pointed (this information is not available for *R. acuminata*); pronotal comb of 21 spines in only known specimen ..... *mesoides*

In addition, in *R. mesoides* the sclerotized metanotal ridge is absent, there is only one seta on the metasternum and the metanotal-metepimeral suture extends to the dorso-posterior angle of the metepisternum. An acetabular seta is present, arising just below the lower point of articulation of the movable process with the fixed process. Bristles are lacking on the inner surfaces of both the hind femur and the hind tibia. One seta below the spiracle on t. III-VI. St. VIII of the male has a smoothly rounded caudal margin and a patch of five setae near its ventrocaudal angle. The caudal margin of the fixed process is mainly convex but bears a slight depression in its apical  $\frac{1}{8}$ . Apex of movable process extending to tip of fixed process.

3. Setae absent from inner surfaces of both hind femur and hind tibia; longest apical bristle of hind tarsal segment II extending beyond middle of segment IV ..... 4
- 3'. Setae present at least on inner surface of hind tibia; longest apical bristle of hind tarsal segment II not extending beyond middle of segment IV ..... 5
4. Metanotal-metepimeral suture extending at most halfway to dorso-posterior angle of metepisternum but continuing as faint line; acetabular seta arising below middle of caudal margin of fixed process, about  $\frac{2}{3}$  distance from its apex; upper spine of genal comb slightly wider and about  $\frac{3}{4}$  length of its lower neighbor ..... *dolomydis*

In *R. dolomydis* the sclerotized metanotal ridge is absent and the metasternum bears two setae. The spines of the genal comb are sharp, though not as much so as in *R. mesoides*. The pronotal comb contains 21-24 pointed spines. The labial palpi are five-segmented and extend about  $\frac{3}{4}$  the length of the fore coxa. St. VIII of the male bears a distinct caudal lobe subtended by a shallow sinus, and a row of 3-4 setae. The caudal margin of the fixed process is straight to slightly concave and st. IX is blunt, rounded and with a caudo-apical lobe.

- 4'. Metanotal-metepimeral suture extending at most halfway to dorso-posterior angle of the metepisternum, not continuing as faint line; acetabular seta arising in middle of caudal margin of fixed process, about half distance from its apex; upper spine of



genal comb slightly wider and about  $\frac{5}{8}$  length of its lower neighbor ..... *buresschi*

The internal sclerotized metanotal ridge is absent in *R. buresschi* and the metasternum bears two setae. The spines of the genal comb are much less pointed than in *R. dolomydis*. The pronotal comb contains 21 spines in the only known specimen. The labial palpi are five-segmented and, by implication in the literature, do not extend more than approximately  $\frac{2}{3}$  the length of the fore coxa. St. VIII of the male bears a pronounced caudal lobe subtended by a shallow sinus and a row of 4-5 setae. The caudal margin of the fixed process is convex and st. IX is blunt, rounded and with a caudo-apical lobe.

5. Two or three setae present on inner surface of hind tibia; acetabular seta arising below lowest articulation of movable process with fixed process; longest apical bristle of hind tarsal segment II extending about to middle of segment IV ..... *pilosa*

Information is not available for *R. pilosa* concerning the degree of development of the internal sclerotized ridge of the metanotum, the number of setae on the metasternum or the development of the metanotal-metepimeral suture. There are reported to be one or two setae on the inner surface of the hind femur in addition to those of the tibia. There are five spines in the genal comb. The upper spine is slightly wider and about  $\frac{2}{3}$  the length of its lower neighbor. The pronotal comb consists of 22-25 spines. St. VIII of the male possesses a gently rounded ventro-caudal angle but the caudal margin is straight and without a conspicuous lobe. The caudal margin of the fixed process is relatively straight with a slight convexity in its upper  $\frac{1}{2}$ . St. IX is blunt and rounded apically with a caudo-apical lobe.

5. One seta present on inner surface of hind tibia; acetabular seta arising at or above lowest articulation of movable process with fixed process, or absent entirely; longest apical bristle of hind tarsal segment II not reaching middle of segment IV ..... 6
6. Acetabular bristle absent; genal comb of five spines which are rounded apically, upper spine wider and extending about  $\frac{5}{8}$  length of its lower neighbor; longest apical bristle of hind tarsal segment II extending about  $\frac{1}{4}$  length of IV ... *hoogstraali*

In *R. hoogstraali* the internal sclerotization of the metanotal ridge is absent, the metasternum bears two setae and the metanotal-metepimeral suture extends only about halfway to the dorso-posterior angle of the metepisternum but continues as a faint line. One seta is present on the inner surface of both the femur and the tibia. There are twenty-one spines in the

pronotal comb. The labial palpus consists of five segments, extending about  $\frac{2}{3}$  the length of the fore coxa. The caudal margin of the fixed process is distinctly convex. St. VIII of the male bears a pronounced caudal lobe. St. IX is blunt, rounded apically and with a caudo-apical lobe.

- 6'. Acetabular seta present; genal comb of five spines which are pointed apically; upper spine wider and extending about  $\frac{2}{3}$  length of its lower neighbor; longest apical bristle of hind tarsal segment II extending only just beyond tip of segment III --- 7
7. Pronotal comb of 21 spines; acetabular bristle arising at level of lower articulation of movable process with fixed process; metanotal-metepimeral suture extending no more than halfway to dorso-posterior angle of metepisternum and not continuing as a faint line; st. VIII of male without conspicuous caudal lobe; t. VIII with a bristle just below spiracle ----- *sobrina*

The internal sclerotization of the metanotal ridge is absent in *R. sobrina* and there are one or two setae on the metasternum. (Peus, 1958, in his description of this species figures the metasternum with a single seta. The illustration in Hopkins and Rothschild, 1962, shows it with two.) There is one seta on the inner surface of the hind tibia. The caudal margin of the movable process is only slightly convex, practically straight. St. IX is blunt, rounded apically and bears a caudo-apical lobe.

- 7'. Pronotal comb of 23 spines; acetabular bristle arising above level of lower articulation of movable process, about  $\frac{3}{4}$  down from apex; metanotal-metepimeral suture extending about halfway to dorso-posterior angle of metepisternum but continuing as faint line; st. VIII of male with more or less conspicuous apical lobe below shallow sinus; t. VIII without bristles --- *strouhali*

The internal sclerotized ridge of the metanotum is absent in *R. strouhali* and there are two setae on the metasternum. There is one seta on the inner surface of the hind tibia. The caudal margin of the fixed process is distinctly convex in its apical  $\frac{2}{3}$  but bears a shallow sinus at about the level of the acetabular seta. St. IX is blunt, rounded apically and with a caudo-apical lobe.

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PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

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ANOTHER ASELOTTE, *HAWAIIANIRA PELEAE* NEW  
GENUS AND SPECIES, FROM THE HAWAIIAN  
ISLANDS (CRUSTACEA; ISOPODA)

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Only four species of the isopod suborder Asellota have previously been reported from the Hawaiian Islands. These represent four genera, four families, and two of the four asellote superfamilies as follows (the Aselloidea and Parastenetriodea are not known from Hawaii).

Stenetrioidea: Stenetriidae: *Stenetrium medipacificum* Miller, 1941.

Paraselloidea: Munnidae: *Munna acarina* Miller, 1941.

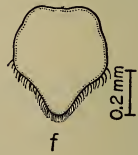
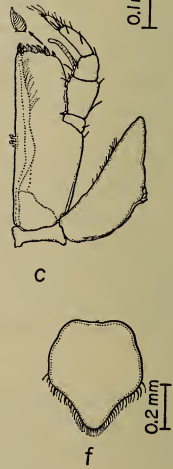
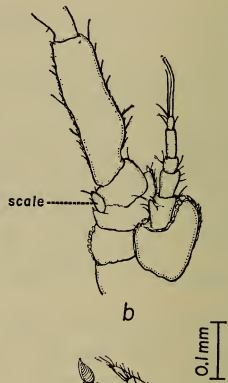
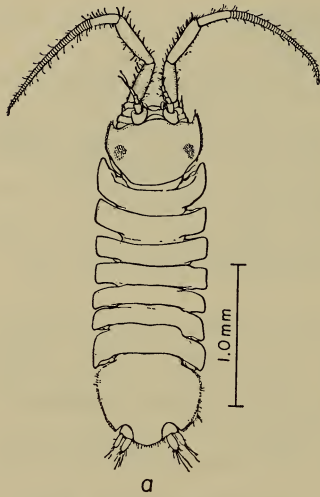
Jaeropsidae: *Jaeropsis hawaiiensis* Miller, 1941.

Janiridae: *Bagatus algicola* (Miller, 1941) Wolff, 1962.

Collections by the author in 1961 and 1966 from fringing lava reefs of Kauai, Oahu and Hawaii produced a fifth asellote herein described as a new genus and species. It is assigned to the family Janiridae as redefined by Wolff (1962:33):

FAMILY JANIRIDAE

*Diagnosis:* Body oblong, depressed. Head and pereonites free, with lateral parts lamellarly expanded in most genera and pereonites subequal in length. Pleon usually of 2 segments; when present, first segment narrow and inconspicuous, the second large and shield-shaped. Eyes often present, situated on upper surface. Antennae almost always longer than antennulae, with 6 joints in peduncle and with squama on joint 3 generally well developed. Mandibles with palp, and normally, with well-developed molar process. Palp of maxillipeds usually with joint 3, in particular, expanded; width of palp almost always equal to, or broader than, endite width. First pair of pereopods usually more or less prehensile; remaining pairs are walking legs of moderate and almost equal length. Dactylus almost always with 2 or 3 claws. Uropods always on lateral or terminal margin, with peduncle, and biramous or, occasionally, uniramous.



**Hawaiianira** new genus

*Type-species: H. peleae* new species

*Diagnosis:* Janiridae with cephalon, pereon, and pleon laterally expanded, but lacking projecting lappets or spinous processes. Cephalon wider than long with acute anterolateral projections. Slightly convex frontal margin, but no rostrum. Eyes dorsal. Pereonites subequal in width with sides parallel, not markedly different in length. Coxal plates (epimera) normally not visible dorsally. Pleonites and telson completely consolidated with no sign of sutures. Pleotelson deeply incised posterolaterally on each side of broadly rounded apex for insertion of short uropodal peduncle. Marginal shelf on underside of pleotelson bordering pleopodal chamber.

First antennae (antennules) short, with dilated basal joint. Second antennae longer than first, but shorter than body, with 6-jointed peduncle bearing scale on third article and multiarticulate flagellum. Mandibles with triarticulate palp, toothed incisive processes subtended by spine rows and lacinia mobilis on left, and well-developed, subcylindrical molar process ending in truncate grinding apex. Maxillipedal palp 5-jointed, with last two points narrower than first three, which are half or less width of endite. Pereopod I biunguiculate, and similar to pereopods II-VII, which are unmodified walking legs not prehensile. First pleopod of male with apex narrower than base, lateral apical processes only slightly divergent. Second male pleopod with geniculate appendix masculinum. First pleopoda completely lacking in female, second operculate. Third and fourth pleopoda in both sexes similar, biramous; fifth uniramous. Anus opens between bases of posterior pleopods. Uropoda biramous with short peduncle and branches.

*Etymology:* Generic name feminine, compounded from "Hawaii," where found, and "*Janira*," typical genus of family to which it is assigned.

**Hawaiianira peleae** new species

(Figs. 1-2)

To the generic diagnosis, the following specific characteristics are added.

*Description:* Holotype male. Body compact, depressed, three times longer than wide (2.4 by 0.8 mm). Surface smooth, sparsely setose at margins, but microscopically scaly or denticulate on areas described below. Sides parallel. Color uniform, pale beige in alcohol, without

←

FIG. 1. *Hawaiianira peleae* new species. a, ♀ paratype, dorsal view, slightly flattened and extended. b, antennule and base of antenna. c, maxilliped ♀. d, e, first and second pleopods ♂. f, second pleopod ♀; g, h, i, third, fourth and fifth pleopods ♂. j, uropod ♂.



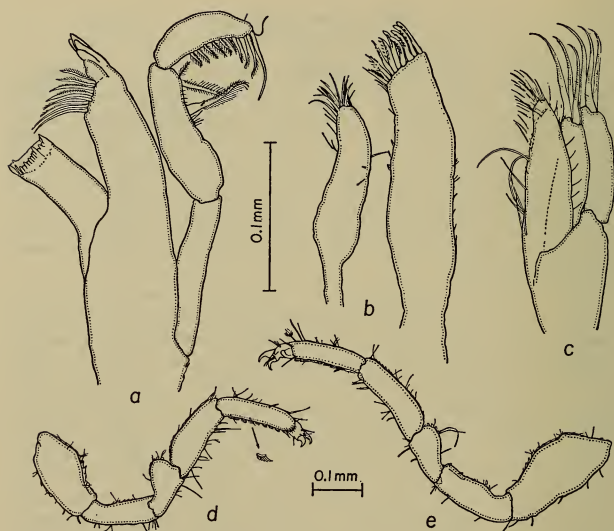


FIG. 2. *Hawaiianira peleae* new species, ♀ mouthparts and pereopods. a, mandible. b, first maxilla. c, second maxilla. d, first pereopod. e, seventh pereopod.

apparent chromatophores. Allotype ovigerous female (2.5 by 0.9 mm). Paratype, ovigerous female (2.0 by 0.7 mm).

Head broad with pointed anterolateral projections. Frontal margin between these weakly trilobate with slightly convex median lobe. Antennal line evident on frons running between antennule sockets. Lateral margin of head scaly. Posterior convex margin fits into concave anterior margin of first pereonite. Eyes dorsal, each composed of about 20-25 ocelli.

First antennae (antennules) composed of greatly dilated basal joint and five narrower articles. Apex of basal article, especially inner side, produced forward on each side of much narrower second article; margin roughly scaly. Pauciarticulate flagellum not extending beyond fifth peduncular joint of second antennae. Flagellum tipped by long bristle and long subcylindrical seta. Second antennae about two-thirds body length, with peduncle of 4 short and 2 subequal long joints and multiarticulate flagellum. Spinose squama at end of third joint. Basal articles scaly and spinose. Number of flagellar articles varies with size (age) and on different sides of same individual. Holotype has 43-

45 articles; allotype markedly asymmetrical with 40 articles on left, but only 17 on shorter right flagellum. First joint of flagellum long, showing incipient segmentation toward end, followed by many short discoidal joints. Setae along sides and tuft of setae at tip.

Mouthparts biting. Mandibles as in genus. Distal article of triarticulate palp bearing comb of about 9 plumose setae and terminal smooth seta, second article with 2 long plumose setae. Molar processes truncate and denticulate, incisive processes with 3 and 5 teeth on right and left, respectively. Lacinia mobilis with several teeth, number varies among specimens. Spine rows well developed with ctenate setae. First maxillae with outer lamina terminating in 8-9 toothed setae, narrower inner plate ending in many simple curved setae. Second maxillae trilobed, with inner lobe fringed by many simple setae, outer two each ending in 3-4 long, finely plumose setae. Maxilliped with triangular, somewhat scaly epipod, narrow basal (coxal ?) plate and broad basis bearing broad endite and a narrower five-jointed palp as described for genus. Palp sparsely setiferous with apical tuft. Long tubular (probably sensory) seta extends inward from distal end of second joint. Setiferous flange extends at right angle toward maxillae along median edge of each maxilliped. Two large coupling hooks on median margin of each maxilliped.

