

The Aquatic Beetle Subfamily
Larainae (Coleoptera: Elmidae)
in México, Central America, and
the West Indies

PAUL J. SPANGLER
and
SILVIA SANTIAGO-FRAGOSO

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 528

SERIES PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

Emphasis upon publication as a means of "diffusing knowledge" was expressed by the first Secretary of the Smithsonian. In his formal plan for the Institution, Joseph Henry outlined a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This theme of basic research has been adhered to through the years by thousands of titles issued in series publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Contributions to Anthropology
Smithsonian Contributions to Astrophysics
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to the Marine Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Folklife Studies
Smithsonian Studies in Air and Space
Smithsonian Studies in History and Technology

In these series, the Institution publishes small papers and full-scale monographs that report the research and collections of its various museums and bureaux or of professional colleagues in the world of science and scholarship. The publications are distributed by mailing lists to libraries, universities, and similar institutions throughout the world.

Papers or monographs submitted for series publication are received by the Smithsonian Institution Press, subject to its own review for format and style, only through departments of the various Smithsonian museums or bureaux, where the manuscripts are given substantive review. Press requirements for manuscript and art preparation are outlined on the inside back cover.

Robert McC. Adams
Secretary
Smithsonian Institution

The Aquatic Beetle Subfamily
Larainae (Coleoptera: Elmidae)
in Mexico, Central America, and
the West Indies

Paul J. Spangler
and
Silvia Santiago-Fragoso



SMITHSONIAN INSTITUTION PRESS

Washington, D.C.

1992

ABSTRACT

Paul J. Spangler and Silvia Santiago-Fragoso. The Aquatic Beetle Subfamily Larinae (Coleoptera: Elmidae) in Mexico, Central America, and the West Indies. *Smithsonian Contributions to Zoology*, number 528, 74 pages, 267 figures, 1992.—The aquatic beetle family Elmidae consists of two subfamilies, the Elminae and the Larinae. There are nine genera presently assigned to the subfamily Larinae in the Western Hemisphere; five of the laraine genera, *Disersus* Sharp (1882), *Hexanchorus* Sharp (1882), *Hispaniolara* Brown (1981a), *Phanocerus* Sharp (1882), and *Pseudodisersus* Brown (1981a), are known to occur in the area of this study—Mexico, Central America, and the West Indies. A new genus *Pharceonus* based on a previously undescribed species is described and brings the number of laraine genera from the area of study to six. Keys are provided for the following: adults of the 2 subfamilies, Elminae and Larinae; adults of the 6 laraine genera known from Mexico, Central America, and the West Indies; 13 species included in those genera; and the 5 known larvae of the subfamily from the area of study (larvae of *Disersus*, *Hexanchorus*, *Hispaniolara*, *Phanocerus*, and *Pseudodisersus*). All included taxa are described or redescribed; synonymies are cited; and maps showing known distribution are included for each species. Pertinent character states for recognition of the various taxa are discussed, illustrated by photographs, line drawings, or scanning electron micrographs. Habitats of adults and larvae are discussed and illustrated with photographs.

The following taxa presently are known to occur in the study area: *Disersus longipennis* Sharp (1882) and *Disersus uncus* Spangler and Santiago (1982); *Hexanchorus caraibus* (Coquerel, 1851), *Hexanchorus gracilipes* Sharp (1882), *Hexanchorus crinitus*, new species, *Hexanchorus browni*, new species, *Hexanchorus usitatus*, new species, and *Hexanchorus emarginatus*, new species; *Hispaniolara farri* Brown (1981a); *Phanocerus clavicornis* Sharp (1882), *Phanocerus congener* Grouvelle (1898); *Pharceonus volcanus*, new genus, new species; and *Pseudodisersus goudotii* (Guérin-Méneville, 1843). Two species, *Phanocerus helmoides* Darlington (1936) and *Phanocerus hubbardi* Schaeffer (1911), are synonymized with *Phanocerus clavicornis* Sharp and the subspecies *Hexanchorus gracilipes orientalis* Zaragoza (1982) is synonymized with *Hexanchorus gracilipes*.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year*. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging-in-Publication Data

Spangler, Paul J.

The aquatic beetle subfamily Larinae (Coleoptera: Elmidae) in Mexico, Central America, and the West Indies / Paul J.

Spangler and Silvia Santiago-Fragoso.

p. cm.—(Smithsonian contributions to zoology : no. 528)

Includes bibliographical references.

1. Elmidae—Mexico—Classification. 2. Elmidae—Central America—Classification. 3. Elmidae—West Indies—Classification. I. Santiago-Fragoso, Silvia. II. Title. III. Title: Larinae. IV. Series.

QL1.S54 no. 528 [QL596.E45] 591 s—dc20 [595.76'45] 92-5590

Ⓢ The paper used in this publication meets the minimum requirements of the American National Standard for Permanence of Paper for Printed Library Materials Z39.48—1984.

Contents

	<i>Page</i>
Introduction	1
Biology	2
Distribution	3
Distinguishing Characters	3
Head	3
Pronotum	4
Elytra	4
Prosternum	4
Legs	4
Abdomen	4
Genitalia	4
Secondary Sexual Characters	4
Larval Characters	5
Materials and Methods	5
Acknowledgments	6
Family ELMIDAE Curtis, 1830	7
Key to the Subfamilies of the ELMIDAE (Adults)	7
Clave para las Subfamilias de ELMIDAE (Adultos)	7
Subfamily LARAINAE	7
Key to the Genera of the Subfamily LARAINAE of Mexico, Central America, and the West Indies (Adults)	7
Clave para los Géneros de la Subfamilia LARAINAE de México, Centroamérica y El Caribe (Adultos)	8
Key to the Genera of the Subfamily LARAINAE of Mexico, Central America, and the West Indies (Larvae)	8
Clave para los Géneros de la Subfamilia LARAINAE de México, Centroamérica y El Caribe (Larvas)	9
<i>Phanocerus</i> Sharp, 1882	10
Larva	10
Key to the Species of <i>Phanocerus</i> of Mexico, Central America, and the West Indies (Adults)	11
Clave para las Especies de <i>Phanocerus</i> de México, Centroamérica y El Caribe (Adultos)	13
1. <i>Phanocerus clavicornis</i> Sharp	13
2. <i>Phanocerus congener</i> Grouvelle	21
<i>Pharceonus</i> , new genus	23
3. <i>Pharceonus volcanus</i> , new species	23
<i>Hexanchorus</i> Sharp, 1882	27
Larva	27
Key to the Species of <i>Hexanchorus</i> of Mexico, Central America, and the West Indies	29
Clave para las Especies de <i>Hexanchorus</i> de México, Centroamérica y El Caribe	30
4. <i>Hexanchorus crinitus</i> , new species	31
5. <i>Hexanchorus usitatus</i> , new species	33
6. <i>Hexanchorus emarginatus</i> , new species	37

7. <i>Hexanchorus browni</i> , new species	39
8. <i>Hexanchorus gracilipes</i> Sharp	43
9. <i>Hexanchorus caraibus</i> (Coquerel)	48
<i>Pseudodisersus</i> Brown, 1981	52
Larva	52
10. <i>Pseudodisersus goudotii</i> (Guérin-Méneville)	53
<i>Hispaniolara</i> Brown, 1981	57
Larva	58
11. <i>Hispaniolara farri</i> Brown	59
<i>Disersus</i> Sharp, 1882	63
Larva	64
Key to the Species of <i>Disersus</i> of Mexico and Central America (Adults)	65
Clave para las Especies de <i>Disersus</i> de México y Centroamérica (Adultos)	65
12. <i>Disersus longipennis</i> Sharp	65
13. <i>Disersus uncus</i> Spangler and Santiago	69
Resumen	72
Literature Cited	73



FIGURE 1.—*Pharceonus volcanus*, new genus, new species.