Pereonites subequal in width and length with lateral margins entire and parallel. Fourth pereonite quadrangular, anterior three bent forward, posterior three bent backward. Pleura of first pereonite embrace posterior part of head with anterolateral angles reaching to eye level. Coxal plates normally not visible dorsally, but discernible on flattened specimens posterior to sixth and seventh and anterior to first pereonite.

All pereopods ambulatory with biunguiculate dactyls, becoming progressively longer from anterior to posterior with seventh one-third longer than first. Dactylus with low knob or tubercle and seta between claws. Inferior margin of propodus with row of low ctenate scales and three stout setae. Basis always, and more distal podomeres sometimes, shows minutely serrated margins.

Pleon as in genus. Several small denticles on margin lateral to excavation for uropod, and few setae along lateral and posterior margin. Caudal lobe between uropodal excavations broadly rounded.

Pleopods in male and female as shown in Fig. 1. First pleopods in male elongate, tightly appressed in midline, laterally slightly constricted, apex narrower than base; distal margin of medial apical lobes rounded, each fringed with about six setae and extending beyond lateral subapical lobes. Subapical lobes indented at tip, not laterally produced. First pleopods absent in female.

Second male pleopods with geniculate appendix masculinum having sharply pointed tip. Second (first apparent) pleopod of female operculate, distal half triangulate and fringed with setae.

Third, fourth and fifth pleopods similar in both sexes. Third with two-jointed exopod and broad, truncate endopod bearing 6-8 plumose

setae. Fourth pleopod with membranous exopod bearing 4-5 apical plumose setae and lateral fringe of simple setae, and thicker, bare endopod. Fifth pleopods uniramous, somewhat fleshy, non-setiferous.

Uropoda biramous. Peduncle short, completely immersed in deep posterolateral excavations of telson, inserted anterior and ventral to these excavations, posteromedial angle acutely produced. Endopod broadly styliform, subequal in length to peduncle. Exopod slightly shorter and narrower than endopod. Both branches with apical setae.

*Localities:* KAUAI: Poipu Beach (13♂♂, 8♀♀), 12 September 1966, M. A. Miller. OAHU: Hanauma Bay (3♂♂, 2♀♀), 26 August 1961, M. A. Miller. HAWAII: Laupahoehoe (2♂♂, 2♀♀), 8 August 1961, M. A. Miller and P. Q. Tomich. Honaunau (type-locality) (2♂♂, 3♀♀), 15 September 1966, M. A. Miller.

At all localities, the specimens were taken in shallow water over lava reefs (aa or pahoehoe) from wash bucket samples of rocks, coral and algae. This species has not been collected in protected bays such as Kaneohe Bay, Oahu and Hanamaula Bay, Kauai. Many other isopods, amphipods, tanaidaceans, decapods and other small crustaceans are generally found in samples with *Hawaiianira peleae* including all the other asellote species mentioned in the introduction. Of the two janirid species now known from the Hawaiian Islands, *Bagatus algicola* is much more widely distributed and abundant than *H. peleae*. More selective sampling is needed to help determine the ecological associations and niches of the various species.

*Disposition of material:* Types are deposited in the U. S. National Museum, catalog nos. 119767-119769. Other material indicated above has been divided between the B. P. Bishop Museum, Honolulu and the author's collection.

*Etymology:* The single known species in the genus is named for "Pele," the Hawaiian fire goddess who, according to legend lives in volcanos that produced the lava reefs where it occurs.

*Relationships:* Before assigning *Hawaiianira* to family, a decision was necessary between two recent interpretations of the family Janiridae as found in major revisions of the Asellota by Menzies (1962a, 1962b) and by Wolff (1962). Both authors recognize that the Janiridae has long been a large heterogeneous assemblage of genera. Attempts by various authors to divide it in some natural manner, however, have not been too successful, at least at the family level (for review, see Wolff, 1962).

Of special interest is Menzies' (supra) proposal to remove from Janiridae all genera (1) with pleotelson composed of a single "somite," instead of two, and (2) with only two claws on pereopods II-VII, that is, lacking an accessory third claw. On both counts, *Hawaiianira* would be excluded from Janiridae as restricted by Menzies. Unfortunately, however, it can not be placed in any of the families established by Menzies for the janirid outcasts. Hence, if Menzies' restricted concept of Janiridae were accepted, it would be necessary to create a new family for *Hawaiianira*. *Hawaiianira* comes close to Ianirellidae, especially

as diagnosed in Menzies (1962a), less so to the amended version published later the same year (1962b). From the latter it differs in three important respects: (1) eyes present, (2) molar process of mandible not expanded at apex, and (3) first three articles of maxillipedal palp much wider than the last two, but only half as wide, instead of as wide, as endite. Also, the genera included in Ianirellidae (*Ianirella* Bonnier, *Spinianirella* Menzies and possibly *Rhacura* Richardson) all have lateral lappets or spiny processes extending from the body, and usually a rostrum. This seems to be true also for other genera contained in the earlier diagnosis of this family (Menzies, 1962a), namely, *Iolella* Richardson, *Jolanthe* Beddard, *Janthopsis* Beddard, *Acanthaspidia* Stebbing and *Microprotus* Richardson. Since these structures seem to be associated with deep or cold water habitats in many other asellote families, they may be regarded as convergent characters of little or no systematic value.

Wolff (supra) rejected Menzies' revision mainly on the grounds that ". . . the number of pleonites varies within well-defined families and even within other genera in the Asellota . . ." and some janirids with a distinctly 2-segmented pleotelson have only two claws. Accordingly, he reconstituted the Janiridae with a broad diagnosis embracing 35 genera, restoring those extracted by Menzies. *Hawaiianira* comfortably fits Wolff's liberal diagnosis of Janiridae.

Considering the alternatives, I prefer to assign *Hawaiianira* to the family Janiridae in Wolff's sense. Although this action adds a 36th genus to an already overburdened family, I believe it gives a better indication of relationships than creation of a new family for a monotypic genus. The basis for such a family would have to be a combination of characters, as none by itself appears to be diagnostic, even at the generic level. Further systematic studies of the janirid complex are indicated.

*Hawaiianira* resembles several other janirid or near-janirid genera in certain characteristics besides those mentioned above. It is like *Jaeropsis* Koehler and *Caecijaera* Menzies in body configuration with broad pereonites lacking lateral incisions or processes, epimera not visible dorsally, and reduced uropods deeply inserted in excavations in the pleotelson. All three genera also have short antennules with expanded basal articles, biunguiculate dactyls, and narrow apex of the first male pleopod.

*Hawaiianira* differs from the above genera in several important respects. From *Jaeropsis* it differs in the characters which have been used to separate *Jaeropsis* from the Janiridae as a distinct family (Jaeropsidae), notably the presence in *Hawaiianira* of an antennal scale, multiarticulate (instead of pauciarticulate) flagellum of second antenna, non-tapering molar process and lacinia mobilis of mandible, and longer branches of uropod. From *Caecijaera*, another janirid genus, *Hawaiianira* can easily be distinguished by the presence of eyes, in having the basal three articles of the maxillipedal palp only half or

less as wide as the endite (rather than equal in width), by its well-developed (rather than reduced) molar process, by its much narrower endopod of first maxilla, and in having a biramous (rather than uniramous) fourth pleopod.

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PROCEEDINGS  
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ON TWO ILLINOIS SPECIMENS OF *DIPLOCARDIA SINGULARIS*, WITH DISCUSSION OF THEIR MODE OF REPRODUCTION (ANNELIDA; OLIGOCHAETA)<sup>1</sup>

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Two undissected, unidentified worms, perhaps also others like it, may have considerably puzzled Frank Smith, the first native-born American to concern himself with oligochaete systematics. The evidence is provided by Smith's failure to identify the specimens, secured by himself in 1901, though he continued to publish on megadriles until 1928. One specimen now is referable to *Diplocardia singularis* (Ude, 1893). Association therewith of the other in a single numbered lot suggests that Smith may have suspected there was some special but hitherto unexplained relationship between the two. That relationship is elucidated below.

Characters of major systematic importance are mentioned in the following brief description to show similarities as well as differences of the two individuals.

*Diplocardia singularis* (Ude, 1893)

1893. *Geodrilus singularis*, Ude, Zeitschr. Wiss. Zool. 57, p. 69. (Type-locality, Danville, Illinois. Types, in the Hamburg Mus.?)

1958. *Diplocardia egglestoni* Murchie, Ohio Jour. Sci. 58, p. 270. (Type-locality, Section 12, Dexter Township, Washtenaw County, Michigan. Syntypes in the U. S. Natl. Mus.)

Illinois

Urbana, woods, 30 April 1901, 0-0-2. F. Smith. (U. S. Natl. Mus. No. 25653. Referred to herein as A and B.)

*External characteristics.* Size, 110 by nearly 2 mm (A), 75 by 2 mm (B). Segments, 112 (A), 79 (B). Prostomium, epilobous, tongue long

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<sup>1</sup> From research financed by the National Science Foundation.



and open (2 specimens). An equatorial circle of very small spots on each of segments ii-xii, obvious after cuticle floated away, produced an appearance of a ring of setal tips. First dorsal pore, at 8/9 but porelike markings at 6/7, 7/8 (2). Clitellum, annular (2), but lacking ventrally in front of eq/xiii and behind eq/xvii (A), or only in xviii (B), xiii-xviii/2 (A), xiii-xviii (B).

Seminal grooves, wide and shallow (A), lacking (B) or perhaps represented by slight furrows in setal annulus of xix, slightly lateral to A (preservation artefacts?). Male pores, each on slight tubercle in seminal groove, about midway between levels of 18/19 and of presetal secondary furrow in xviii (A), unrecognizable, probably lacking (B). Prostatic pores and apertures of associated setal follicles, unrecognizable, but penial setae of xvii protrude to the exterior conspicuously (A). Prostatic pores, lacking. Ventral setae of xviii-xx, externally recognizable, some of them seemingly of about same size as in adjacent segments, AB about as wide as in adjacent segments, on each side of xx apertures of *a,b* follicles within a transversely elliptical tumescence (B). Genital markings, paired, in AB, postsetal in xvii and xx, each with translucent central area and opaque peripheral band. A median marking may be present about on site of 17/18 which is unrecognizable ventrally (A). Genital markings, lacking (B).

*Internal anatomy.* Gizzards, two, in v, vi (2 specimens). Intestinal origin, in xvii (2). Typhlosole, recognizable from xix, rudimentary (2). Dorsal blood vessel, single throughout (2). Last hearts, in xii (2). Sperm ducts, not traceable behind xviii, though superficial (on not within the parietes, 2).

Prostatic ducts, slender, tightly coiled close to parietes (A). Prostates, none (B). Penisetal follicles, long, perhaps as long as prostatic ducts, each in crescentic curve, common muscle strand from each pair of follicles in xvii with parietal insertion well beyond *D* and at or behind 18/19. Penial setae, long, slender, most of shaft rather crescent-shaped but shortly recurved in opposite direction ectally. Terminal ectal portion, soft, folded on itself, tip slightly wider but of nondescript shape (no reserves found, A). Ventral follicles of xx, conspicuously projecting into the coelom. The *a,b* follicles of one side of xx each contained a single seta much like those of prostatic individuals but associated with one follicle was a normally sigmoid shaft. Ventral setae of same side of xix, sigmoid. Ventral follicles of same side of xviii protrude into coelom but not as far as in xx and each contains only a sigmoid seta (B).

Spermathecal diverticulum, rather sausage-shaped, with very short and slender stalk from its middle to duct entally. The coagulum within each diverticulum is constricted into lobes by ridges of variable height, discrete seminal chambers not recognized. Ventral follicles of vii-ix, enlarged, more protuberant into coelomic cavities than in adjacent segments. Copulatory setae may be present but only nondescript fragments of shafts were obtained (A). Spermathecal diverticulum, sausage-shaped, ventrally directed on lateral face of duct but not reaching

parietes, opening through single aperture (seemingly without stalk) into very ental end of spermathecal duct. Diverticular wall, thick, with numerous circular ridges (B).

Ovaries, fanshaped and with several egg strings.

*Reproduction.* Spermatozoal iridescence, recognizable on male funnels and in spermathecal diverticula. Reproduction is assumed to be biparental because sperm had been matured, copulation had taken place, and also because of lack of any evidence of structural degradation so often associated with male sterility (A).

Clitellum, probably at maximal tumescence. Spermatozoal iridescence, lacking on male funnels and in spermathecal diverticula. Seminal vesicles, acinous, perhaps of medium size, certainly not rudimentary. Gonads of x, xi fanshaped. One looks quite definitely like a young ovary and occasional cells in digitiform lobes do look like immature ova. Specimen (B) appears to be male sterile.

*Discussion.* Sterility, in earthworms, is of two sorts: fortuitous and hereditary. The first, arising as a result of some unusual interference with normal development, is male and/or female, usually in association with metameric abnormality and/or homoeosis. Rarity, in the pertinent population, and absence of exact repetition of the associated morphology proves the fortuitousness. If sterility is male only, copulation with a normally hermaphroditic earthworm can result in reproduction by the abnormal individual whereas its normal copulatory partner will be unable to reproduce itself, at least until after copulation with a normal worm. Hereditary sterility is always male, much more common and is not usually (but can be) associated with abnormal metamerism or regional homoeosis. The exactness with which the associated anatomy is repeated again and again proves this kind of sterility to be hereditary.

Hereditary male sterility requires reproduction to be parthenogenetic, though some earthworms of various families can reproduce amictically even when apparently normal spermatogenesis is profuse. In species after species, parthenogenesis has enabled gross modifications in anatomy, such as increase in number of organs, deletion of parts of organs, of whole organs or even entire sets of organs.

Hereditarily repetitive genital anatomy that departs from generic or family norms now requires consideration of the possibility that it is due to parthenogenesis. Too many megadrile species have been based on single types with defective genitalia.

The aprostatic Illinois specimen at first was thought to be a result of interference with normal embryonic development, primarily because hereditary sterility and associated conditions were unknown in the family to which *Diplocardia* belongs. The description of *egglestoni* showed that absence of prostate glands occurred commonly, perhaps in a large population, and so was hereditary. Information as to method of reproduction is lacking for *egglestoni* but there are no contra-indications to male sterility which is evidenced directly by the spermathecae, by

the size and condition of seminal vesicles, as well as indirectly by the organ deletions. Assuming reproduction to be parthenogenetic, the next question is, from which of the presently known species of *Diplocardia* could the Michigan population have been derived by any of the structural degradations so often associated with hereditary male sterility and parthenogenesis?

Prostates, more than any other structure, unless it be spermathecae, are the organs most commonly deleted. The types of *egglesoni*, except for the male terminalia, do not differ significantly from normal, amphimictic specimens of *D. singularis*. Accordingly *egglesoni* falls into the synonymy of *singularis*. The International Code of Zoological Nomenclature does not allow latinized names for clones, morphs, or infrasubspecific taxa. The Michigan population can, if necessary, be referred to as an aprostatic *singularis* morph, or, if further study shows additional differences, as Michigan morphs. Although prostates had been deleted in that population seminal grooves, now of no use, are retained although incompletely. (At full development, grooves extend at least to equators of xviii and xx.) Seminal grooves have disappeared in an Illinois morph, unless a last vestige is represented in the equatorial annulus of xix. Penial setae, though now without function, are present in the Michigan population. Those setae, in the Illinois morph, are being lost. Form of setal shafts secreted by ventral follicles of prostatic pore segments gradually changes during amphimictic adolescence and maturity. Eventually the sigmoid shape is lost and penial setae have markedly different shapes, sizes, and may be variously ornamented or sculptured. Ability to make those changes is being lost by worms of the Illinois morph. With completion of that evolutionary process, condition of the ventral setae in prostatic segments will have reverted, in adults, to a long lost ancestral condition. Ventral setae of the male pore segment are dehisced without replacement during amphimictic adolescence or are retained in juvenile size within the body wall throughout maturity. Ability to do that is disappearing in the Illinois morph, and when it has been lost by all eight ventral follicles, setae of the former male pore segment will have reverted to a long lost ancestral condition. Especial attention is asked for those two instances as some individuals emphatically denied (*in litt.*) that reversion is possible.

The anatomical degradation, often associated with parthenogenesis, obviously has evolved further in Illinois than in Michigan morphs, at least insofar as the male terminalia are concerned. Evolution of *singularis* polymorphism seems unlikely to have been limited to two aprostatic morphs. They can be readily recognized externally because of the lack of appropriate pores at the equators of xviii and xx. Testes of Smith's aprostatic individual were not examined microscopically. Supposed ova could have been parasitic bodies, or feminization of testes may have been incomplete. Complete feminization seems likely to be

found in the unknown original home of the Illinois morph, providing reproduction has been parthenogenetic long enough. The basis for this prediction is complete conversion, in species of other families, of testes into ovaries of a quite characteristic and obviously different shape from that of male gonads. Less interesting, perhaps because of frequency elsewhere, would be reduction in number of spermathecae or deletion of the entire battery.

Parthenogenesis, in association with male sterility, has been reported hitherto from several genera (*cf.* Gates, 1956, 1960, 1961) in each of four families, Glossoscolecidae, Lumbricidae, Megascolecidae, Ocnero-drilidae. The present record is the first for *Diplocardia* and also for its family, Acanthodrilidae.

A recent publication (Gates, 1960) provided information (but without discussion) as to frequency of parthenogenesis in the earthworm fauna of America north of Mexico except for a small region extending from northern California into Washington. Endemic species, according to that contribution (Table 1, p. 76) are in four genera. For *Bimastos* Moore, 1893, seven species were named. The validity of most of these remains to be established. Six according to the "New Systematics" certainly are not species at all. The needed revision now seems likely to decrease, rather than increase the number of its species. For *Eisenia*, two species were listed and further autochthones are not now expected. So little was known at that time about the genus *Diplocardia* that species were not listed. Merely to provide a definite figure for discussion, 15 of those species that had been named in the past were assumed to be valid. In *Sparganophilus*, Benham, 1892, one American species only has been recognized by recent writers.

The endemic fauna of a very large portion of North America, as known today, comprises 25 or more species in four genera. Island Ceylon, with an area of 25,332 sq. miles, has more than 70 species mostly endemic. The number of genera is 13 but will probably be increased when revisions are made. Burma (261,789 sq. miles) on the Asiatic mainland, along with adjacent and neighboring islands, has at least 150 species most of which are endemic. Why then does such a great area as the above-limited major portion of North America have so few species (60 +)? One obvious answer might be that the small numbers just cited are fictitious because of our vast ignorance of American megadriles. Two genera are indeed likely to be added when properly preserved material has been made available to qualified specialists. One of these two genera now seems likely to be exotic, the other may be indigenous. Even when both are defined the number will be small with reference to size of the area being discussed. As fortuitous accumulation of occasional small samples or single individuals is replaced by systematic searches and intensive local surveys, further species perhaps should be expected. A Pakistani Visiting Professor (Bhatti, 1966), secured just in the vicinity of Philadelphia in six months,



23 species. Number of species listed for other states were: Illinois 24 (Smith, 1928), central Maine 22 (Gates, 1961), Michigan 18 (Murchie, 1956), Ohio 17 (+ 1 or 2? Olson, 1928), New York 16 (Olson, 1940), Washington 11 (Altman, 1936). Although 14 of Bhatti's species had not been reported previously from Pennsylvania, none were new and 19 are exotic on this continent. Unless much different results can be obtained in also unglaciated states further south, few new species will be added to a short continental list.

Associated with the problem posed by the paucity of continental endemics is another, that of the percentage of parthenogenesis. Six of the seven species of *Bimastos* probably are parthenogenetic. In the seventh that mode of reproduction may be optional. Parthenogenesis now is recorded for one species of *Diplocardia*. How widespread that phenomenon may be among the largest group of endemic species on this continent cannot be said. Prior to the "New Systematics," method of reproduction was unimportant and megadriles of course were always thought to be hermaphroditic and obligatorily amphimictic. Even today very few of the descriptions of earthworm species that are published provide any indication as to manner of reproduction. Six species of *Bimastos*, 1 of *Diplocardia*, and possibly at least one other, means 28 percent (or more) parthenogenesis among continental endemics.

The questions thus posed seemingly can be answered very briefly. During the Quaternary, earthworms were exterminated everywhere that glacial ice was thousands of feet thick. Implicit in recent discussion of megadrile distribution (*cf.* Omodeo, 1963) was an assumption that European species alone survived on nunataks in Greenland and Iceland, as well as on the continent itself. Until someone can show how worms could have maintained themselves during exposure to arctic conditions on denuded mountains through many millenia, the nunatak thesis needs no further consideration. Even after recession of the ice sheet was well under way, conditions for some time remained unfavorable for earthworms. Gravel, sand and clay now are often uninhabited by megadriles. Even today, at least several thousand years after the glacial epoch, earthworms are unknown in most of Alaska and northern Canada. Climatic conditions below the southernmost advance of the ice must have been far from favorable. In some such area the struggle for existence conceivably could have been so difficult that survival became possible only through adoption of parthenogenesis. If so, that area and to the north may have been the chief home of *Bimastos*. *Eisenia* (American section only) could have had a more southern distribution so that two of its species were able to survive there without being forced into parthenogenesis. *Diplocardia*, on the contrary may have only just begun to penetrate into a belt of climatically enforced parthenogenesis.

Somewhere in that belt, when it has been determined, may be found the original home of the *singularis* aprostatic morphs. No evidence has yet been presented to show that *D. singularis* reached glaciated regions

of Illinois and Michigan by its own unaided efforts. Transportation, presumably by man, probably was responsible for introduction to those area.

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PROCEEDINGS  
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A NEW SPECIES OF SHREW (GENUS *CRYPTOTIS*) FROM  
JALISCO, MEXICO (MAMMALIA; INSECTIVORA)

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From 6 July to 11 July 1966, vertebrates were collected on Volcán de Fuego, Jalisco, for the Museum of Natural History, The University of Kansas, by Genoways and Percy L. Clifton. On 10 July a shrew of the genus *Cryptotis* was obtained on a steep slope across the valley to the north of the active cone of the volcano. The specimen was caught in a steel trap placed in the tunnel of a pocket gopher; because the opening had not been covered after the trap was set, it could not be determined whether the shrew was using the tunnel as a runway or had entered the opening.

Vegetation on the complex of mountains that includes Volcán de Fuego consists of pine-oak forest up to about 7500 ft; fir, first appearing at 7500 ft, becomes dominant between 8500 and 10,000 ft and occurs in sheltered areas up to 12,000 ft; bunchgrass occurs above 12,000 ft and on exposed slopes as low as 9000 ft (see Goldman, 1951:181; Baker and Phillips, 1965:691). Vegetation at the site (9800 ft) where our shrew was captured consisted of bunchgrass interspersed with low deciduous bushes and small coniferous trees.

The braincase was broken into many fragments by the trap, but the pelage and the remainder of the skull were not damaged. The specimen represents an heretofore unknown species that is named and described below.

***Cryptotis euryrhynchis* new species**

*Holotype*: Adult male, skin and imperfect skull, no. 107,143 Museum of Natural History, The University of Kansas, from Volcán de Fuego (also called Volcán de Colima), 9800 ft, Jalisco; obtained on 10 July 1966 by Percy L. Clifton (original number 11,059).

*Distribution*: Known only from the type-locality.

*Diagnosis*: Size medium for members of the genus both externally and cranially (total length 106, palatal length 8.6); rostrum broad and massive (maxillary breadth 6.7); mesopterygoid fossa broad (pterygoid breadth 3.05); upper parts gray; underparts pale, hairs tipped with pale gray; feet pale brown.

*Comparisons*: From 16 specimens of *Cryptotis mexicana mexicana* (Coues) from Las Vigas, 8500 ft, Veracruz, *C. euryrhynchis* differs as follows: larger externally (total length 106 as compared to 100); rostrum broader (rostral breadth across parastyle of M2 6.1 as compared to 5.3); palate longer (8.6 as compared to 8.0); mesopterygoid fossa broader (pterygoid breadth 3.05 as compared to 2.7); dentition more massive; upper parts paler; underparts pale gray rather than brown.

From three specimens of *Cryptotis mexicana goldmani* (Merriam) from Omilteme, 7300 ft, Guerrero, *C. euryrhynchis* differs as follows: hind feet longer (14.5 as compared to 12); front feet and claws larger; rostrum broader (rostral breadth across parastyle of M2 6.1 as compared to 5.5); palate longer (8.6 as compared to 8.3); underparts pale gray rather than brown.

From two specimens of *Cryptotis goodwini* (Jackson), one from 5 mi. N, 1 mi. W El Chol, 6000 ft, Guatemala, and the other from 3.5 mi. SW San Juan Ixcay, 10,120 ft, Guatemala, *C. euryrhynchis* differs as follows: tail shorter (25 as compared to 30); rostrum broader (rostral breadth across metastyle of P4 5.4 as compared to 5.1); palate shorter (8.6 as compared to 9.3); dentition more massive.

From three specimens of *Cryptotis alticola* (Merriam) from Mt. Popocatepetl, Mexico (U. S. Nat. Mus. 52043; 52045-6), *C. euryrhynchis* differs as follows: mesopterygoid fossa broader (pterygoid breadth 3.05 as compared to 2.85); postero-internal cingulum of P4-M2 less extensive; upper parts and underparts gray rather than brown.

*Measurements*: External and cranial measurements, in millimeters, of the holotype of *Cryptotis euryrhynchis* are given in Table 1. Pterygoid breadth refers to the least distance from the outside of one pterygoid to the outside of the other at a place just behind the posterior end of the palate. Definitions of other cranial dimensions used here, excepting the two pertaining to rostral breadth, are from Jackson (1928:13). All cranial measurements were taken with a binocular microscope equipped with an ocular micrometer and a stage micrometer.

*Remarks*: The systematic relationships of shrews of the genus *Cryptotis* are difficult to interpret because many populations seem to be isolated at high elevations on mountains (see Hall and Kelson, 1959: 57-64). In addition, there sometimes is considerable variation among specimens from the same population (for example, see Raun, 1965: 215). Certain characteristics used by Merriam (1895) and others to distinguish alleged species probably are age variations. Our one specimen of *Cryptotis euryrhynchis* has distinctive cranial features that are

TABLE 1. Selected measurements of five taxa of *Cryptotis*.

	<i>C. eurhynchis</i> <sup>1</sup> (1) <sup>2</sup>	<i>C. mexicana</i> <i>mexicana</i> (16)	<i>C. mexicana</i> <i>goldmani</i> (3)	<i>C. alticola</i> (3) <sup>3</sup>	<i>C. goodwini</i> (2)
Total length	106	100 (94-105)	100 (97-102)	101 (100-102)	115, 105
Length of tail vertebrae	25	25 (23-28)	27 (25-30)	28 (25-29)	31, 30
Length of hind foot	14.5	13 (13-17)	12 (12-12.5)	15 (14.5-15.0)	14, 14
Palatal length	8.6	8.0 (7.3-8.5)	8.3 (8.1-8.4)	8.9 (8.9-9.0)	—, 9.3
Length of maxillary tooth-row	7.3	6.8 (6.4-7.2)	6.9 (6.9)	7.5 (7.5)	—, 7.8
Interorbital breadth	5.2	4.9 (4.7-5.1)	5.0 (4.9-5.1)	5.0 (5.0)	—, 5.3
Maxillary breadth	6.7	6.1 (5.8-6.4)	6.2 (6.0-6.3)	6.6 (6.6-6.7)	—, 6.4
Rostral breadth across parastyle of M2	6.1	5.3 (5.1-5.6)	5.5 (5.4-5.6)	6.3 (6.3-6.4)	5.9, 6.0
Rostral breadth across metastyle of P4	5.4	4.6 (4.4-4.7)	4.7 (4.6-4.8)	5.5 (5.4-5.6)	5.1, 5.1
Pterygoid breadth	3.05	2.7 (2.6-2.9)	2.8 (2.7-2.9)	2.85 (2.75-2.95)	—, 3.2

<sup>1</sup> Holotype.<sup>2</sup> Number of specimens examined in parentheses.<sup>3</sup> Measurements of USNM 52043 and 52045-6.

not likely to vary much with age and that distinguish it from specimens of related species of all age categories that we have examined. Sexual dimorphism is not known in the genus, and none was found in the comparative material.

Judging from external and cranial dimensions, *Cryptotis euryrhynchis* belongs to the *mexicana* group. Two of the characteristics used by Jackson (1933:81) to distinguish *C. goodwini* from *C. mexicana* were depth and breadth of cranium. Because the braincase of the holotype of *C. euryrhynchis* is lacking, we were unable to determine morphologically whether *C. euryrhynchis* resembles *C. mexicana* more than *C. goodwini*.

*Cryptotis euryrhynchis* is the northernmost known representative of the *mexicana* group in western Mexico. The species in the *mexicana* group that occur nearest Volcán de Fuego are *C. alticola* (Monte Río Frío, 45 km ESE Mexico City—Davis, 1944:376) and *C. mexicana goldmani* (2 mi. W Omilteme, 7900 ft, Guerrero—Davis and Lukens, 1958:350). *Cryptotis goodwini*, known only from farther south (the nearest locality of record is Calel, 10,200 ft, Guatemala—Jackson, 1933:81) probably is not so closely related to *C. euryrhynchis* as is *C. mexicana*.

The specific name *euryrhynchis* is from the Greek *eurys*, broad, and *rhynchos*, snout. Funds for field work were made available by the Kansas University Endowment Association (Watkins Fund).

*Specimen examined*: One, the holotype.

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PROCEEDINGS  
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A NEW SUBSPECIES OF THE FREE-TAILED BAT,  
*MOLOSSOPS GREENHALLI*, FROM WESTERN  
MEXICO (MAMMALIA; CHIROPTERA)

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In June of 1964, field parties from the Museum of Natural History, The University of Kansas, collected two specimens of a unique free-tailed bat in Mexico, one in the state of Guerrero and the other in Oaxaca. These proved to be the first specimens of *Molossops greenhalli* (Goodwin, 1958) taken outside of Trinidad and the first bats of the genus to be reported from north of Panama (Jones and Dunnigan, 1965: 462). Subsequently, Percy L. Clifton obtained, in the state of Jalisco, three more individuals of *M. greenhalli*, including the first male from the North American mainland.