The Aquatic Beetle Subfamily Larainae (Coleoptera: Elmidae) in Mexico, Central America, and the West Indies

Paul J. Spangler and Silvia Santiago-Fragoso

Introduction

This publication is the result of a study we conducted on the family Elmidae (riffle beetles) from Mexico, Central America, and the West Indies. Since Hinton's revision of the Mexican elmids in 1940, no major study of the group from Middle America has been undertaken and the results published. The family comprises two subfamilies, the Larainae and the Elminae, and we treat the Larainae in this publication. Our study is an effort to revise the family from the larger area and include previously undescribed taxa, additional distributional data, larval descriptions, and available biological data. We hope the publication will be of use to taxonomists, aquatic biologists, and others interested in aquatic biota. In addition, we hope the data included in this study will contribute to future phylogenetic analyses of the Elmidae.

In the Western Hemisphere, the elm mid subfamily Elminae includes 58 genera, 400 species, and 8 subspecies; the Larainae includes 9 genera, 32 species, and 1 subspecies. As a result of our study, 5 of the 9 previously described laraine genera from the Western Hemisphere and 1 new genus are recognized from Middle America. The Middle American laraine fauna now includes 8 previously described species and 5 new species; 2 previously described species and the single subspecies are placed in synonymy.

In the following historical account only the publications that include descriptions of new taxa or keys that treat laraine elmids from our area of study, Middle America, are discussed. The earliest publication treating any laraine from our area of

study is Guérin-Méneville's paper of 1843 in which he described several new species of laraine elmids from Colombia. Among his new taxa was one described as *Potamophilus goudotii*, which is now in the genus *Pseudodisersus*, and is known to occur as far north as Costa Rica.

The second laraine species described from Middle America was *Potamophilus caraibus* by Coquerel (1851) in his revision of the genus *Potamophilus*. The species was transferred to *Hexanchorus* by Grouvelle (1896) (as *Xexanchorus*, sic) and is known only from the Lesser Antilles.

In 1882, Sharp, in the *Biologia Centrali-Americana*, described the following laraine genera and species: *Disersus longipennis*, from Panama; *Hexanchorus gracilipes*, from Guatemala; and *Phanocerus clavicornis*, from Mexico.

Schaeffer in 1911 described *Phanocerus hubbardi* from Jamaica and Darlington in 1936 described *Phanocerus helmoides* from Haiti. We have examined the type specimen of *P. hubbardi* and two paratypes of *P. helmoides* (specimens in the National Museum of Natural History, Smithsonian Institution) and find both taxa to be synonyms of *P. clavicornis*.

In 1940a, Hinton published a thorough and well-illustrated revision of the Elmidae of Mexico. That study was based on elmids he collected primarily in the state of Mexico during the summers of 1933 and 1934. Hinton's revision included keys to two tribes (now the subfamilies Larainae and Elminae); a key to the world laraine genera (6, Old World; 5, New World); a key to the Mexican elmine genera (11); keys to adults of 36 species and 1 subspecies of Elmidae known from Mexico; and a key to larvae of 19 genera of the family Elmidae (7, Old World; 12, New World); and included the first descriptions and illustrations of the larva of *Phanocerus clavicornis* Sharp and the larva and pupa of *Hexanchorus gracilipes* Sharp. In addition, he described and illustrated the alimentary canal, male and female reproductive organs, and central nervous systems for 10 of the

Paul J. Spangler, Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.
Silvia Santiago-Fragoso, Instituto de Biología, Universidad Nacional Autónoma de México, Departamento de Zoología, Apartado Postal no. 70-153, 04510 México 20, D.F.

11 genera he included in his study. He also described larvae of six of the genera in the subfamily Elminae known from Mexico.

Brown in 1981a published a key to the world genera of the Larinae and described four new laraine genera. Two of his new genera, *Pseudodisersus* from Colombia and *Hispaniolara* from the Dominican Republic, occur in our study area and each is known by a single species.

In 1982, Zaragoza described a subspecies, *Hexanchorus gracilipes orientalis*, from Mexico. We have not been able to justify this form as a subspecies and have relegated it to synonymy under *H. gracilipes*.

Spangler and Santiago in 1982 described a species, *Disersus uncus*, from Costa Rica and brought the number of species of *Disersus* known from Middle America to two.

In 1987, Spangler and Santiago included a key to genera of the Larinae of the Western Hemisphere in a revision of the genera *Disersus*, *Pseudodisersus*, and *Potamophilops*. They also provided the first detailed descriptions of the larvae of *Disersus* and *Pseudodisersus*.

BIOLOGY

All of the laraine genera and species from Middle America share the following probably adaptive characters that allow them to live successfully as inhabitants of cascades, brooks, and cold, clear streams. All of the taxa have a sparse to dense covering of hydrofuge pubescence on most of the body surface; strong legs with large femora and large, very sharp tarsal claws; and well-developed hind wings.

The six laraine genera known from our area of study may be divided into two different groups by behavior and body types. In one group are the genera *Phanocerus* and *Pharceonus*, new genus, (Figure 1); members of these genera are usually found above the water line. Their body form and legs do not exhibit modifications for life in rapid waters; they are short in body length, are only moderately compressed dorsoventrally, have legs of average length with cylindrical and swollen femora and only moderately flattened tibiae.

Specimens of *Phanocerus* are found above water in splash zones on downstream surfaces of rocks and in leaf packs lodged against rocks, logs, branches, etc. They have been found in brooks 50 cm wide to shallow rivers 15 m wide and usually less than 50 cm deep and in splash zones of cement dam breasts and sides of aqueducts. They have been found singly and, on rocks, in aggregations that numbered up to 100 specimens. Intermittent splashing or complete immersion caused by minor fluctuations of the water does not seem to disturb them. Adults and larvae have been collected in aquatic habitats at altitudes ranging from 140 to 1250 m.

Little is known about the habitat or behavior of *Pharceonus volcanus*, new genus, new species. Our only collection of *Pharceonus* was made in Panama at an altitude of 1000 m, in a small brook about 50 cm wide and 3–10 cm deep with a gravel

and rocky substrate.

The second group includes the genera *Disersus*, *Hexanchorus*, *Hispaniolara*, and *Pseudodisersus*. The taxa included in this group are considered semiaquatic because they have been found out of water, in splash zones on surfaces of rocks in brooks, under water on rock surfaces, and on bedrock in cascades. When they are under water, adults of these genera may be spotted by the silvery respiratory bubble formed by the air space surrounding each one as the water washes over them. They are seemingly morphologically adapted to life in fast flowing water and have elongated body forms; flattened venter; long legs; enlarged and flattened front and middle femora (only minimal surface area is exposed to the current); and large, sharp tarsal claws.

It has not been determined what the adults of *Disersus*, *Hexanchorus*, and *Pseudodisersus* are doing when they are under water. It seems probable that they are feeding on the periphyton and females may also be ovipositing.

Adults of *Hexanchorus* are known to fly readily when disturbed, and in several instances on the island of Dominica, specimens appeared to fly directly into the water running over the vertical surfaces of the rocks. On Dominica, specimens of *Hexanchorus caraibus* (Coquerel) were found in aggregations of 21 to 131 specimens. Two specimens of *Hexanchorus gracilipes* Sharp from Río La Palma, Veracruz, Mexico, were placed in a jar of water for observation; they crawled about on a submerged twig and remained submerged without any apparent discomfort for 6 minutes before they crawled up the twig and surfaced.

In Panama at 19 km west of Volcán, a series of 32 males and 21 females of *Pseudodisersus goudotii* (Guérin-Ménéville) was collected from a cascade on the rock face of a vertical drop about 1.5 m high. All specimens were under water ($\sim 1/2$ cm) and were clinging tenaciously to the bedrock substrate. These specimens made no attempt to fly.

Specimens of *Disersus*, *Hexanchorus*, *Phanocerus*, and *Pseudodisersus* have been captured in ultraviolet light traps operated adjacent to their habitats.

The life cycles of laraines have not been studied in detail except Steedman and Anderson (1985) reported that the North American *Lara avara* LeConte (1854) grow through seven instars in 4 to 6 years, and pupae were found buried in small cells under moss on the surface of a partially submerged log.

In addition to the description of the larva and pupa of *Hexanchorus gracilipes*, Hinton (1940a) gave a brief description of the egg and reported that the mature larvae may crawl out of water as far as 3 feet above the water level and burrow under algae or moss where they construct a small cell and pupate.