Comparison with material from Trinidad indicates that the Mexican bats represent a distinctive subspecies, which is named and described below.

***Molossops greenhalli mexicanus* new subspecies**

*Holotype*: Adult male, skin and skull, no. 108,609 Museum of Natural History, The University of Kansas; from 7.5 mi. SE Tecamate, 1500 ft, Jalisco; obtained on 7 December 1966 by Percy L. Clifton, original no. 11,998.

*Geographic distribution*: Known only from western Mexico (states of Guerrero, Jalisco, and Oaxaca); known altitudinal range, 1500 ft in Jalisco up to 4800 ft in Oaxaca.

*Description*: Size large, both externally and cranially (see measurements and Table 1); braincase high and well inflated; rostrum slightly deflected downward in lateral view; teeth robust; relatively large space between upper incisor and canine, smaller (but clearly evident) space between canine and upper premolar; dorsal color varying from dark brown to reddish brown, contrasting little with ears and membranes; venter paler than dorsum.



TABLE 1. Measurements (mm) of forearms and crania of two subspecies of *Molossops greenhalli*. Catalog numbers are associated with geographic place-names in the list of specimens examined.

	<i>Molossops greenhalli greenhalli</i> , Trinidad			<i>Molossops greenhalli mexicanus</i> , Mexico					
	AMNH 175326 <sup>1</sup> ♂ holotype	AMNH 176285 ♀	AMNH 176286 ♀	AMNH 207071 ♀	KU 108609 ♂ holotype	KU 108608 ♀	KU 108610 ♀	KU 99741 ♀	KU 99747 ♀
Length of forearm	36.8	33.5	33.7	33.9	36.8	35.7	34.6	36.0	36.3
Greatest length of skull	18.5	17.6	17.4	17.0	20.4	18.0	17.8	18.3	18.2
Condylobasal length	—	15.9	15.8	15.4	18.3	16.7	16.4	16.7	16.5
Zygomatic breadth	12.4	11.6	—	11.2	13.1	11.5	11.8	11.9	12.0
Mastoid breadth	11.9	11.2	10.6	10.6	13.1	11.2	11.0	11.3	11.4
Interorbital constriction	4.5	4.4	4.2	4.2	4.6	4.3	4.4	4.6	4.4
Breadth of rostrum	7.9	7.3	7.1	7.2	8.6	7.2	7.2	7.4	7.4
Breadth across upper molars	8.2	7.9	7.6	7.8	8.8	8.3	8.2	8.5	8.2
Length of maxillary tooth-row	6.8	6.5	6.5	6.2	7.6	6.9	6.9	6.9	6.8

<sup>1</sup> Measurements after Goodwin (1958: 4).

*Measurements:* Some external measurements (mm) of the holotype, followed by those of four females from Jalisco (2), Guerrero, and Oaxaca, respectively, are: total length 107, 93, 92, 90, 96; length of tail 33, 28, 29, 29, 30; length of hind foot 12, 10, 10.5, 9, 11; length of ear from notch 17.5, 16, 16.5, 14, 16; weight 16.2 and 16.5 g in the females from Guerrero and Oaxaca. Some cranial measurements of the holotype and an adult female from the same locality in addition to those listed in Table 1 are, respectively: greatest length of skull exclusive of incisors 19.0 and 17.1; breadth across upper canines 5.8 and 4.7; palatal length 8.6 and 7.6; alveolar length of mandibular tooth-row (c-m3) 8.1 and 7.3.

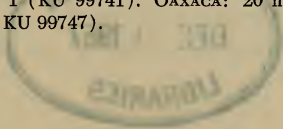
*Comparisons:* From *Molossops greenhalli greenhalli* of Trinidad, the only other subspecies of the species, *M. g. mexicanus* differs in: size larger, both externally and cranially; weight more (10.8 and 12.8 g in two females of *greenhalli*—see Goodwin and Greenhall, 1961:283); skull heavier, not so flattened dorsally in lateral view (rostrum of *mexicanus* angles slightly downward); braincase higher and more inflated; pre-sphenoid ridge more pronounced; evident space between canine and upper premolar (the two teeth abut in *greenhalli*); space between upper incisor and canine noticeably larger; teeth generally somewhat more robust; dorsum less richly colored than in specimens of *greenhalli* examined, but all the latter are preserved in spirits.

*Remarks:* Little is known of the biology of *Molossops greenhalli*. Goodwin and Greenhall (*loc. cit.*) reported a colony living in a hollow tree in the Royal Botanic Gardens in Port-of-Spain, Trinidad. Four of six females taken there on 6 June 1955 were pregnant, each with a single embryo. All of our Mexican specimens were captured in mist nets. Those from Jalisco were netted over a small stream in "dense, tall tropical deciduous forest" (P. L. Clifton, field notes) on the nights of 6 and 7 December 1966. Seven other species of bats, including *Molossus aztecus*, were taken in the same net.

Of the other two Mexican specimens, both captured in June, the one from Guerrero was trapped in a net stretched over a small pond situated just below the lower limits of the pine-oak zone. The Oaxacan specimen was one of 28 bats caught in three adjacent nets in dense forest, one net over a small pond and the other two over a swift-flowing stream. None of our four females evidenced reproductive activity.

*Molossops greenhalli* probably will be found to occur in Central America as well as on the South American mainland. According to Goodwin (1958:3-5), none of the nominal species assigned to the subgenus *Cynomops* in South America appears to be closely related to *greenhalli*.

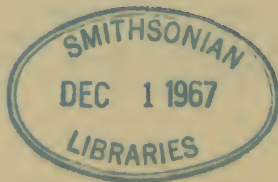
*Specimens examined* (total 5, all from MEXICO): JALISCO: 7.5 mi. SE Tecamate, 1500 ft, 3 (KU 108608-10). GUERRERO: 3 km N Agua del Obispo, 3180 ft, 1 (KU 99741). OAXACA: 20 mi. S, 5 mi. E Sola de Vega, 4800 ft, 1 (KU 99747).



Three specimens of *M. g. greenhalli* (AMNH 176285-86, 207071) from Port-of-Spain, Trinidad, were examined through the courtesy of Karl F. Koopman, American Museum of Natural History. Rodolfo Hernandez Corzo kindly issued scientific collecting permits for field work in Mexico, the cost of which was defrayed by the Kansas University Endowment Association.

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TWO NEW *ELEUTHERODACTYLUS* FROM WESTERN  
MEXICO (AMPHIBIA; LEPTODACTYLIDAE)

BY JOHN D. LYNCH<sup>1</sup>

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One of the most abundant and conspicuous elements of the American tropics is the frog genus *Eleutherodactylus*. More than 300 species are known ranging throughout the West Indies, Middle America and South America. Within so large a genus, numerous species groups are known but as yet no subgeneric units have been diagnosed. In México and northern Central America one finds eight species groups. Some of these are lower Central American or South American groups that have invaded México but a few are autochthonous elements of southern México and Guatemala.

One of these autochthonous elements is the spatulate-toed *alfredi* group containing 13 taxa, two new species of which are described below.

This species group has previously been known only from the Caribbean Slopes of México and Guatemala and on the semi-arid Yucatán Peninsula (Lynch, 1965). The two new species are from localities in the cloud forests on the Pacific versant of México.

In the course of investigations on the avifauna of a cloud forest in the Isthmus of Tehuantepec, México, a field party from Louisiana State University Museum of Zoology (LSUMZ) found a specimen of a new species of the *alfredi* group. The frog is related to *E. decoratus* Taylor and *E. guerreroensis* sp. n. (described below).

***Eleutherodactylus silvicola* new species**

*Holotype*: LSUMZ 7557, 12 mi. NNE Zanatepec, Oaxaca, México, 4900 ft elevation; L. C. Binford collector, 9 April 1964.

<sup>1</sup> Present address Museum of Natural History, University of Kansas, Lawrence.



FIG. 1. *Eleutherodactylus silvicola*, holotype LSUMZ 7557, 12 air miles NNE Zanatepec, Oaxaca, México, 1500 m, actual length 40.2 mm.

*Diagnosis:* A species of the *alfredi* group of *Eleutherodactylus* distinguished by: dorsum and legs without a bold contrasting pattern; tympanum moderate-sized; toes lacking webbing; skin of venter areolate; first finger shorter than second; vertical dark bars on flanks; dark bands on legs separated by light interspaces of equal width; size moderate (40 mm).

*Description of holotype:* (Fig. 1) Snout rounded in dorsal view; head as wide as body; head only slightly broader than long; interorbital distance slightly greater than width of upper eyelid; canthus rostralis



FIG. 2. *Eleutherodactylus guerreroensis*, holotype KU 86873, 3 km N Agua del Obispo, Guerrero, México, 980 m, actual length 39.6 mm.

sharp, area between greatly constricted; loreal region very concave, sloping gradually to lips; in lateral view (Fig. 4) snout truncate; tympanum moderate-sized, higher than long, separated from eye by distance almost as great as length of tympanum; supra and posttympanic fold poorly developed, darkened; nostrils set back from tip of snout; skin of head and dorsum shagreened, that of venter areolate; tongue large, fleshy, notched behind, posterior edge free; choanae well within borders of lip; vomerine dentigerous processes slightly larger than choanae, closely juxtaposed, oval, four and five teeth on right and left processes respectively.



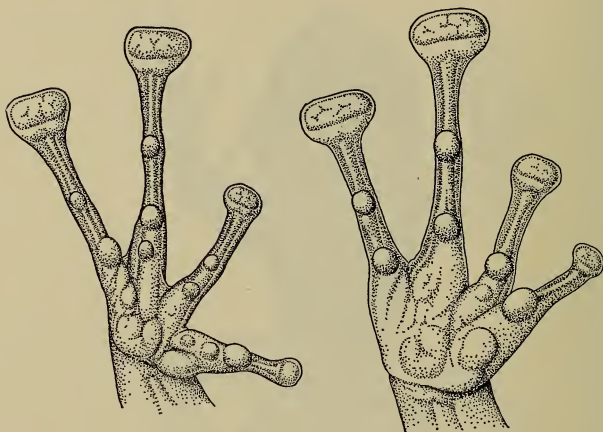


FIG. 3. Hands of *E. guerreroensis* (left) and *E. silvicola* (right).

Row of flat tubercles on forearm; three palmar tubercles, outer difficult to see; supernumerary tubercles absent on palm; subarticular tubercles simple, large, flat; finger tips greatly expanded; fingers long and slender; first finger shorter than second; faint tarsal fold for length of tarsus; tarsus lacking folds or tubercles; inner metatarsal tubercle oval, six times size of small, round, conical, outer metatarsal tubercle; toes lacking web; supernumerary tubercles few in number on sole; toes lacking lateral fringes; tips of toes twice as wide as digit; four dark bands on thigh, four on tibia, two on tarsi, two on forearm; all dark bands equal in width to light interspace bands; dorsum with numerous irregular blotches; four labial bands.

*Color in alcohol:* The dorsum and flanks are gray to cream, the markings dark brown. The venter is immaculate.

*Measurements (in mm):* Snout-vent 40.2; tibia 22.5; head width 17.0; head length 16.1; interorbital distance 4.2; eyelid width 4.2; length of eye 5.1; tympanum length 3.0.

*Comparisons:* *E. silvicola* can be separated from the other members of the *alfredi* group by its drab coloration, large tympanum, the areolate skin of the venter, and vertical barring on the flanks. Most likely to be confused with this species are *E. decoratus* (two subspecies) and *E. guerreroensis*.

*Remarks:* The specimen, an adult female, is full of large yellowish eggs indicating that the species probably lays its eggs in late April or May.

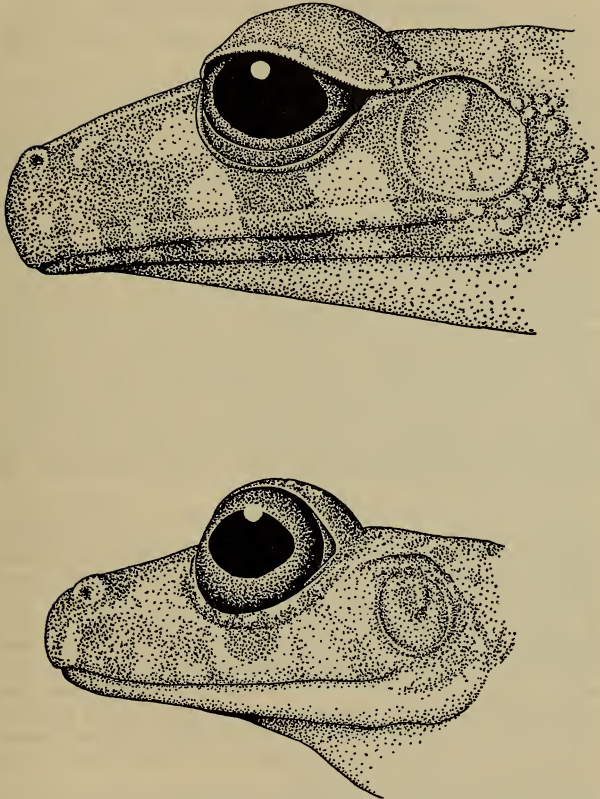


FIG. 4. Side of head of *E. guerreroensis* (top) and *E. silvicola* (bottom).

*Habitat*: The only known specimen was taken in the cloud forest above Zanatepec, Oaxaca, at 4900 ft.

Field work by the University of Kansas in the relatively well-collected Chilpancingo region of Guerrero during July, 1964, resulted in the collection of three specimens of an undescribed species of spatulate-toed *Eleutherodactylus* allied to *E. silvicola* and *E. decoratus*. The new form is more closely allied to *E. silvicola* and probably restricted to the Sierra Madre del Sur of Guerrero.

***Eleutherodactylus guerreroensis* new species**

*Holotype*: KU 86873, 3 km N Agua del Obispo, Guerrero, México, 980 m, collector J. S. Waddick, 8 June 1964.

*Diagnosis*: An occidental species of the *alfredi* group of *Eleutherodactylus* distinguished by: weak tarsal fold for length of tarsus; vocal slits in males; tympanum of males large, three-fourths diameter of eye; adult males to 40 mm snout-vent length; fingers long and thin; lateral bars absent on flanks; supernumerary tubercles absent on sole; thighs and shanks with wide dark bands; skin of venter smooth.

*Description*: (Fig. 2) Head as broad as body, broader than long; snout subacuminate in dorsal view; eyelid width greater than interorbital distance; tympanum large, circular, edges slightly elevated; supra- and posttympanic fold well defined, ending at posterior edge of tympanum; tympanum close to eye, almost reaching lip border; canthus rostralis moderately sharp; loreal region concave, sloping gently to lip; nostril at tip of snout; snout long, truncate in lateral profile; tongue small, fleshy, not notched behind, free for posterior one-fourth; vocal slits in floor of mouth from angle of jaws to below tongue; vomerine dentigerous processes oval, between choanae, 2-5 teeth on each process; choanae large, not hidden by edge of lip, oval, closest anteriorly, about three times size of one dentigerous process; skin of head, dorsum and flanks shagreened, that of venter smooth.

Forearm lacking row of tubercles; three palmar tubercles, supernumerary tubercles absent or few in number on palm; subarticular tubercles small, non-conical, simple; finger pads wide, five to six times width of narrowest part of digit, each pad with a transverse groove across tip; fingers free of web, long and slender; two broad dark bands on forearms with narrow interspace dark bands dividing the light interspaces; anal region granular; dorsum with diffuse blotches; flanks lacking pattern; venter immaculate; thighs and tibia with wide, dark bands; outer tarsal fold or tubercles absent, a faint inner tarsal fold; inner metatarsal tubercle elongate, five or six times size of round ill-defined outer metatarsal tubercle; foot with slight webbing between inner three toes; supernumerary tubercles few on soles; tips of toes expanded; toes lacking lateral fringes.

*Measurements* (mm) and proportions of holotype (KU 86873) and paratypes (KU 86870, 86871): Snout-vent length 39.6 (35.2, 32.3); length of tibia 21.6 (19.7, 18.6); head width 14.6 (14.5, 12.9); head length 16.3 (13.8, 13.1); tympanum diameter 3.6 (3.4, 3.0); eye length 5.0 (4.0, 3.6); width of pad of third finger 2.8 (2.1, 2.0). Ratios (in percent). Tibia length/snout-vent length 54.6 (55.7, 57.5); tympanum length/head width 24.9 (23.3, 22.8); tympanum length/eye length 72.5 (84.2, 83.2).

*Color*: Ground color gray with slight greenish cast; blotches darker brown, usually ill-defined except for interorbital triangle; venter cream-yellow; three labial bars on very light background. The bands on the limbs are dark brown.

*Variation:* Two paratypes (KU 86870-71) are available from the type-locality. They agree with the holotype in all features. Both are males and have a large round tympanum. The dorsal blotching varies as to intensity and extent in paratypes.

*Remarks:* Lynch (1965) in describing *E. bufonoides* suggested its closest relatives were *E. decoratus* and *E. hidalgoensis* Taylor. I have shown (1967) *E. hidalgoensis* to be a synonym of *E. decoratus*. *Eleutherodactylus bufonoides*, as presently understood, is more closely allied to *E. spatulatus* Smith as evidenced by its small tympanum and tarsal condition. Some doubt exists in my mind as to the status of *E. bufonoides* and it may well be that it is only a variation of the sympatric *E. spatulatus*.

These two new species are placed in the *decoratus* subgroup of the *alfredi* group (Lynch, 1966). The addition of these species to that subgroup does not expand the definition of the subgroup which now includes the following *E. decoratus* (2 subspecies), *E. guerreroensis* and *E. silvicola*. These species occur at low to moderate elevations on the eastern and southern periphery of the Mexican highlands.

*Acknowledgments:* Mr. David Dennis drew the illustrations of the frogs. I have profited from discussions with Messers. F. Wm. Burley and K. L. Williams and Prof. H. M. Smith regarding these frogs. Drs. Wm. E. Duellman and D. A. Rossman kindly loaned the specimens to me for study.

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PROCEEDINGS  
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*PARACAPRELLA BARNARDI*, A NEW SPECIES OF  
CAPRELLID (CRUSTACEA; AMPHIPODA)  
FROM THE WEST COAST OF PANAMA

BY JOHN C. MCCAIN  
*Division of Crustacea, Smithsonian Institution*

In 1955 J. Laurens Barnard of the Smithsonian Institution had an opportunity to make amphipod collections at Culebra Island, Canal Zone. From rock washings made near the marine railway, numerous specimens of a hitherto undescribed species of *Paracaprella* were obtained. This species is herein described and named in honor of Dr. Barnard.

*Paracaprella barnardi* new species

*Material examined:* Culebra Island, Canal Zone; IV/23/55; ♂ holotype, USNM 120505; ♀ allotype, USNM 120506; 68 ♂, 78 ♀, 19 juvenile paratypes, USNM 120507.

*Diagnosis:* Large males with anterodorsal tubercle on pereonite 2, anterior margin of pereonite 2 with sharp ventrolateral projection, propodus of gnathopod 2 deeply notched.

*Description:* Male holotype (Fig. 1).—Body smooth except for large anterodorsal tubercle and ventrolateral projection on anterior margin of pereonite 2. Length 5.5 mm. Peduncle of antenna 1 inflated and setose, flagellum of 10 articles, basal article of 5 fused articles. Antenna 2 subequal in length to articles 1 and 2 of antenna 1, flagellum of 2 articles. Mandible with only seta as vestige of palp; incisor 5-toothed; right lacinia mobilis apically serrate, left 5-toothed; molar large. Outer lobe of maxilla 1 with 6 apical spines, inner lobe with 3 apical setae and 1 seta on anterior surface. Inner lobe of maxilliped rounded apically and with 2 apical setae; outer lobe with 2 apical setae and several medial setae; penultimate article of palp with distal triangular projection, dactylus with serrate grasping margin and 2 subterminal setae. Propodus of gnathopod 1 with 1 proximal grasping spine, grasping margin of dactylus serrate. Propodus of gnathopod 2 deeply notched with 1 proximal grasping spine; dactylus setose and grooved on grasping margin, lateral side with medial bulge. Gills on pereonite 3 larger than those of pereonite 4. Pereopods 3 and 4 2-segmented, terminal article with 2 or 3 setae, penultimate article with or without setae. Pereopods



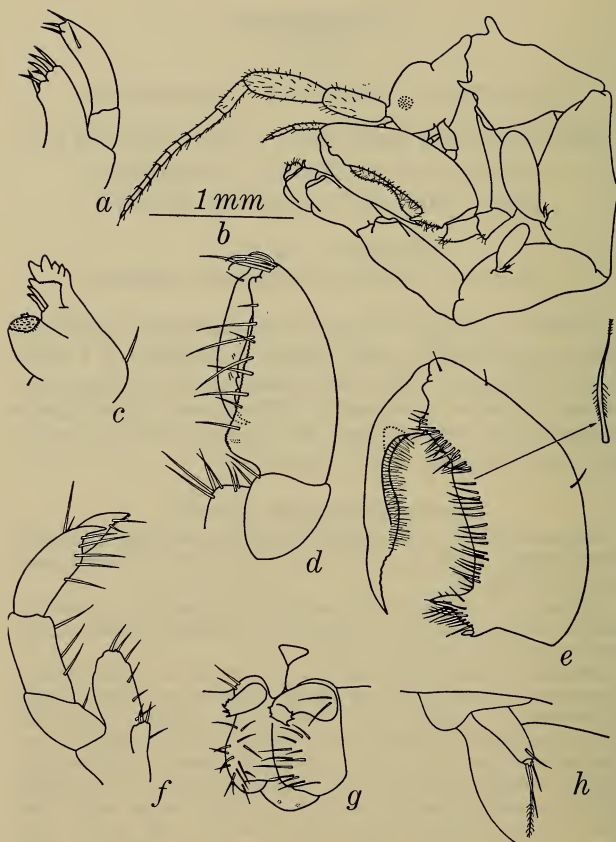


FIG. 1. *Paracaprella barnardi*, male holotype. a, maxilla 1; b, lateral view; c, right mandible; d, gnathopod 1; e, gnathopod 2; f, maxilliped; g, abdomen; h, pereopod 4.

5-7 missing. Abdomen with pair of apically serrate appendages and pair of setose lobes.

Female allotype (Fig. 2).—Body smooth. Length 3.8 mm. Antennae similar to male except peduncle of antenna 1 not inflated. Mouthparts

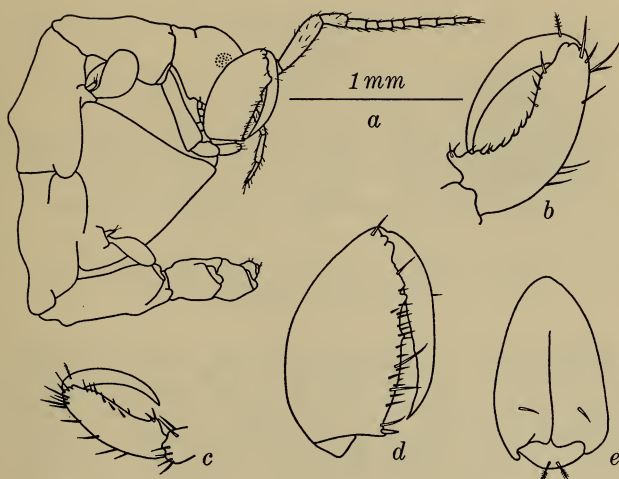


FIG. 2. *Paracaprella barnardi*, female allotype. a, lateral view; b, pereopod 7; c, pereopod 5; d, gnathopod 2; e, abdomen. (b and c drawn at same scale).

similar to male except inner lobe of maxilliped with 3 apical setae. Gnathopod 1 as in male. Propodus of gnathopod 2 slightly convex with proximal grasping spine, distal tubercle, and mid-distal tubercle. Gills on pereonite 3 larger than those of pereonite 4. Pereopods 3 and 4 similar to male. Propodus of pereopod 5 with pair of proximal grasping spines. Propodus of pereopods 6 and 7 with numerous knobs, each with single seta; pereopods 6 and 7 larger than pereopod 5. Abdomen with pair of lobes bearing single seta.

**Variation:** The largest male was 5.5 mm, largest female 4.4 mm, and the smallest ovigerous female 2.8 mm. Figs. 3a-c shows the variation in the depth of the propodal notch, larger males having a deeply notched propodus and smaller males showing a progressive decrease in the depth of the notch. The anterodorsal tubercle on pereonite 2 also was proportional to size, larger males having larger tubercles (Figs. 3d-f).

**Remarks:** The genus *Paracaprella* was hitherto composed of 4 species: *P. alata* Mayer, 1903; *P. crassa* Mayer, 1903; *P. pusilla* Mayer, 1890; and *P. tenuis* Mayer, 1903. Large males of *P. barnardi* differ from these species by the presence of a large anterodorsal tubercle on pereonite 2, a sharp ventrolateral projection on the anterior margin of pereonite 2,

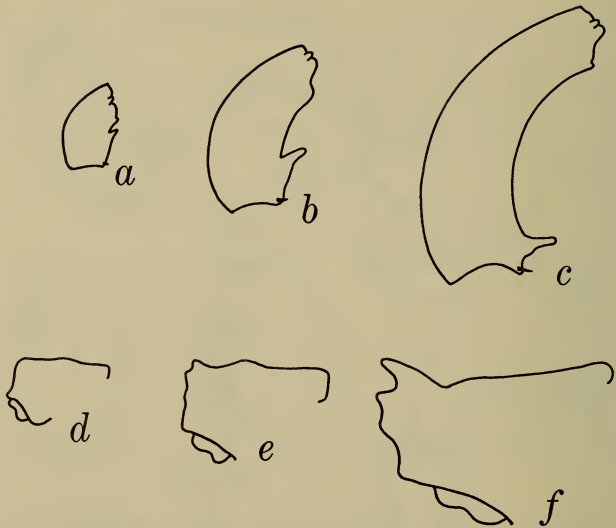


FIG. 3. Variation of propodus of gnathopod 2 (a-c) and anterodorsal tubercle on pereonite 2 (d-f). (a and d = ♂, 2.8 mm in length; b and e = 3.9 mm, c and f = 5.3 mm).

and a deeply notched propodus of gnathopod 2. *P. pusilla* seems to be the most closely related species of this genus. Occasionally *P. pusilla* bears a small anterodorsal tubercle on pereonite 2, however, the tubercle is not as well developed as in *P. barnardi* and the ventrolateral projection on the anterior margin of pereonite 2 is much larger in *P. pusilla*.

The lateral views of the holotype and allotype show the characteristic body curling of most members of this genus when they are preserved. This peculiar habit makes *Paracaprella* relatively easy to sort from other caprellids.

PROCEEDINGS  
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BIOLOGICAL SOCIETY OF WASHINGTONTHE SYSTEMATIC POSITION OF THE BATS *DESMODUS*  
AND *CHILONYCTERIS*, BASED ON HOST-PARASITE  
RELATIONSHIPS (MAMMALIA; CHIROPTERA)<sup>1</sup>BY C. E. MACHADO-ALLISON  
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Central de Venezuela*

Patterson (1956) has pointed out that the fossils and ectoparasites of bats provide very little evidence which can be used in clarifying the problems of phylogeny in the order Chiroptera. Indeed, chiropteran fossils are scarce, and the majority of chiropteran ectoparasites belong to groups that, having a life history stage off the body of the host, do not show notable specificity. Another factor detracting from the use of ectoparasites is the intimate ecological association existing between bats of different groups, particularly those found in caves, holes in trees, etc., where, occasionally, several species roost together. This behavior favors, without doubt, polyhaematophagy, and there are striking cases of this such as the presence of fleas of the family Ischnopsyllidae on bats of the distantly related families Molossidae (*Tadarida Rafinesque*) and Noctilionidae (*Noctilio* Linnaeus). However, host-parasite relationships may yet prove to be of value in shedding new light on phylogenetic problems in Chiroptera. It must be realized that we still know little about such relationships in the majority of bats and that only in the last few years have careful, well-documented collections of the ectoparasites been made.

In view of these facts, it becomes particularly important to study a group of ectoparasites, such as the Spinturnicidae (Acarina, Mesostigmata) which apparently show great host

<sup>1</sup>A contribution of the Smithsonian Venezuelan Project, supported by a contract (DA-49-193-MD-2788) of the Medical Research and Development Command, Office of the Surgeon General, U. S. Army.

specificity (Rudnick, 1960; Machado-Allison, 1965a), and also show peculiar modifications in their life cycle (Baer, 1952; Rudnick, *op. cit.*), for instance, ovoviviparity and reduction in number of nymphal stages.

In the past few years I have been studying the taxonomy of the Neotropical Spinturnicidae, especially of the genus *Periglischrus* Kolenati (Machado-Allison, 1965b), which is intimately related to the bats of the family Phyllostomidae. Comparing the arrangement of the genera and subfamilies of Phyllostomidae, based on the work of Miller (1907) and Simpson (1945), now accepted by most mammalogists, with certain data offered by the relationships of Spinturnicidae and the bats, I find some significant disagreements which I want to point out.

According to Simpson (*op. cit.*), the superfamily Phyllostomoidea includes the families Phyllostomidae and Desmodidae. Simpson divided the family Phyllostomidae into seven subfamilies: Chilonycterinae, Phyllostominae, Glosophaginae, Carollinae, Sturnirinae, Stenodermatinae, and Phyllonycterinae. Among these subfamilies, only one, Phyllonycterinae, is not known to be parasitized by the Spinturnicidae (there are no published data on the Carollinae, but I have recently found a new spinturnicid on *Rhinophylla pumilio* Peters).

The Chilonycterinae occupy a special position in the Phyllostomidae. The absence of a noseleaf and the lack of articulation of the trochiter with the scapula clearly differentiate these bats from those of the other subfamilies. These features led Winge (1923) to associate the Chilonycterinae with the Noctilionidae in a section of the Phyllostomidae that he called "Mormopini." Novick (1963) found the orientation sounds and associated anatomical features of the Chilonycterinae to differ sharply from those of other phyllostomids.