We have found larvae of *Hexanchorus* in leaf packs and collected them in a net or seine when "kick samples" were made among gravel and cobble substrates. Larvae of *Disersus* and *Pseudodisersus* were found commonly on submerged woody debris and occasionally in galleries of submerged,

rotten branches and logs.

All members of the larvae genera treated in this study are presumed to be saprophytophagous. The presence of larvae of *Disersus* and *Pseudodisersus* on rotting wood and examination of their gut contents confirmed that they are primarily xylophagous. The adults and larvae of *Phanocerus* have been commonly found together in leaf packs, and examination of their gut contents showed that they feed on the decaying leaves. The common occurrence of adults of *Hexanchorus* on damp or submerged surfaces of rocks and the occurrence of larvae of *Hexanchorus* on submerged rocks suggest that they may feed primarily on periphyton. The food habits of *Hispaniolara* and *Pharceonus* are not confirmed but their occurrence in woody and leafy debris suggests that they also are saprophytophagous taxa.

DISTRIBUTION

To establish the ranges of the larvae taxa in Mexico, Central America, and the West Indies, many more collections of these beetles need to be made. We have seen no larvae from El Salvador nor Nicaragua, and we believe this is an artifact and exemplifies how insufficient the data are. We believe taxa "extend through Central America" if they are known from areas north and south of El Salvador and Nicaragua. Unlike the other species we studied, the widespread *Phanocerus clavicornis* is known from southern Texas, through Mexico, Central America, the Greater Antilles, and tropical South America. The monotypic genera *Hispaniolara* and *Pharceonus* each are known only from a single locality and, in our area of study, the monotypic *Pseudodisersus* is known from a few collections in Costa Rica and Panama. Members of *Hexanchorus* are comparatively common and are known from southern Mexico, through Central America, the Lesser Antilles, and tropical South America.

The known distribution of larvae beetles in the Caribbean countries also suffers from limited fieldwork. The only known surveys of elmids of the Greater Antilles were by Darlington in 1926, 1934, 1936, and 1938. Darlington (1936) reported, "The

absence of Dryopidae in many rivers and brooks in the West Indies is a striking phenomenon, worth recording in detail." He speculated that "possibly extensive clearing of forests resulting in heavy freshets, has eliminated the insects in places by tearing up the stream beds and destroying aquatic vegetation, while they survive where, as near La Hotte, the forest is mostly uncut or where conditions are favorable for some other reason." During trips to collect water beetles in the Antilles Spangler found the elmids fauna depauperate. The extensive deforestation Darlington saw in 1934 has progressed at a rapid pace, and many streams that appeared to be suitable elmids habitats from a distance were found to be heavily silted and devoid of elmids. Other streams were polluted or recently scoured by flooding and also devoid of elmids.

Altitudinal data (Figure 2) from the specimens studied provide an extensive range for *Phanocerus* and *Disersus*, a moderate range for *Hexanchorus* and *Pseudodisersus*, and a narrow range for *Hispaniolara* and *Pharceonus*. Undoubtedly, the altitudinal ranges for the last two genera mentioned will increase as new material is collected.

The six genera included in our study of Middle American larvae elmids are known only from the neotropics. All of the genera except *Hispaniolara* and *Pharceonus* are known from South America and, except the monotypic *Pseudodisersus*, are represented there by numerous described species and a number of known new species awaiting description.

DISTINGUISHING CHARACTERS

Members of the six larvae genera known to occur in Middle America have the following characteristics.

HEAD.—The head is retracted into the pronotum as far as the mentum or submentum. The dorsal surface above the clypeus rarely provides diagnostic characters because the cuticle and its sculpture are obscured by dense pubescence. As is characteristic of almost all genera of Elmidae, the antennae are 11 segmented; the maxillary palpi are 4 segmented; and the labial palpi are 3 segmented. Some differences are present in the shapes of the apical palpal segments and the arrangement of

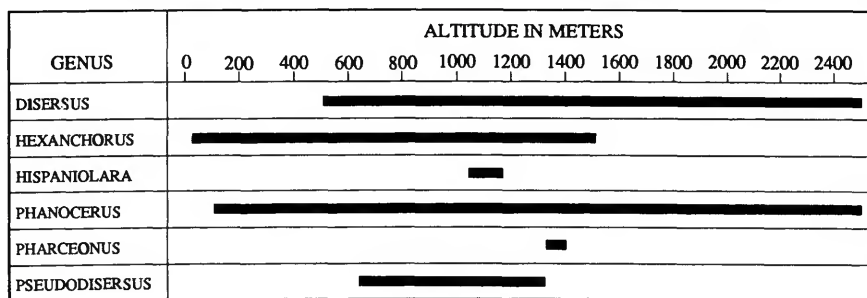


FIGURE 2.—*Disersus*, *Hexanchorus*, *Hispaniolara*, *Phanocerus*, *Pharceonus*, *Pseudodisersus*; ranges in altitude by genus.

sensilla thereon (Figures 20, 68, 139, 183, 244). However, most of the sensory structures are of limited taxonomic use because of their small size.

PRONOTUM.—The pronota of most larvae genera offer the most diverse and easily distinguished characteristics for generic recognition. The pronotal characters consist of different transverse and longitudinal impressions and occasional basomedial foveae; the presence or absence of and different combinations of these characters are diagnostic.

ELYTRA.—The elytral sculpture, as that on the head and pronotum, is obscured by the dense pubescence. Where the pubescence is abraded and the sculpture not obscured, the punctate striae vary from distinct to partly effaced, especially in the widespread genus *Phanocerus*. Males and females of some species of *Disersus*, *Hexanchorus*, and *Pseudodisersus goudotii* may be segregated by the different shapes of their elytral apices, which may be rounded (Figures 151, 153) or either obtusely (Figures 196, 197) or acutely spinous (Figures 256, 257).

PROSTERNUM.—The prosternum in front of the procoxal cavities is long in some genera (*Phanocerus*, *Pharceonus*) (Figures 16, 59) and very short in others (*Disersus*, *Hexanchorus*, *Hispaniolara*, *Pseudodisersus*) (Figures 239, 130, 215, 184). The shape of the prosternal processes also varies and provides useful generic characters.

LEGS.—The legs of Larinae do not have the intricate and distinctive plastron setae present on legs of known Elminae. In *Disersus*, *Hispaniolara*, and *Pseudodisersus*, the upper (anterior) surface of the profemora is without pubescence while members of *Phanocerus*, *Pharceonus*, and *Hexanchorus* have the profemora densely pubescent. Various species of *Hexanchorus* may be distinguished by the differing extent of the pubescent areas on the mesotibiae. The extent of the pubescent area on the metatibia of various species of *Disersus* has been useful in recognizing South American species. The tarsi of larvae have sparse setae on the ventral surface. Only members of *Hexanchorus* have a distinctive, apicoventral, long, slender, hair-like seta on tarsal segment 4. Stippled areas on line drawings of mesotibiae and metatibiae indicate the pubescent areas.

ABDOMEN.—The larvae we studied have six visible abdominal sterna, and we refer to them as sternum 1, sternum 2, etc. The sixth sternum often is retracted and not readily visible. The visible abdominal sterna provide some characteristics that may be useful for distinguishing some genera and some species. On abdominal sternum 1, the presence of an arcuate carina extending from the posteromedial margin of each metacoxal cavity to or near the posterior margin of the sternum is helpful in segregating specimens of *Disersus*, *Hexanchorus*, *Pharceonus*, and *Pseudodisersus* from those of *Hispaniolara* and *Phanocerus*.

The shape of the posterior margin of abdominal sternum 5 may be arcuate, subtruncate, or emarginate. If emarginate, the

emargination may be broad, narrow, deep, or shallow and is useful in distinguishing various species, especially in the genus *Hexanchorus*.

GENTALIA.—The male genitalia of the Larinae are basically the trilobed type typical of most elmids. The interspecific differences in shapes are distinctive and should be used for confirmation when identifying these taxa. A modification of the ejaculatory duct near the gonopore occurs in the median lobe of *Disersus*, *Hexanchorus*, *Hispaniolara*, and *Pseudodisersus*. The modification is a cluster of setae in a pouch-like structure that often everts when the genitalia are cleared in potassium hydroxide (Figures 84, 85). No homologous structure is present in *Phanocerus* nor *Pharceonus* (Figures 30, 70).