Spinturnicidae have not been found on the Noctilionidae, and the only South American form that I have found on *Chilonycteris* Gray presents morphological characteristics so peculiar that I have considered it to belong to a genus *Cameronieta* Machado-Allison, distinct from *Periglischrus* (Machado-Allison, 1965a). The other subfamilies of Phyllostomidae are

TABLE 1. Host-parasite relationships of Phyllostomidae with Spinturnicidae.

Spinturnicid species	Chiropteran genera	Present subfamilial assignment
<i>Cameronieta thomasi</i>	<i>Chilonycteris</i>	Chilonycterinae
<i>Periglischrus acutisternus</i>	<i>Phyllostomus</i>	Phyllostominae
<i>Periglischrus torrealbai</i>	<i>Phyllostomus</i>	
<i>Periglischrus parvus</i>	<i>Micronycteris</i>	
<i>Periglischrus setosus</i>	<i>Glossophaga</i>	Glossophaginae
<i>Periglischrus squamosus</i>	<i>Anoura</i>	
<i>Periglischrus hopkinsi</i>	<i>Lionycteris</i>	
<i>Periglischrus oastii</i>	<i>Sturnira</i>	Sturnirinae
<i>Periglischrus iheringi</i>	<i>Artibeus</i> , <i>Vampyrops</i> , etc.	Stenodermatinae
<i>Periglischrus</i> sp.	<i>Rhinophylla</i>	Carolliinae
<i>Periglischrus herrerae</i>	<i>Desmodus</i>	Desmodidae

parasited by species of *Periglischrus* (three species on Glossophaginae, three on Phyllostominae, one on Carolliinae, one on Sturnirinae, and one on Stenodermatinae; see Table 1).

*Desmodus rotundus* E. Geoffroy, family Desmodidae, is the host of the species *Periglischrus herrerae* Machado-Allison, which clearly belongs to the genus *Periglischrus*. In orientation behavior *Desmodus* resembles phyllostomid genera (Novick, *op. cit.*).

The evidence presented here indicates that a reappraisal of the familial relationships of the Chilonycterinae and the Desmodidae is in order. I would suggest that rather than being a subfamily of the Phyllostomidae, the chilonycterines may form a distinct family. The desmodids, on the other hand, may be no more than a subfamily of the Phyllostomidae.

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PROCEEDINGS  
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BIOLOGICAL SOCIETY OF WASHINGTON

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NAMED MAIN DIVISIONS OF TELEOSTEAN FISHES

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In our recent teleostean classification (Greenwood, Rosen, Weitzman, and Myers, 1966), three main "Divisions" are adopted, each of which is believed to have evolved independently from holostean forebears. These Divisions were not named, but were numbered—I, II, III. Several colleagues have suggested that the three Divisions should be named rather than numbered, which would obviate difficulty in any readjustment of numbered categories.

There is some doubt that the Division I teleosts really form a monophyletic group, because the association of the fishes included in the Superorder Clupeomorpha with the others (Elopomorpha) is doubtful. If the clupeomorphs were to be relegated to a separate division, the numbered system for Divisions would break down.

It is to be noted that our Divisions occur at precisely the position in the hierarchical system that is occupied by the taxon called cohort by Simpson (1945). To take the place of Divisions I, II, III, the following names are proposed:

**Taeniopaedia** new cohort (= Division I) As type-genus, we designate the genus *Elops* Linnaeus, 1766.

**Archaeophylaces** new cohort (= Division II) As type-genus, we designate the genus *Osteoglossum* Vandelli, 1829.

**Euteleostei** new cohort (= Division III) As type-genus, we designate the genus *Perca* Linnaeus, 1758.

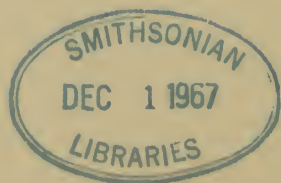
Derivation of the names: TAENIOPAEDIA (from the Greek) signifies "ribbon-young," in reference to the leptocephalus larvae of the Elopomorpha. ARCHAEOPHYLACES (Greek) sig-

nifies "ancient watchmen," from the large eyes of the Osteoglossiformes and the electric detection-field of the mormyrid form fishes. EUTELEOSTEI (Greek) is from *eu-*, an intensive, and Teleostei.

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PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTONFURTHER SYSTEMATIC NOTES ON THE  
AVIFAUNA OF PANAMABY ALEXANDER WETMORE  
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The descriptions and records in the following pages have come to my attention through further field work and research concerned with a second part of an account of the species of birds found in the Isthmus of Panamá. They include studies made on collections of other institutions, in addition to those of the U. S. National Museum.

## DESCRIPTIONS OF NEW SUBSPECIES

***Neocrex columbianus ripleyi* subsp. nov.**

*Characters:* Similar to *Neocrex columbianus columbianus* Bangs<sup>1</sup> but decidedly darker; crown and occiput darker gray; brown of the remainder of the upper surface and the flanks darker; remiges olive gray; under surface darker; under tail coverts pale cinnamon-buff, basally white.

*Description:* Holotype, U. S. National Museum no. 532988, ♂, from Achiote, Colón, Panamá, collected 8 November 1965, by Henry van Horn of the Gorgas Memorial Laboratory. Crown and occiput dark mouse gray; hindneck, scapulars, back and rump olive-brown; upper tail coverts and tail duller, fuscous; primaries and secondaries between mouse gray and deep mouse gray; wing coverts buffy brown; chin and throat white; sides of head, fore neck, breast and sides deep neutral gray; flanks drab (without bars); center of abdomen clear white; under wing coverts white, with dusky streak along wing edge.

*Measurements:* Holotype, wing 98.2, tail 29.7, culmen from base 21.7, tarsus 31.4 mm.

*Remarks:* The holotype collected in the Caribbean lowlands in the western sector of the Province of Colón, near the northwestern boundary of the Canal Zone, is the first record of this group of rails north of South America. The Colombian relative, *Neocrex columbianus*, de-

<sup>1</sup>*Neocrex columbianus* Bangs, Proc. Biol. Soc. Washington, vol. 12, 31 October 1898, p. 171. (Palomina = Palomino, 1500 meters elevation, Sierra Nevada de Santa Marta, Magdalena, Colombia.)



scribed originally from the Sierra Nevada de Santa Marta, is now known to range in small numbers through Colombia, from west of the Eastern Andes south into northwestern Ecuador. Currently *columbianus* has been listed as a geographic race of *Neocrex erythropis* (Sclater), also little known. The typical form of *erythropis* is found from Perú and Brazil southward to northwestern Argentina. A closely allied subspecies, *olivascens* Chubb, is recorded from the Eastern Andes of Colombia through Venezuela. These two subspecies are closely similar in the pattern on the flanks and under tail coverts, which is slate gray barred with white. Also the nostril in these two subspecies is widely open and easily seen to be pervious. Typical *columbianus* and *ripleyi* have the bill more slender, with the external slit of the external nares narrowed by the greater width of the membrane on the upper margin of the opening. These are such evident differences that it seems reasonable to treat *erythropis* and *columbianus* as distinct species, each with two races.

In addition to the holotype of *ripleyi*, I have another male collected at Acandí, extreme northern Chocó, Colombia, taken in low second-growth near the Río Acandí on 2 January 1950, by M. A. Carriker, Jr.

*Etymology*: This interesting race is named for S. Dillon Ripley, Secretary of the Smithsonian Institution, in recognition of his studies on the intriguing family of the Rallidae.

*Specimens examined in comparisons*: *Neocrex columbianus columbianus*, COLOMBIA—MAGDALENA: Palomino, ♀ (holotype). VALLE: San Antonio, ♂. NARIÑO: Barbacoas, ♂, ♀; La Guayacana, 2♀. ECUADOR—Pambilar, ♂; San Javier, 2♂, ♀; Puente del Chimbo, ♂; Santo Domingo, 2♀.

#### *Phaeochroa cuvierii furvescens* subsp. nov.

*Characters*: Similar to *Phaeochroa cuvierii cuvierii* DeLattre and Bourcier,<sup>2</sup> but foreneck, upper breast and sides darker green; averaging darker green above; lower breast and abdomen slightly duller pinkish buff; slightly larger.

*Description*: Holotype, U. S. National Museum no. 448750, ♂, Zapotillo, 30 km west of Soná, Veraguas, Panamá, collected 19 May 1953, by A. Wetmore and W. M. Perrygo (original no. 17592). Upper surface, including wing coverts and upper tail coverts, bright metallic green; crown somewhat duller than back; wings dusky with faint violaceous sheen; two outer rectrices distally sooty black, tipped with white; outer webs of these two rectrices basally, and of remaining pairs entirely dark, faintly bluish green; foreneck, upper breast and sides like back, but with feathers tipped very narrowly with brownish gray, which produces faintly squamate pattern; center of lower breast

<sup>2</sup> *Trochilus Cuvierii* Ad. DeLattre and J. Bourcier, Rev. Zool., vol. 9, Sept. (Nov.), 1846, p. 310. ("isthme de Panama et Telemán, Amér. Centr." Here restricted to Panama City, Panamá.)

and abdomen drab-gray, changing at outer edge of feathers to vinaceous-buff; tuft of fluffy white in femoral area on both sides; under tail coverts basally somewhat brighter green than breast, dusky gray externally, edged with white. Maxilla and tip of mandible black; base of mandible pale dull pinkish-buff; lower part of tarsus, toes and claws black (from dried skin).

*Measurements (average in parentheses)*: Males (14 from Chiriquí, Veraguas and Los Santos), wing 70.1–75.8 (72.4), tail 41.0–45.6 (43.2, average of 13), culmen from base 22.7–26.6 (24.0) mm.

Females (10 from Chiriquí, Veraguas and Los Santos), wing 68.4–72.4 (70.0), tail 42.0–45.8 (43.7), culmen from base 23.8–26.7 (25.5, average of 9) mm.

Holotype, male, wing 73.4, tail 43.8, culmen from base 23.9 mm.

*Range*: Tropical lowlands of western Panamá in Chiriquí, southern Veraguas, including the western side of the Azuero Peninsula, and Los Santos.

*Remarks*: The population here described as a distinct race currently has been placed with *Phaeochroa cuvierii saturator*, named for its darker color by Hartert in 1901 from Isla Coiba, a large island which lies isolated, approximately 30 km at sea southwest of the coast of Veraguas. This race was known only from the rather brief original description until my visit to Coiba in 1956. The seven specimens of *saturator* now available prove that the race is valid, but also show definitely that the mainland population that has been identified with it differs in such a paler coloration that it requires a name.

The typical race *Phaeochroa c. cuvierii* is found in central Panamá from the Canal Zone east to the Pacific side through the eastern sector of the Province of Panamá, and on the Caribbean slope through the Comarca de San Blas nearly to the boundary with Colombia. The broad expanse of the savanna region of Herrera, Coclé and western Panamá Province, an area from which these hummingbirds as yet are unknown, separates it from the race *furvescens*. A population, lighter in color, *Phaeochroa c. maculicauda* Griscom, is found in Costa Rica.

In the original description of *cuvierii* the specimens are indicated as collected by "Ad. DeLattre," who is known to have travelled in Guatemala, Nicaragua, Panamá and Perú. The locality cited as "isthme de Panama et Teleman, Amér. Centr." requires restriction as Telamán in eastern Guatemala is in the range of a related hummingbird, *Phaeochroa roberti* (Salvin). In that early day DeLattre would have come to Panamá either on the Caribbean coast, or by way of Panama City on the Pacific. It is appropriate to designate the type-locality as Panama City.

*Etymology*: The subspecific name for this race has been taken from the Latin *furvescens*, meaning dusky.

*Specimens examined in comparisons*: *Phaeochroa cuvierii cuvierii*, PANAMÁ—CANAL ZONE: Gatun, ♂, 2♀; Lion Hill, 4♂, 2♀; Juan Mina, 2♂, ♀. PROVINCE OF PANAMÁ: La Jagua, ♂; Pacora, ♂, ♀;

Chimán, ♂. SAN BLAS: Mandinga, 2♂. *Phaeochroa cuvierii maculicauda*, COSTA RICA—Pigres, 2♂, 6♀; El General, ♂; Bebedero, ♂, 2♀; El Zapotal, 2♂, ♀; Buenos Aires, ♂, ♀; San Pedro, ♂. *Phaeochroa cuvierii saturator*, Isla Coiba: 5♂, 2♀.

***Haplophaedia aureliae galindoi* subsp. nov.**

*Characters:* Similar to *Haplophaedia aureliae floccus* (Nelson)<sup>3</sup> but darker green above and below; upper tail coverts darker, duller rufous; female, with white edgings on feathers of lower surface narrower, less prominent, so that the spotting is heavier.

*Description:* Holotype, U. S. National Museum no. 484355, adult ♂, from 1425 m elevation on Cerro Malí, Darién, collected 21 February 1964, by A. Wetmore (original no. 25910). Crown metallic spinach green, with the feathers tipped with dusky; nape, hindneck, cheeks and an indefinite line over eye light bronze-green; back, rump, and greater to lesser wing coverts metallic grass green; upper tail coverts dull green basally, changing to bronzy cinnamon-brown on tips; rectrices dull black, with faint sheen of bluish green; wings fuscous, with faint purplish sheen; under wing coverts dull grass green; narrow line on edge of wing rufous anteriorly, buffy white distally; foreneck, breast, sides of abdomen and under tail coverts dark metallic grass green, with each feather dark basally, tipped lightly with grayish, the light tipping wider, more prominent on lower breast and sides of abdomen; center of abdomen somewhat grayish white; prominent, elongated tibial tufts pure white, mixed slightly with cinnamon-buff.

The holotype in the flesh had the iris dark brown; cutting edge of the mandible dull yellow (concealed within the maxilla when bill was closed); rest of bill black; tarsus and toes fuscous; claws black.

A female, taken 20 Feb. 1964, was similar to the male, except that the front of the tarsus and the top of the toes were dark brown; back of tarsus and under side of toes dull buffy white.

*Measurements (averages in parentheses):* Males (10 from Cerro Malí and Cerro Tacarcuna, Darién), wing 59.9–63.5 (61.5), tail 38.5–40.3 (39.0), culmen from base (20.0–21.7 (20.5) mm.

Females (4 from Cerro Malí and Cerro Tacarcuna, Darién), wing 55.7–57.8 (56.8), tail 34.3–35.2 (34.7), culmen from base 20.0–20.8 (20.3) mm.

Holotype, wing 62.3, tail 38.3, culmen from base 20.0 mm.

*Range:* Known from the summit of Cerro Malí and the adjacent slopes of Cerro Tacarcuna, Darién, Panamá; extending across the international boundary to the head of the Río Cutí, Chocó, Colombia.

*Remarks:* The first specimens of this interesting hummingbird were taken by Harold E. Anthony and David S. Ball, 11 April 1915, on the

<sup>3</sup> *Eriocnemis floccus* Nelson, Smithsonian Misc. Coll., vol. 60, no. 3, 24 Sept. (27 Sept.) 1912, p. 8. (Cerro Pirre, at 1525 m elevation, near the head of Río Limón, Darién.)