The female genitalia of all taxa included in this study are illustrated. Intergeneric differences, especially the shapes of the valvifers, coxites, and styli are evident. Further study of the female genitalia needs to be conducted to determine the intraspecific differences.

SECONDARY SEXUAL CHARACTERS.—Although the secondary sexual characters present on the various larvae taxa are not as diverse as those on elmids, the following differences between the sexes are present. *Phanocerus* and *Pharceonus*: No distinctive secondary sexual characters have been found in the material examined. *Hexanchorus*: Protibiae of males are slightly shorter and more arcuate than protibiae of females. The last protarsal segment of *H. caraius* is broader apicomediaally (Figure 164) than that on any other Middle American species (Figure 152) and will distinguish the male of this species from all others. Males of some species have a fine, short, nearly longitudinal carina on the inner apex of the mesotibia. The disc of the metasternum and abdominal sterna 1-3 are deeply concave in all males and convex in females. Males have an arcuate carina extending from the posteromedial margin of each metacoxal cavity to or near the posterior margin of abdominal sternum 1. The apical margins of abdominal sternum 5 are differently emarginate in the sexes. Male specimens are generally shorter than females of the same species. *Pseudodisersus*: The secondary sexual characters noted in the only described species of this genus are the slightly more angular elytral apices of the female and the more conical apex of abdominal sternum 5 of the male. *Hispaniolara*: The differences in the shape of the apicomediaal margin of abdominal sternum 5 is the only secondary sexual character found in the single described species of this genus. Males have the apicomediaal margin deeply emarginate, and females have the apicomediaal margin subtruncate. *Disersus*: Few secondary sexual characters have been noted in the various species of this genus. However, the apical margins of abdominal sternum 5 differ; most males have small emarginations apicomediaally, and margins of most females are rounded or slightly truncate apicomediaally. The moderate differences in the shapes of the elytral apices in some species of *Disersus* will help to

distinguish the two sexes.

LARVAL CHARACTERS.—The terminology used to describe larval beetles is diverse and complex; the various sclerites, especially those on the ventral surface of the thorax, are difficult to homologize. We have examined the terminology used in the descriptions of elmid larvae by Bertrand (1940), Hinton (1940a), and Sanderson (1954) and arrived at a slightly different terminology for some of the thoracic sterna referred to in our descriptions. The sclerites are labeled on Figures 38 and 256 and illustrate the terminology used in our larval descriptions. The larval illustrations are line drawings so that the principal morphological characteristics are shown as clearly as possible. Consequently, the integumental sculpture is indicated only on tergum and sternum of abdominal segment 1.

MATERIALS AND METHODS

This study is based on approximately 5200 specimens; in addition to those in the collections of the National Museum of Natural History, Smithsonian Institution, specimens were borrowed from 22 museums and personal collectors as indicated under "Acknowledgments." Full label data for all specimens are given, and individual identification labels have been placed on all specimens examined. For consistency, dates of collection were converted to day-month-year.

CLEANING SPECIMENS.—To facilitate identification of larvae for this study, adults were first cleaned by placing specimens in a vial containing a warm mixture of water and ammonia and then briefly (~15 seconds) immersing the vial in an ultrasonic cleaning device. This cleaning removed a flocculent deposit sometimes present around the bases of the hydrofuge pubescence covering most of the body, and previously dry specimens were cleaned and relaxed sufficiently for dissection by this procedure. Larvae were also cleaned in the same manner.

PREPARATION OF MALE GENITALIA.—Because the male genitalia provide the most diagnostic characters and, usually, must be carefully examined to confirm identifications based on the external taxonomic characters, the genitalia must be dissected carefully and cleared. Dissection of clean specimens preserved in alcohol was easily accomplished usually without additional procedures. Dry specimens were relaxed as mentioned above during the cleaning procedure or simply placed in water and heated until the appendages could be moved freely.

To extract the genitalia, we bent the point of a number 3 insect pin into a minute hook by exerting a slight downward pressure on the pin as we dragged it against a flat piece of glass or metal. The hook was small enough to be only slightly noticeable when pulled between one's finger tips. The tiny hook was then inserted into, and to one side of, the cloacal opening while the beetle was held head down between the thumb and forefinger, venter against the thumb. The hook was moved carefully into the connective tissue at the base of the

genital apparatus and then pulled gently until the genitalia was extruded. Oftentimes, the shape was distinctive enough that the species could be recognized without further treatment, and the genitalia was allowed to dry in the extruded position, was returned to the abdomen, or was removed and glued to a rectangle of good quality paper or placed in glycerine in a microvial; the rectangle or microvial was then added to the pin below the specimen.

After removal from the body cavity, the genitalia used for microscopic examination were placed in a 10% solution of cold potassium hydroxide overnight or were heated while being carefully monitored to be sure the genitalia were not altered by exposure to the caustic potash. After the muscle tissue was "digested" by the solution, gentle pressure was exerted on the sclerotized portion of the genitalia, and the soft contents were forced out of the structure. At this point, the action of the potash was stopped by placing the dissection in a weak solution of acidified water. The dissections were then placed on a paper rectangle or in a microvial as mentioned above.

HABITAT DATA.—As available, we have included water chemistry data and listed aquatic Coleoptera and aquatic Heteroptera collected in association with the larvae taxa. The biological data available for the species treated in this study is insufficient and not intended for an analysis of species diversity. Investigation of stream ecology in the neotropics is in its infancy, and stream biocies, especially for macroinvertebrates, have not been established. The biological data were included primarily to provide clues to types of habitats and some of the associates and localities worth visiting.

ILLUSTRATIONS.—To obtain scanning electron micrographs, specimens or parts of specimens were glued to wires that were attached at the other end to aluminum stubs or cover slips that were glued to the stub. If an entire beetle were to be scanned, one end of the wire was lightly coated with glue and inserted into the cloaca, and the other end was bent into a ring that was glued to the stub. This method allowed the specimen to be photographed from all angles. The specimens were coated with gold-palladium, and the micrographs were taken with a Cambridge 250 or Hitachi 570 scanning electron microscope at 5 to 10 kv. The specimens are stored on the stubs.

Line drawings were made by Young T. Sohn with the aid of a camera lucida on a Wild M5APO stereoscopic microscope mounted on a Wild transmitted-light Stand EB. In addition to the transmitted light, a Volpi Intralux 5000 fiber optic lamp was used to illuminate the stage from above. The original sketch was prepared using 15× oculars with 25× or 50× objectives and was then enlarged 1.5× with a supplemental lens. Magnifications of ×56.25 or ×112.5 were thus obtained using these combinations of lenses. The original sketch was then enlarged on an opaque projector to about 15 cm. The scale placed on the plate was established by measurements made with an ocular micrometer.

MEASUREMENTS.—Specimens were measured by means of a

moveable stage vernier scale with an attached pin-holding device. All measurements were made by aligning a cross-hair in the ocular on one end of the area to be measured and turning the micrometer knob until the cross-hair reached the other end; the measurement was automatically displayed on an electronic digitizer.

DISTRIBUTION RECORDS AND MAPS.—All locality records and general distribution data given for each species are based on specimens we have examined except the records of *Phanocerus congener* reported from St. Vincent and Tobago by Hinton (1971). One obviously mislabeled specimen was excluded from the text and maps.

The collection localities reported under "Specimens Examined" are arranged as follows. Countries are listed first and arranged from north to south starting with the United States, followed by Mexico, Belize, Guatemala, Honduras, Costa Rica, and Panama. The West Indian countries follow and are arranged alphabetically. Political divisions such as states, provinces, parishes, and counties follow the country and are arranged alphabetically; cities and towns follow and are also arranged alphabetically. Specimens labeled with only the name of the country are listed first followed by the notation "no additional locality."

ACKNOWLEDGMENTS

Our study of these poorly known and poorly collected aquatic beetles would be much diminished without the funding from the institutions mentioned, and we gratefully thank them for their generous support.

The fieldwork during which specimens were collected by Spangler was supported by grants from the following organizations: American Philosophical Society Grant #9284 (1983); Cuban Academy of Sciences/Smithsonian Institution Exchange Program (1983); National Science Foundation Grant GB1697 (1963); Smithsonian Institution Research Opportunities Fund (1981, 1983, 1984); Universidad Nacional Autónoma de México, Instituto de Biología (1981, 1990).

Support that enabled S. Santiago-Fragoso to work on this cooperative study at the National Museum of Natural History was received from Consejo Nacional de Ciencia y Tecnología, CONACYT #431 (1981); Smithsonian Institution International Exchange Visitor's Program (1989, 1990); Smithsonian Institution Short Term Visitors Program (1983); and Smithsonian Institution Women's Committee (1984).

For their assistance and encouragement with this project we thank José Sarukhán, Chancellor, Universidad Nacional Autónoma de México; Antonio Lot Helgueras, Director, Instituto de Biología, Universidad Nacional Autónoma de México; and Joaquin Bueno S., Academic Secretary, Instituto de Biología, Universidad Nacional Autónoma de México.

We especially acknowledge the major contribution to this study by our colleague and riffle beetle specialist, Harley P. Brown, who lent us 1600 specimens and generously donated a share of these beetles to our respective museums.

For their special efforts to collect specimens for this study we are indebted to and thank the following individuals. Smithsonian Institution Personnel: Robin A. Faitoute, Oliver S. Flint, and Warren E. Steiner. Volunteers: Carol M. Flint, James M. Hill, J.M. Mitchell, Phyllis M. Spangler, and Jill M. Swearingen. Colleagues: Mary Alkins-Koo, Cheryl B. Barr, Karen Buzby, Joaquín Bueno S., Herbert L. Dozier, R. Wills Flowers, Peter Fraissinet, E.C. Masteller, Philip D. Perkins, and William D. Shepard.

We thank the following individuals for the extensive and valuable assistance they provided: Christine von Hayek, Research Entomologist, The Natural History Museum, London, for numerous loans and information regarding Sharp's and Hinton's elmids in that museum; Young T. Sohn, Scientific Illustrator, Smithsonian Institution, for his excellent line drawings and advice on artwork problems; Robin A. Faitoute, Museum Specialist, and Susann G. Braden, SEM microscopist, Smithsonian Institution, for the SEM micrographs; Phyllis M. Spangler, volunteer, for typing the manuscript, editorial assistance, and unflinching assistance with most other aspects of this study.

We are also indebted to the following colleagues for lending specimens in their care (codens in parentheses): Biosystematic Research Centre (BRI), Ales Smetana; The Natural History Museum, London (formerly British Museum (Natural History)) (BMNH), Christine von Hayek, Enid Peacock; California Academy of Sciences (CAS), David H. Kavanaugh; California State Department of Agriculture (CSDA), Allan R. Hardy; Canadian Museum of Nature (CMN), François Genier; Cornell University (CU), Peter Fraissinet; Illinois Natural History Survey (INHS), Warren U. Brigham; Louisiana State University (LSU), Cheryl B. Barr, Joan B. Chapin, Vicky Mosley; Museum of Comparative Zoology (MCZ), Alfred F. Newton; Muséum National d'Histoire Naturelle, Paris (MNHN), N. Berti; Natural History Museum of Los Angeles County (LACM), Charles L. Hogue; Ohio State University (OSU), Charles A. Triplehorn; Pennsylvania State University, The Behrend College (PSB), Edward C. Masteller; Stovall Museum of Science & History, The University of Oklahoma (SMSH), Harley P. Brown; Universidad Nacional Autónoma de México (UNAM), Joaquín Bueno S.; Universidad de Panamá (UPan), Diomedes Quintero A.; University of California, Berkeley (UCalB), John A. Chemsak, G.W. Ulrich; University of California, Davis (UCalD), R.O. Schuster, R. Kimsey; University of Missouri, Columbia (UMo), Mark S. Davis, Wilbur R. Enns; University of the West Indies (UWI), Mary Alkins-Koo; Zoologisch Museum Amsterdam (ZMA), J. Stock, L. Botosaneanu; Cheryl B. Barr, personal collection (CBB).

The coden (NMNH) is used for those specimens from the collections of the National Museum of Natural History, Smithsonian Institution (formerly the United States National Museum (USNM)).

In conclusion, we thank the three anonymous reviewers for their constructive critiques. Any remaining errors are solely ours.

Family ELMIDAE Curtis, 1830

Key to the Subfamilies of the ELMIDAE

(Adults)

- Adults only occasionally entering water; fly commonly. Body densely pubescent; without plastrons. Cuticle moderately soft. Procoxae strongly transverse and trochantin exposed **LARAINAE**
- Adults aquatic, rarely leaving water; fly rarely. Body not densely pubescent; with plastrons, especially ventrally. Cuticle typically hard. Procoxae generally globose and trochantin not exposed **ELMINAE**

Clave para las Subfamilias de la Familia ELMIDAE

(Adultos)

- Adultos solo ocasionalmente bajo el agua; comunmente voladores. Cuerpo densamente pubescente; sin plastron. Cutícula moderadamente blanda. Procoxas fuertemente transversas y trocantín expuesto **LARAINAE**
- Adultos acuáticos, raramente fuera del agua; raramente voladores. Cuerpo sin densamente pubescente; con plastron, especialmente en la superficie ventral. Cutícula típicamente dura. Procoxas generalmente globosas y trocantín no expuesto **ELMINAE**

Subfamily LARAINAE

LARINI LeConte, 1861:116.—Horn, 1870:30.—LeConte and Horn, 1883:164.—Hinton, 1940a:225.—Chandler, 1956:359.—Spangler, 1966:413; 1987:25.—Brown, 1972:13.
 POTAMOPHILAIRES Mulsant and Rey, 1872:11.
 POTAMOPHILIENS Grouvelle, 1896:77.
 POTAMOPHILINEN Kolbe, 1901:136.
 POTAMOPHILINI Ganglbauer, 1904:100.—Reitter, 1909:83; 1911:166.—Zaitzev, 1910:5.—Leng, 1920:185.—Barthe, 1927:4.—Porta, 1929:284.—Bollow, 1938:163.
 LARIDAE Böving, 1929:67.
 LARINAE Böving and Craighead, 1931:45.—Hinton, 1935:173; 1936a:89; 1936b:216; 1936c:1; 1937b:289; 1939:133.—Sanderson, 1938:660.—Blackwelder, 1944:272.—Crowson, 1955:56.—Steffan, 1961:296.—Delève, 1968:211.—Bertrand, 1972:478.—Olmi, 1976:126.—Brown, 1981a:76; 1981b:137; 1982:113; 1983:2; 1987:256.—Spangler and San-

tiago, 1982:17.—Spangler, 1985:538; 1986:77; 1987:25.—Wiezlak, 1986:16; 1987:441.
 POTAMOPHILINAE Hinton, 1937a:95.—Bertrand, 1972:478.
 LARAINAE Spangler, 1986:77; 1987:25.—Spangler and Santiago, 1987:3.—ICZN, 1988:245.

DIAGNOSIS.—Body form elongate, subparallel or subovate. Cuticle moderately soft; covered dorsally and ventrally with dense, hydrofuge pubescence; never with tracts of plastron setae. Procoxae transverse, trochantin conspicuous. Antennae clubbed or filiform. Abdomen with 5 or 6 visible sterna. Elytron with 1 or 2 accessory striae at base between sutural (first) and second striae or without accessory striae. Tarsal claws without teeth. Adults riparian or subaquatic. Larvae aquatic.