Atlantic slope of Cerro Tacarcuna on the Colombian side of the boundary. Previously E. W. Nelson (1912, p. 8) described a hummingbird of this species from Cerro Pirre, Darién as *Eriocnemis floccus*. Simon (1921, p. 374), though apparently he had seen no specimens, placed Nelson's name (spelled "flocens" through error) in the synonymy of a subspecies *Haplophaedia aureliae caucensis* that he had described from northwestern Colombia. Griscom (1935, p. 323) in his catalog of the birds of Panama accepted this action, and in the range outlined under the subspecies name *caucensis* listed records from Tacarcuna, in addition to those from Pirre. As Cerro Pirre is an isolated mountain mass separated by extensive lowlands from the West Andean range of *caucensis* it has been no surprise on comparison of the series of specimens from Colombia now available, through collections made by M. A. Carriker, Jr. for the Smithsonian, to find that Nelson's description is valid. His bird, under modern terminology, is to be recognized as *Haplophaedia aureliae floccus*. It is probable that the race *galindoi*, known now from specimens from Cerro Tacarcuna and its spur Cerro Malí, may extend for some distance to the north along the Serranía del Darién, a region whose avifauna is as yet unknown.

*Etymology*: The race is named for Dr. Pedro Galindo of the Gorgas Memorial Laboratory in Panamá, in recognition of his constant interest in the avifauna of his county.

*Specimens examined in comparisons*: *Haplophaedia aureliae aureliae*, COLOMBIA—ANTIOQUIA: Valdivia, ♂ 2 adult, 1 immature, ♀ 1 immature, 1 with sex?. HUILA: Belén, 3♂, 4♀. SANTANDER: Virolín, 2♂, 2♀. Bogotá tradeskins, 27 without indication of sex or locality. *Haplophaedia aureliae floccus*, PANAMÁ—DARIÉN: Cerro Pirre, 3♂, including the holotype, 8♀. *Haplophaedia aureliae caucensis*, COLOMBIA—ANTIOQUIA: La Bodega, 2♂, 6♀; Urrao, 3♂, 1♂?; Hacienda Potreros, 10♂. CAUCA: Road Cali-Buenaventura, ♂; Tijeras (Moscopán), 2♀; Cerro Munchiquito ♂, ♀; San Antonio, ♂, ♀; El Roble, ♂; E. of Palmira, sex?; Gallera, west of Popayán ♂.

#### *Hylocharis eliciae earina* subsp. nov.

*Characters*: Similar to *Hylocharis eliciae eliciae* (Bourcier and Mulsant)<sup>4</sup> but definitely darker above, being dark metallic green, with crown and back nearly uniform; coppery brown of upper tail coverts and lower rump slightly darker; this color less extensive on upper rump; tail duller metallic bronze-green.

*Description*: Holotype, U. S. National Museum catalog no. 423199, adult ♂, collected at 225 m elevation in the Quebrada Chucantí, Cerro Chucantí, eastern Province of Panamá, Panamá, 16 March 1950, by A. Wetmore and W. M. Perrygo (original no. 15724). Dorsal surface from

<sup>4</sup> *Trochilus Eliciae* Bourcier and Mulsant, Ann. Sci. Phys. Nat. Agric. Industr., Soc. Roy. Agric. Lyon, vol. 9, 1846, p. 314. (Provenience unknown, type-locality here designated as Cobán, Alta Verapaz, Guatemala.)

forehead to upper rump metallic forest green, with feathers of crown tipped narrowly with dusky; lower rump and upper tail coverts metallic hazel; rectrices, on both upper and lower surfaces, glittering bronze-green; greater, middle and lesser wing coverts metallic deep grape green; wings, including primary coverts, dusky, with faint purplish sheen; anterior lores and chin cinnamon-buff, spotted with iridescent violet-blue, these markings increasing until on lower foreneck they cover entire feather; sides of breast and abdomen metallic light cress green; center of breast and abdomen somewhat dull pinkish-buff; under tail coverts olive-gray bordered rather widely with clay color; under wing coverts metallic cress green.

Iris dark brown; distal end of maxilla and mandible slaty black, varying in extent from extreme tip to more than half of length; rest of bill (usually more than half of length) light red; tarsus, toes and claws slaty black. (From recently killed specimens.)

*Measurements (averages in parentheses)*: Males (17 from Isla Coiba, Isla Gobernadora, Chiriquí, Los Santos, Province of Panamá, and Darién), wing 48.2–51.8 (49.7), tail 25.6–28.1 (26.7), culmen from base 17.0–19.6 (18.2) mm.

Females (6 from Isla Coiba, Isla Ranchería, Chiriquí, and Province of Panamá) wing 46.4–49.8 (47.7), tail 25.2–27.2 (25.9), culmen from base 18.6–20.0 (19.4, average of 5) mm.

Holotype, wing 50.0, tail 26.6, culmen from base 18.7 mm.

*Range*: Local on the Pacific slope in Panamá from Chiriquí through Veraguas, the Azuero Peninsula, and the Province of Panamá to eastern Darién; also on the Caribbean slope in the lower Chagres Valley (Lion Hill, Gatun). Islas Coiba, Ranchería and Gobernadora.

The 31 specimens of the species *Hylocharis eliciae* in the National Museum collections from the northern part of the range in Chiapas, Guatemala, Honduras, Nicaragua and Costa Rica differ decidedly from the series from Panamá in the lighter color of the dorsal surface, which in these northern birds is bright metallic bronze-green from the pileum to the lower back, with lower rump more reddish brown. The tail, on both upper and lower surfaces also is a brighter metallic bronze-green. The northern series appears fairly uniform, with the exception of an occasional specimen that is somewhat brighter in color, particularly on the rump and upper tail coverts, where a few feathers may be almost red. Size is similar to that of the population of Panamá.

*Etymology*: The subspecific name for the race of Panamá is from the latin adjective *earinus*, meaning greenish.

*Remarks*: Carriker and de Schauensee, (1935, p. 422) suggested the possibility of a southern race, but without conclusion, as they compared their single specimen from Guatemala with six others that included birds from Honduras, Nicaragua and Costa Rica in addition to Panamá.

Bourcier and Mulsant in 1846 described *Trochilus eliciae* (named in honor of "Mme. Elicia Alain") from a specimen without data as to the country of its origin, so that it is necessary in connection with the present



description to establish a type-locality for the nominate form. A probable source for the original specimen should be sought in the period prior to the original description. The name of the naturalist DeLattre comes to mind at once, as he travelled extensively in tropical America in that early period. Further, while his principal search was for plants, including orchids, he found hummingbirds attractive and collected numerous examples that came to ornithologists of the time. Griscom (1932, p. 5) writes that "Delattre visited Guatemala in 1842, and remained in Vera Paz for nearly a year, with headquarters at Coban." Concerning *Hylocharis eliciae* Salvin and Godman (1892, vol. 2, p. 312) state that in "Guatemala it is by no means common . . . we only met with the bird on rare occasions on both sides of the main mountain-chain. Some of them were obtained at Coban." It seems appropriate then to designate Cobán, Alta Verapaz, Guatemala, as the type-locality of *H. eliciae*.

*Specimens examined in comparisons: Hylocharis eliciae eliciae*, MÉXICO—CHIAPAS: Ocuilapa, ♂. GUATEMALA—Gualán, ♂; Masagua, ♂. HONDURAS—Santa Ana, ♂; Río Coco (Segovia), ♂. NICARAGUA—Sucuya, ♂. COSTA RICA—San Pedro (Mojón), 2♂, 4♀; Pigres, 3♂, ♀; Liberia, 2♂, ♀; Río Turubales, ♂, 2♀. With incomplete data from Guatemala and Costa Rica—9.

***Lampornis castaneiventris homogenes* subsp. nov.**

*Characters:* Male with throat violet-purple, like *Lampornis castaneiventris calolaema* (Salvin),<sup>5</sup> but with breast and abdomen darker gray; female darker, more rufous on lower surface, like that of *L. c. castaneiventris* (Gould), but somewhat darker, more bluish green on dorsal surface; central rectrices darker bronze-green; white tipping on outer rectrices less in extent; bluish black subterminal band broader.

*Description:* Holotype, American Museum of Natural History no. 246095, adult ♂, Chitra, 1430 meters elevation, Veraguas, Panamá, collected 26 February 1926, by R. R. Benson (original no. 2281). Forehead and crown metallic emerald-green, varying to bluish green with change in angle of light; upper surface from hindneck to upper tail coverts, including wing coverts, rather dull bronze-green; tail dull, slightly bluish black; inner secondaries dull bronze, greenish on the outer webs; rest of wing dull, somewhat purplish brown; side of head dusky bronze-green, with a prominent post-ocular streak of white; chin and throat metallic violet to purple, the feathers basally dull white; upper breast and sides dull metallic bronze-green; lower breast and abdomen light grayish olive; under tail coverts dusky, edged narrowly with dull white; tibial plumes white; under wing coverts dull bronze-green.

*Measurements (average in parentheses):* Males (10 from eastern

<sup>5</sup> *Oreopyra calolaema* Salvin, Proc. Zool. Soc. London, 1864 (February 1865), p. 584. (Volcán de Irazú, Costa Rica.)



Chiriquí and Veraguas), wing 62.2–65.9 (63.4), tail 33.6–37.6 (35.6), culmen from base 19.6–21.2 (20.5) mm.

Females (11 from eastern Chiriquí, Veraguas and western Coclé), wing 55.1–57.5 (56.4), tail 31.8–33.3 (32.5), culmen from base 20.8–22.6 (21.5) mm.

Holotype, wing 62.5, tail 34.5, culmen from base 20.7 mm.

*Range:* Subtropical zone in mountains of eastern Chiriquí (Cerro Flores, Cordillera de Tolé), Veraguas (Santa Fé, Chitra), and western Coclé (Alto Carvallo, north of El Copé).

*Etymology:* The name *homogenes* given to the race described above is from the Greek, meaning "of the same kind."

*Remarks:* *Lampornis castaneiventris*, found in mountain areas from northwestern Nicaragua through Costa Rica to western Panamá, has presented difficulties in taxonomic treatment. In its early history the females were regarded as a separate species, with the males distributed among two more according to their white or purple throat color. In due time the identity of the females was established, but uncertainty remained as to species limits. In recent discussions Berlioz (1949, pp. 4–5), from examination of about 50 males, finally outlined his belief that the group as a whole is a complex, a species in which the characters of the males are not completely stable. Blake (1958, pp. 519–521) regarded them as divided in two species, with some apparently aberrant individuals produced as hybrids.

Following study of more than three times the number of specimens seen by Berlioz I have been led to agree with his conclusion. The extensive series seen allows recognition of five populations segregated geographically in which more than 90 per cent of the individuals possess restrictive characters of color, and so may be treated as subspecies. All are to be listed as races of *castaneiventris*, which has priority in publication. Following is a brief summary of the other races.

*Lampornis castaneiventris castaneiventris* (Gould)

*Trochilus* (———?) *castaneiventris* Gould, Proc. Zool. Soc. London, pt. 18, 1850 (28 February 1851), p. 163. (Volcán de Chiriquí, 1800 m, Chiriquí, Panamá.)

*Oreopyra leucaspis* Gould, Proc. Zool. Soc. London, pt. 28, 18, August 1860, p. 312. (Volcán de Chiriquí, 2750–3000 m, Chiriquí, Panamá.)

*Characters:* Male, in normal phase, with throat white, rarely with this area violet-purple; tail black to bluish black; breast darker gray than in *cinereicauda*; female, darker, more rufous on lower surface than in *calolaema* or *cinereicauda*; central rectrices dark metallic green to slightly bronze-green.

The white throat in normal males viewed in a strong light coming from behind shows a pale pink reflection. Some also have a faint tinge of violet along the lower edge of the gorget, and occasionally a violet feather along the side or even out among the white feathers. Very rarely a male in the range of this group has the throat purple. I have

examined a few museum specimens that show this peculiarity, but in four expeditions in the range of this form did not recognize one in life among the many white-throated birds seen.

Common in the subtropical and temperate zones in the higher levels of the Chiriquí Volcano.

*Lampornis castaneiventris cinereicauda* (Lawrence)

*Oreopyra cinereicauda* Lawrence, Ann. Lyc. Nat. Hist. New York, vol. 8, 1867, p. 485. (Costa Rica.)

*Characters:* Throat in male white as in typical *castaneiventris*, but breast lighter gray; tail distinctly gray. In many males the white of the throat is mixed with purple. Female, like *L. c. calolaema* in paler color of the lower surface; differs from other females in dull bronze-green to grayish bronze-green of central rectrices, and slightly paler color of the adjacent pairs.

Common in the mountains of southern Costa Rica from the northern end of the Cordillera de Talamanca, including the Dota area, eastward toward Panamá.

*Lampornis castaneiventris calolaema* (Salvin).

*Oreopyra calolaema* Salvin, Proc. Zool. Soc. London, 1864 (February, 1865), p. 584. (Volcán de Irazú, Costa Rica.)

*Oreopyra venusta* Lawrence, Ann. Lyc. Nat. Hist. New York, vol. 8, 1867, p. 484. (Costa Rica.)

*Characters:* Male, throat violet-purple; in general similar to male of *L. c. homogenes* of west central Panamá, but somewhat lighter gray on breast and abdomen; auricular region blacker. Female, like *L. c. cinereicauda* in paler color of lower surface, but with the central rectrices darker green.

Mountains of north central Costa Rica from the Cordillera de Tilarán to the volcanoes and higher ridges of the Cordillera Central.

*Lampornis castaneiventris pectoralis* (Salvin)

*Oreopyra pectoralis* Salvin, Ann. Mag. Nat. Hist., ser. 6, vol. 7, no. 4, April, 1891, p. 377. (Costa Rica.)

*Characters:* Male nearest in color to *Lampornis c. homogenes*, but breast with the green restricted, the lower area darker, near hair brown; throat darker; under tail coverts darker; green of foreneck and upper tail coverts decidedly darker. Female, like *L. c. calolaema*, but crown darker; averaging faintly paler below, especially on breast.

Mountains of northwestern Costa Rica and western Nicaragua.

From the scanty material seen, *pectoralis* appears to be a valid form, though as yet there is limited information concerning it. In the original description, cited above, Salvin said merely "Adult male. Similar to that of *O. calolaema* in all respects except that the breast, when viewed from in front, is nearly black, and not glittering green. The female is

probably indistinguishable from that of *O. calolaema*. Hab. Costa Rica." Later Salvin and Godman (1892, p. 308) listed the male mentioned above as in the Salvin-Godman collection, and two males and two females in the Gould collection in the British Museum (Natural History). Other authors who have mentioned this bird have quoted or cited Salvin. Warren (1966, p. 222) says of the type "Costa Rica, 1883. Obtained by Whitely; prepared by Endres." Peters (1945, p. 83) includes *pectoralis* with other subspecies of *castaneiventris* with a range in western Nicaragua and northwestern Costa Rica.

The U. S. National Museum has in its collections a male *pectoralis* that came with several other hummingbirds from the collector A. R. Endrés, in 1867, with the locality indicated as "Costa Rica," with no other information. Apparently all of the older specimens seem also to have come from this man. From what is known of the other races and their distribution, it is supposed that Endrés' birds were obtained somewhere in the northwest of the country.