Key to the Genera of the Subfamily LARAINAE of Mexico, Central America, and the West Indies

(Adults)

- 1. Length, 2.33–4.70 mm 2
- Length, 5.50–10.1 mm 4
- 2. Pronotum with a distinct transverse impression at anterior third; with or without arcuate sublateral impressions 3
- Pronotum without transverse impression at anterior third; with arcuate sublateral impressions [Figures 3, 17] *Phanocerus* Sharp
- 3. Pronotum with arcuate sublateral, subbasal, medial, and transverse impressions [Figures 4, 55] *Pharceonus*, new genus
- Pronotum without arcuate sublateral impressions; with deep transverse impression at apical third [Figures 5, 129] *Hexanchorus* Sharp

4. Pronotum with arcuate sublateral impressions, a transverse impression at apical third, and 2 robust tubercles basomedially [Figures 6, 171] . . . *Pseudodisersus* Brown
 Pronotum without arcuate sublateral impressions, with or without transverse impression at apical third, and without basomedial tubercles 5
5. Pronotum with transverse impression at apical third [Figures 7, 205]
 *Hispaniolara* Brown
 Pronotum without transverse impression at apical third [Figures 8, 232]
 *Disersus* Sharp

**Clave para los Géneros de la Subfamilia LARAINAE
 de México, Centroamérica y El Caribe
 (Adultos)**

1. Longitud, 2.33–4.70 mm 2
 Longitud, 5.50–10.1 mm 4
2. Pronoto con una evidente impresión transversa en el tercio anterior; con o sin impresiones sublaterales arqueadas 3
 Pronoto sin una impresión transversa en el tercio anterior; con impresiones arqueadas sublaterales [Figuras 3, 17] *Phanocerus* Sharp
3. Pronoto con impresiones arqueadas sublaterales, subbasales, mediales y transversas [Figuras 4, 55] *Pharceonus*, nuevo género
 Pronoto sin impresiones arqueadas sublaterales; con una profunda impresión transversa en el tercio apical [Figuras 5, 129] *Hexanchorus* Sharp
4. Pronoto con impresiones arqueadas sublaterales, con una impresión transversa en el tercio apical, y 2 tubérculos robustos basomediales [Figuras 6, 171]
 *Pseudodisersus* Brown
 Pronoto sin impresiones sublaterales arqueadas, con o sin una impresión transversa en el tercio apical; sin tubérculos basomediales 5
5. Pronoto con una impresión transversa en el tercio apical [Figuras 7, 205]
 *Hispaniolara* Brown
 Pronoto sin una impresión transversa en el tercio apical [Figuras 8, 232]
 *Disersus* Sharp

**Key to the Genera of the Subfamily LARAINAE
 of Mexico, Central America, and the West Indies
 (Larvae)***

1. Body flattened dorsoventrally. Lateral margins of thoracic and abdominal segments falcate [Figures 10, 11] *Phanocerus* Sharp
 Body cylindrical or subcylindrical. Lateral margins of thoracic and abdominal segments moderately flattened, not falcate [Figures 80, 169, 200, 230] 2
2. Body cylindrical. Sternopleural sclerites present on abdominal segments 1–5. Without longitudinal rows of seta-bearing tubercles on abdominal terga 1–8 [Figure 169] *Pseudodisersus* Brown
 Body cylindrical or subcylindrical. Sternopleural sclerites present on segments 1–6 [Figures 81, 231] or 1–7 [Figure 201]. With or without rows of seta-bearing tubercles on abdominal terga 1–8 3

3. Body compressed, subcylindrical, ovoid [Figure 80] or not [Figures 82, 83]. Apex of last abdominal segment rounded. Abdominal tergum 8 with a large tubercle on each side of meson posteriorly. Length, to 5.23 mm *Hexanchorus* Sharp
 Body cylindrical, parallel sided [Figure 230]. Apex of last abdominal segment emarginate. Abdominal tergum 8 without posterior tubercles. Length, to 10 mm 4
4. With 4 short, longitudinal rows of seta-bearing tubercles on abdominal terga 1-8. Lateral margins of the thoracic and abdominal segments explanate [Figure 230]. Sternopleural sclerites present on abdominal segments 1-6 [Figure 231] *Disersus* Sharp
 With 10 short, longitudinal rows of setae-bearing tubercles on abdominal terga 1-8. Lateral margins of thoracic and abdominal segments not explanate [Figure 200]. Sternopleural sclerites present on abdominal segments 1-7 [Figure 201] *Hispaniolara* Brown

*Larva of *Pharceonus* is unknown.

**Clave para los Géneros de la Subfamilia LARAINAE
 de México, Centroamérica y El Caribe
 (Larvas)***

1. Cuerpo aplanado dorsoventralmente. Márgenes laterales de los segmentos torácicos y abdominales falcados [Figuras 10, 11] *Phanocerus* Sharp
 Cuerpo cilíndrico o subcilíndrico. Márgenes laterales de los segmentos torácicos y abdominales moderadamente aplanados, no falcados [Figuras 80, 169, 200, 230] 2
2. Cuerpo cilíndrico. Escleritos esternopleurales presentes en los segmentos 1-5. Sin hileras longitudinales de tubérculos con sedas largas en los tergos abdominales 1-8 [Figura 169] *Pseudodisersus* Brown
 Cuerpo cilíndrico o subcilíndrico. Escleritos esternopleurales presentes en los segmentos 1-6 [Figuras 81, 231] o 1-7 [Figura 201]. Con o sin hileras de tubérculos con sedas en los tergos abdominales 1-8 3
3. Cuerpo comprimido, subcilíndrico, ovoide [Figura 80] o no [Figuras 82, 83]. Apice del último segmento abdominal redondeado. Octavo tergo abdominal con un tubérculo grande en cada lado de meson posteriormente. Longitud, hasta 5.23 mm *Hexanchorus* Sharp
 Cuerpo cilíndrico con márgenes paralelos [Figura 230]. Apice del último segmento abdominal emarginado. Octavo tergo abdominal sin tubérculos posteriormente. Longitud, hasta 10 mm 4
4. Con 4 hileras cortas longitudinales de tubérculos con sedas, en los tergos abdominales 1-8. Márgenes laterales de los segmentos torácicos y abdominales aplanados [Figura 230]. Escleritos esternopleurales presentes en los segmentos 1-6 [Figura 231] *Disersus* Sharp
 Con 10 hileras cortas, longitudinales de tubérculos con sedas, en los tergos abdominales 1-8. Márgenes laterales de los segmentos torácicos y abdominales no aplanados [Figura 200]. Escleritos esternopleurales presentes en los segmentos 1-7 [Figura 201] *Hispaniolara* Brown

*La larva de *Pharceonus* no se conoce.

***Phanocerus* Sharp, 1882**

Phanocerus Sharp, 1882:128 [type species: *Phanocerus clavicornis* Sharp; by monotypy].—Grouvelle, 1896:78.—Zaitzev, 1908:289; 1910:8.—Schaeffer, 1911:119.—Leng, 1920:185.—Darlington, 1936:73.—Hinton, 1937a:95; 1940a:245; 1940b:142.—Blackwelder, 1944:273.—Sanderson, 1953:153; 1954:10.—Brown, 1965:151; 1972:13; 1975:150; 1981a:77; 1981b:137; 1983:2; 1987:266.—Spangler, 1966:413; 1973:356; 1981:164.—Bertrand, 1972:495.—Spangler and Santiago, 1987:4.

DIAGNOSIS.—Length of 4.5 mm or less. Pronotum with sublateral impressions only (Figures 3, 17).

ADULT (REDESCRIPTION).—Body elongate, subparallel, and moderately convex. Integument clothed, for the most part, with dense, moderately long, usually recumbent hydrofuge pubescence.

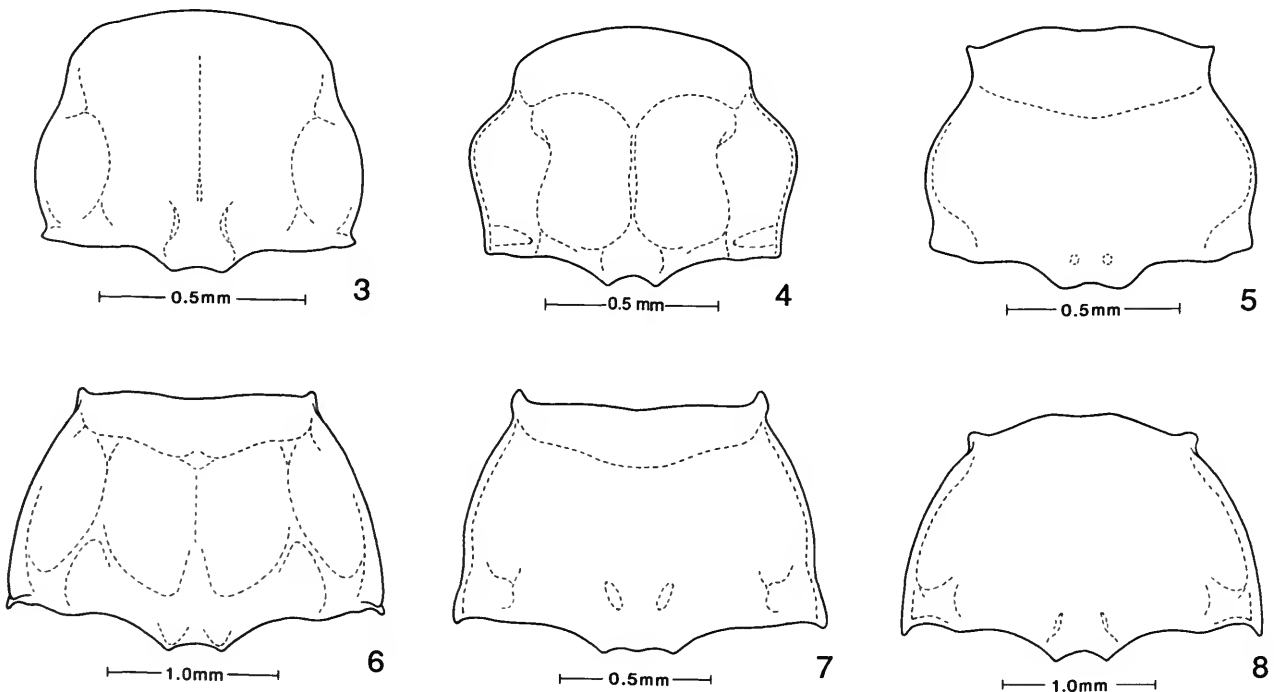
Head partly retracted into pronotum but not beyond the basal portion of the submentum. Antenna, 11 segmented; apical 5 segments forming a club. Mouthparts visible. Maxillary palpus, 4 segmented. Labial palpus, 3 segmented. Clypeus transversely rectangular; clypeal suture deep, extending between bases of antennae; anterolateral angles broadly rounded. Labrum transversely rectangular; anterior margin subtruncate; anterolateral angles rounded.

Pronotum widest at basal third; anterior margin moderately arcuate over base of head; on each side at apical third, a sublateral impression that curves mesally then posteriorly,

ending in a subbasal fovea; base in front of scutellum with 2 foveae separated by low convex ridge. Hypomeron oblique. Scutellum flat, subtriangular, but all sides arcuate. Elytron with punctate striae; without accessory stria; intervals flat. Hind wing (Figure 9) without radial cross vein; without anal cell; anal vein 2 with branches 1 and 2 fused; anal vein 1 very short, present only distally and not connected to cubito-anal cross vein; cubito-anal cross vein joining anal vein 2 to cubitus. Prosternum in front of procoxae about two-thirds length of procoxa, flat, and about in same plane as prosternal process. Prosternal process slender; 4 times as long as wide, apex acute; longitudinally subcarinate. Mesosternum with a deep broad depression on midline for reception of prosternal process. Metasternum with disc slightly convex; with narrow, glabrous longitudinal groove on midline; posterior two-thirds of disc depressed adjacent to groove. Epipleuron oblique until posterior margin of abdominal sternum 4 then inflexed horizontally.

Abdomen with all sterna slightly convex in both sexes; sternum 5 rounded apicomediaally.

LARVA (BY ASSOCIATION) (Figures 10, 11).—Length to 5.14 mm; greatest width, 1.54 mm. Body elongate, flat, slightly convex dorsally, subparallel. Margins of all segments with flat, falcate lobes. Color of cuticle light yellow-brown. Sides of thoracic segments and abdominal segments 1–8 with flattened, nearly falcate lobes terminating in sharp posterolateral angles;



FIGURES 3–8.—Pronota: 3, *Phanocerus*; 4, *Pharceonus*; 5, *Hexanchorus*; 6, *Pseudodisersus*; 7, *Hispaniolara*; 8, *Disersus*.

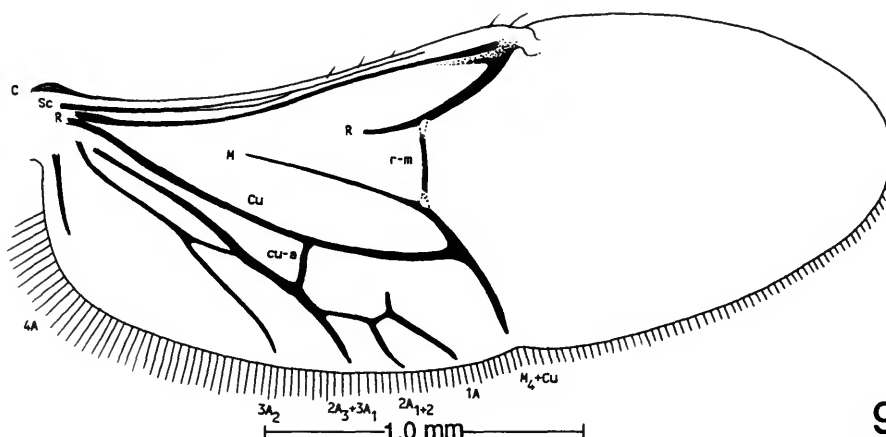


FIGURE 9.—*Phanocerus clavicornis* Sharp, adult, hind wing.

margins of falcate lobes with ornate setae. Ecdysial cleavage line present on thoracic terga and abdominal tergum 1.

Head with 1 stemma on each side; without tooth on anterior margin between base of antenna and clypeus. Antenna, 3 segmented. Clypeus completely fused with frons, thus fronto-clypeal suture not apparent. Mandible symmetrical; with 3 subacute apical teeth; prostheca long, slender, densely hirsute. Maxilla with palpus, 4 segmented; stipes without palpifer; galea and lacinia separate and apex of each densely spinose. Labium with palpus 2 segmented; prementum without palpiger; postmentum undivided. Gula well developed.

Prothoracic, mesothoracic, metathoracic, and abdominal terga with scattered asperities; without longitudinal rows of seta-bearing, low tubercles. Prosternum with medial, small, triangular, cervical sclerite; episternum long and broad in front of coxal cavities; epimeron undivided; sternellum narrowly ovate; with a broad, rectangular, posteromedial sclerite, thus procoxal cavities closed posteriorly (Figure 11). Mesosternum and metasternum each with episternal sclerite, a single epimeral sclerite, and an undivided transverse sclerite in front of mesocoxae and metacoxae.

Abdomen without tergopleural sclerites; with sternopleural sclerites on segments 1-8; segment 9 with apex rounded or

moderately emarginate. Operculum tapering to moderately broad, rounded apex.

Spiracles present laterally on mesothorax and abdominal segments 1-8; opening on small tubercle.