*Specimens examined in comparisons:* *Lampornis castaneiventris castaneiventris*, PANAMÁ—CHIRIQUÍ: Cerro Punta, 4♂, 3♀; El Volcán, 10♂, 7♀; Boquete, 61♂, 23♀. *Lampornis castaneiventris cinereicauda*, COSTA RICA—Copey, 8♂, 8♀; Santa María de Dota, 17♂, 19♀; Las Vueltas, ♀. *Lampornis castaneiventris calolaema*, COSTA RICA—Peoresnada, ♂; Palmira, 2♂, ♀; Cartago, ♂; Rancho Redondo, ♂, ♀; Coliblanco, 5♂, 2♀; Navarro, ♀; Candelaria, 6♂, 3♀; Irazú, 4♂, 2♀.

Numerous others of these races with incomplete data have not been listed.

#### ***Trogon collaris heothinus* subsp. nov.**

*Characters:* Similar to *Trogon collaris puella* Gould,<sup>6</sup> but male with the bars on the tail narrower, the white bars being somewhat broader, more prominent, and the black ones correspondingly reduced; female duller, more grayish olive-brown on the upper surface and breast; size of *T. c. puella*, thus larger than *T. c. extimus* Griscom of Cerro Pirre, Darién.

*Description:* Holotype, U. S. National Museum no. 484312, adult ♂, from the north fork of the Río Pucro, 2000 m elevation, on Cerro Tacarcuna, Darién, Panamá, collected 28 February 1964, by A. Wetmore (original no. 26049). Upper surface (except the wings), lower foreneck and upper breast metallic green; central rectrices metallic green, tipped rather narrowly with black; two adjacent pairs black, with the outer webs metallic green; three outer pairs black, barred narrowly with white, except on the concealed area of the inner webs, the white bars being somewhat narrower than the black ones; the white band on the tip broader than the others; wings dull black; wing coverts and secondaries banded very narrowly with irregular lines of dull white; outer webs of longer primaries edged narrowly with white, especially

<sup>6</sup> *Trogon puella* Gould, Proc. Zool. Soc. London, pt. 13, April, 1845, p. 18. (Escuintla, Guatemala.)

toward the base; lores, space around eyes, auricular area, side of jaw, chin and throat black; a broad band of white across the upper breast; rest of lower surface deep red; under wing coverts dark slate, with the anterior series lined narrowly with white.

*Measurements (averages in parentheses):* Males (3 specimens), wing 121.3–122.4 (121.9), tail 137.4–139.8 (138.4), culmen from base 17.9–18.2 (18.0), tarsus 14.2–15.1 (14.7) mm.

Female (1 specimen), wing 121.0, tail 140.0, culmen from base 18.7, tarsus 14.0 mm.

Holotype, wing 122.4, tail 138.4, culmen from base 18.0, tarsus 15.1 mm.

*Range:* Known from Cerro Tacarcuna, and its southwestern spur Cerro Malí, in eastern Darién; presumed to be found through the elevated eastern area of the Serranía del Darién.

*Etymology:* The name *heothinus* from the Greek, is in the sense of eastern, from its range in the Republic of Panamá.

*Remarks:* As indicated in the summary of characters, this population is nearest the subspecies *puella*, found from southern México to the mountain areas of Chiriquí in western Panamá. The three males and one female from the Tacarcuna massif have been checked against long series of that race.

The nearest form to the new race geographically is *T. c. extimus*, described by Griscom from Cerro Pirre on the opposite side of the great Tuira valley. This differs from *heothinus* and *puella* in smaller size, and also, in the adult male, in the much broader white tip on the three outer rectrices. In this latter character *extimus* agrees with the forms of South America found to the south in the Andes of Colombia. It should be noted that comparison for this should be made with adult males of *puella*, as individuals in their first post-juvenile dress may have the terminal tail band broader than in adults that have completed a second tail molt. For comparison, the following are measurements of *extimus*: Males (5 individuals), wing 108.0–118.0 (113.1), tail 112.0–124.5 (117.3) mm. Females (4 individuals), wing 110.0–115.7 (113.6), tail 117.8–126.7 (121.9) mm.

*Specimens examined in comparisons:* *Trogon collaris puella*, MÉXICO—PUEBLA: Metlatoyuca, ♂. VERACRUZ: Cerro Tuxtla, 2♂, 3♀. TABASCO: Teapa, 2♂. CAMPECHE: Apazote, ♂. YUCATÁN: Tizimín, ♂; without other locality, 2♂. CHIAPAS: Chicharras ♂, ♀; Tumbala ♂, ♀. GUATEMALA—Alotenango, ♂; no other locality, 2♀. HONDURAS—without other locality, ♂. COSTA RICA—Zarcero, ♂; San Mateo, ♂; Barranca, ♂; Copey, ♂; Santa María de Dota, ♂, 3♀; Irazú, ♂; Coliblanco, ♂; Cuayabo, ♂, 2♀; Bonilla, ♀. PANAMÁ—CHIRIQUÍ: Santa Clara, 2♂, 3♀; El Volcán, 7♂, 8♀; Cerro Punta, ♀; Buena Vista, ♂; Boquete, 2♂, 3♀. *Trogon collaris extimus*, PANAMÁ—DARIÉN: Cerro Pirre, 5♂, 4♀. *Trogon collaris virginialis*, COLOMBIA—ANTIOQUIA: Hacienda Potrerros, 4♂, 2♀; CAUCA: without other locality, 4♂. ECUADOR—Paramba-Imbabura, ♂. *Trogon collaris subtropicalis*,

COLOMBIA—ANTIOQUIA: La Bodega, 2♂; Hacienda Zulaiba, 2♀; Valdivia, ♂, ♀. CALDAS: Hacienda Sofia, ♂. HUILA: Belén, 2♂, ♀; La Candela, ♀.

*Lysurus crassirostris eurous* subsp. nov.

*Characters:* Similar to *Lysurus crassirostris crassirostris* (Cassin)<sup>7</sup> but with the longitudinal central yellow band on the breast and abdomen narrower and faintly duller yellow; gray of side of head lighter, less blackish; lower foreneck grayer; pileum darker, more chestnut brown; bill slightly larger.

*Description:* Holotype, U. S. National Museum no. 484963, adult ♂, 1250 m elevation near head of the north fork of the Río Pucro, Cerro Tacarcuna, Darién, 28 February 1964, A. Wetmore (original no. 26068). Crown and hindneck liver brown; back, scapulars and rump olive-green, the upper tail coverts duller, darker; tail dull slaty black, with the outer webs dull olive-green; wing coverts basally dull fuscous-black, edged with deep olive-green; primaries and secondaries dull fuscous-black, with the outer web edged with dull olive-green; side of head, including lores and narrow space above eye, blackish gray; malar region, chin and throat white, tipped with dark gray; lower foreneck dark gray with the feathers blacker basally; breast, sides and under tail coverts dark olive-green, with a narrow area of rather dull yellow down the breast and upper abdomen; edge of wing dull yellow marked lightly with olive; under wing coverts pale dull greenish slate.

Iris dark brown; maxilla, except cutting edge, black; mandible and basal half of cutting edge of maxilla neutral gray, becoming brownish gray on anterior half; tarsus and toes fuscous-brown; claws somewhat brownish dark neutral gray. (Colors recorded from the bird in the flesh).

Measurements of holotype, wing 73.9, tail 58.4, culmen from base 17.3, tarsus 27.5 mm.

*Remarks:* The holotype was taken in a mist net set across the narrow stream of the north fork of the Río Pucro on the high slope of Cerro Tacarcuna. It is the first record of the species for eastern Panamá. The typical form, *Lysurus crassirostris crassirostris* is found from Costa Rica in the Cordillera Central to the higher mountains of Chiriquí and Veraguas, in Panamá ranging also to the Caribbean slope in western Bocas del Toro.

From examination of more than 40 specimens of typical *L. c. crassirostris* the holotype of the Darién bird differs clearly in the characters listed.

Measurements of *L. c. crassirostris* are as follows (averages in parentheses):

Males (15 from Costa Rica, Chiriquí and Veraguas), wing 74.0–

<sup>7</sup> *Buarremon crassirostris* Cassin, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 170. (Barranca, Puntarenas, Costa Rica.)



80.1 (76.7), tail 58.6–68.9 (63.1), culmen from base 16.0–17.5 (16.6, average of 14), tarsus 27.3–30.1 (28.7) mm.

Females (15 from Costa Rica, Chiriquí, and Bocas del Toro), wing 70.8–75.3 (73.9), tail 56.5–62.3 (59.1), culmen from base 15.5–17.4 (16.5, average of 14), tarsus 26.1–28.8 (28.0) mm.

The new form is definitely allied to nominate *Lysurus c. crassirostris* in having a yellow central stripe on the under surface, more extensive on the upper breast, and broad throughout as well as bright yellow. Also, the markings of the foreneck and the side of the head are blacker. *Lysurus castaneiceps* (Sclater) that ranges north on the western slope of the western Andes to northwestern Antioquia (Frontino) in Colombia, has the throat and foreneck plain dark gray, mottled faintly with dull black, but without white. The breast in some of the Andean birds has the olive green feathers lightly washed with dull olive-yellow, but this forms merely a hint of the distinct yellow band on the under surface in the northern species. One specimen in the Academy of Natural Sciences has a trace of white in the malar area below the eye, and a little more as faint edgings on the feathers of the chin. These are indications of relationship, but from available evidence it appears that the two have been long separated.

*Etymology*: The subspecific name *eurous* is from the Latin meaning eastern.

*Specimens examined in comparisons*: *Lysurus crassirostris crassirostris*, COSTA RICA—La Hondura, 3♂, 2♀; Cariblanco de Sarapiquí, ♂, 2♀; Carrillo, ♂, ♀; Santa Cruz de Turrialba, ♂; Guayabo, ♀; Navarro, ♀; Buena Vista, ♀. PANAMÁ—CHIRIQUÍ: Boquete, 10♂, 3♀; Cordillera de Tolé, ♀. BOCAS DEL TORO: Cedral, ♀. VERAGUAS: Cordillera del Chucú, ♀; Chitra, ♂, 2♀. *Lysurus castaneiceps*, COLOMBIA—ANTIOQUIA: Hacienda Potreros, ♀; Frontino, ♀. CAUCA: Gallera, ♂; El Tambo, 2♂; Novita Trail, ♂, ♀; Cocal, ♀. CALDAS: La Selva, 2♀. ECUADOR—Gualea, ♂; Nanegal, ♂; Sumaco Abajo, ♀. PERÚ—Marcapata, ♂, ♀.

#### OTHER ADDITIONS TO THE RECORDED LIST OF BIRDS FROM THE REPUBLIC OF PANAMÁ

*Myiobus villosus villosus* Sclater, Tawny-breasted Flycatcher.

The first records for the Republic of this species, widely distributed in South America, come from the higher ridges of Cerro Tacarcuna, Darién, near the Colombian boundary. The first one taken, a male, was caught 2 March 1964, in a mist net set at 1460 m. On 7 March, after I had moved to another camp on the lower base of the mountain, Charles O. Handley, Jr. secured another, a female. This specimen was captured at 1250 m in a mist net set across a small stream, tributary to the headwaters of the Río Tacarcuna. In northwestern Colombia the nearest population of these birds is found in the upper tropical and subtropical zones in the mountains of Antioquia, separated from the Serranía del



Darién of Panamá by the broad lowlands of the lower basin of the Río Atrato.

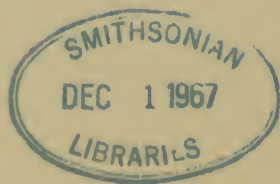
*Myiodynastes chrysocephalus minor* Taczanowski and Berlepsch, Golden-crowned Flycatcher.

This flycatcher, widely distributed in the mountains of Colombia and Ecuador, is known in Panamá from two specimens in the collections of the U. S. National Museum. E. A. Goldman collected a female on Cerro Pirre, Darién, 17 April 1912, at 1580 m near the head of the Río Limón. The second, a male, was secured by Dr. Pedro Galindo of the Gorgas Memorial Laboratory on the slopes of Cerro Tacarcuna, Darién, on 25 May 1963. This bird was taken at 1460 meters near the point where the ridge of Cerro Malí joins the main Serranía del Darién, a short distance from the boundary line with Colombia.

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PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW SUBSPECIES OF FLYCATCHER FROM LUZON,  
PHILIPPINE ISLANDS (AVES; MUSCICAPINAE)

BY S. DILLON RIPLEY AND JOE T. MARSHALL, JR.

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In the course of his field work on Luzon, Dr. Marshall collected by mist net a single flycatcher, which by its appearance immediately showed that it was related to the enigmatic, dull-colored population of the central Mindanao mountains, known as *Muscicapa crypta* Vaurie (1951), which population is known from three specimens. The new specimen has impelled Ripley to compare it with all specimens of *M. crypta* known in museums, thanks to the collaboration of the authorities of the American Museum of Natural History, New York, and the Field Museum, Chicago, and to reach the conclusions presented below based on the appearance and total range of the species.

Although Vaurie (1951) described *M. crypta* as a distinct species, he pointed out its resemblance to *M. bonthaina* (Hartert) of the Celebes. The discovery of a single female representing another population on Luzon, so close in color and appearance to females of *bonthaina*, makes the zoogeographic conclusion compelling that all three forms should be considered representatives of a single species. *M. crypta*, in the middle of the range, is the most rufescent, thus showing the greatest deviation in color, but it shares with the new form from the northern Philippines, lack of a prominent superciliary.

***Muscicapa bonthaina disposita* new subspecies**

*Holotype*: Adult female, USNM no. 519335, Zambales Mountains above Crow Valley, Tarlac Province, Luzon, Philippine Islands, 27 January 1966. Collected by Joe T. Marshall, Jr. Original no. 6303.

*Diagnosis:* Closest to *Muscicapa bonthaina crypta* Vaurie of Mount Apo and Mount McKinley, Mindanao, but differs strikingly in color by being more olive, less rufous on the upperparts with more grayish olive on the head, rather than rich brown, and in having the tail feathers a lighter cinnamon brown with blackish central areas and blackish tips to the lateral feathers rather than rich rufous. The cheeks are more olive gray-brown than *crypta*, the throat is whitish, not washed with pale cinnamon rufous; and the chest is more grayish-fuscus, rather than brownish. The underside of the tail feathers is brown, rather than reddish brown as in *crypta*. The male is unknown.

Females of the subspecies *bonthaina* of the Celebes are very close to the Luzon specimen, being more brownish, less reddish brown above than *crypta*. The underparts of *bonthaina* females, however, are washed with pinkey-buff on throat and chest.

The male specimen of *bonthaina* shows a prominent superciliary. In *crypta* and *disposita* this is only indicated by a paling at the base of the lores.

Wing measurements show an increase in length from the northern Philippines to the Celebes:

*Measurements:*

	Sex	Wing	Tail	Culmen	Tarsus
<i>disposita</i> (holotype)	♀	54	40.3	12	18 (USNM)
<i>crypta</i> (holotype)	♂	57	39	14	21 (FMNH)
	♀	61	43	13	18 (AMNH)
	(presumably ♀)	57	47	13	17 (FMNH)
<i>bonthaina</i>	(12♂♂)	62-67			
(from Stresemann, 1940)	(10♀♀)	59-63			

*Soft parts:* Bill dark brown, feet pink-pearl.

*Range:* Known only from a single specimen collected at the type locality in rain forest at 2500 feet altitude.

*Etymology:* The name *disposita* refers to the furtive, secretive, and skulking habits of the bird.

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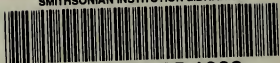








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