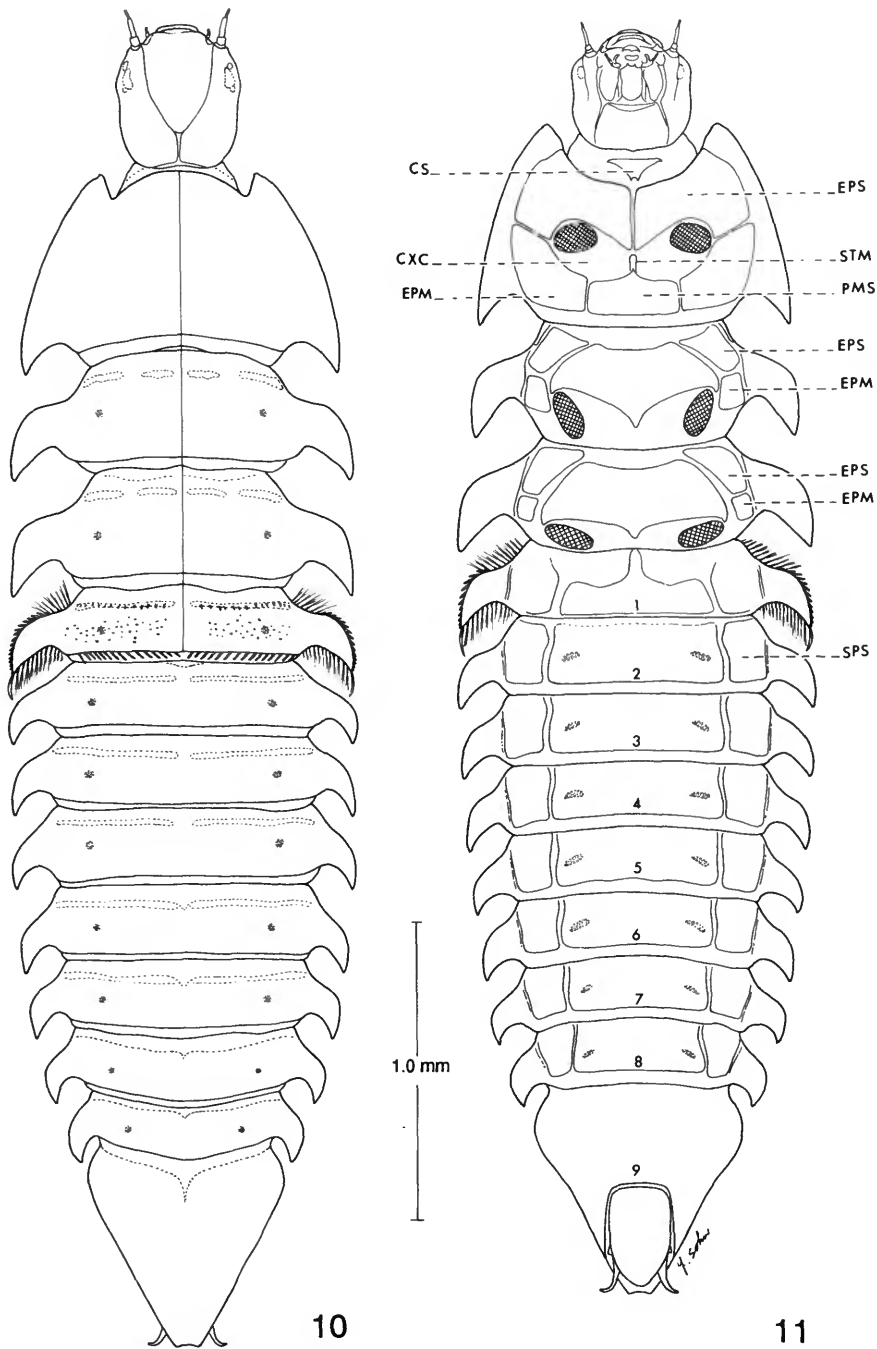
The described larva, presumed to be a last instar, was collected in association with adults of *P. clavicornis* from Mexico, Veracruz, Los Tuxtlas area, Río Maquinas, 11 May 1981, P.J. Spangler, and is deposited in the National Museum of Natural History, Smithsonian Institution.

The distinctively flattened larva of *Phanocerus* (Figures 10, 11) has been known since its operculum was described by Hinton (1939:138). In 1940, the larva was included in a key and fully described by Hinton (1940a:229, 251). Since that time it has been discussed, described, or included in keys by the following authors: Sanderson, 1953:155 (key); Leech and Chandler, 1956:360 (key); Leech and Sanderson, 1959:1016 (key); Spangler, 1966:414 (figure); Bertrand, 1972:478 (key); Brown, 1972:57 (key); White, Brigham, and Doyen, 1984:411 (key).

The larva of *Phanocerus* closely resembles the larva of the South American genus *Phanoceroidea* described by Hinton (1939); but the presence of two instead of three mesosternal and metasternal sclerites distinguishes the larva of *Phanocerus*.

Key to the Species of *Phanocerus* of Mexico, Central America, and the West Indies (Adults)

- Pronotum elongate, convex; anterolateral angles narrow, not explanate 1. *P. clavicornis* Sharp
- Pronotum subquadrate, moderately convex; anterolateral angles broad, explanate 2. *P. congener* Grouvelle



FIGURES 10, 11.—*Phanocerus clavicornis* Sharp, larva: 10, dorsal view; 11, ventral view. (cs = cervical sclerite, cxc = coxal cavity, epm = epimeron, eps = episternum, pms = posteromedial sclerite, sps = sternopleural sclerite, stm = sternellum.)

Clave para las Especies de *Phanocerus* de México, Centroamérica y El Caribe
(Adultos)

- Pronoto alargado, convexo; ángulos anterolaterales angostos, no aplanados 1. *P. clavicornis* Sharp

 Pronoto subcuadrado, moderadamente convexo; ángulos anterolaterales amplios, aplanados
 2. *P. congener* Grouvelle

1. *Phanocerus clavicornis* Sharp

FIGURES 12–40

Phanocerus clavicornis Sharp, 1882:129.—Zaitzev, 1908:289; 1910:8.—Schaeffer, 1911:118.—Leng, 1920:185.—Darlington, 1936:73.—Hinton, 1937a:95; 1940a:246.—Blackwelder, 1944:273.—Bertrand, 1972:495.—Brown, 1972:13; 1981a:82; 1982:113; 1983:3.—Spangler, 1973:356; 1981:164.

Phanocerus hubbardi Schaeffer, 1911:119.—Leng and Mutchler, 1914:423 [new synonym].

Phanocerus helmoides Darlington, 1936:74 [new synonym].

DIAGNOSIS.—Length, 2.33 to 3.23 mm. Pronotum elongate, convex; anterolateral angles narrow, not explanate (Figure 17). Not sympatric with *P. congener*, which is known only from the Lesser Antilles.

REDESCRIPTION (MALE).—*Body Form and Size*: Elongate, subparallel, moderately convex. Length, 2.41 mm; greatest width, across humeri, 1.02 mm.

Color: Cuticle reddish black to pale brown; mouthparts, basal antennal segments, and legs paler brown. Dorsal surface with erect brownish hair-like setae and more dense and finer hair-like setae that are golden in certain lights.

Head: Without distinct impressions. Punctate; punctures contiguous to separated by diameter of puncture. Eyes narrowed posteriorly; lateral and posterior margins around eyes with very long, stout, black setae that curve across eye and generally meet about middle of eye. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin broadly, shallowly, arcuately emarginate, and angle on each side broadly rounded; anterior margin, except middle, with a dense fringe of long testaceous hair-like setae; a tuft of longer and denser hair-like setae on each side behind angle. Labial palpus as illustrated (Figures 18–20). Gula, at anterior margin, $\frac{4}{5}$ as broad as submentum; sides converging and posterior margin about $\frac{1}{3}$ as wide as submentum. Submentum with anterior margin truncate.

Thorax: Pronotum broader than long (0.78 mm : 0.61 mm); broadest at basal two-fifths; base broader than apex; surface similarly but more sparsely punctate than head. Scutellum flat, broader than long; base broadly arcuate and coming to a rounded point posteriorly. Elytron 1.72 mm long; 0.51 mm wide. Elytra nearly parallel between humeri and apical two-fifths; humeri slightly gibbous; each apex rounded

and apices conjointly rounded; lateral margins smooth; intervals flat and surface punctate as pronotal disc; striae lightly impressed, becoming narrower and more shallow toward apex; striae punctures coarse basally, becoming progressively finer toward apex; discal striae punctures round to subquadrate, separated longitudinally by about a diameter, and $\frac{1}{3}$ – $\frac{1}{2}$ as broad as intervals; punctures becoming slightly finer laterally and much finer toward apex; diameter of punctures on apical fourth less than one-third width of adjacent interval. Prosternum moderately short in front of anterior coxae. Metasternum with a shiny, impressed, median, longitudinal line on posterior two-thirds; longitudinal line becoming effaced anteriorly.

Abdomen: Apical margin of sterna 5 broadly rounded.

Genitalia: As illustrated (Figures 30, 31).

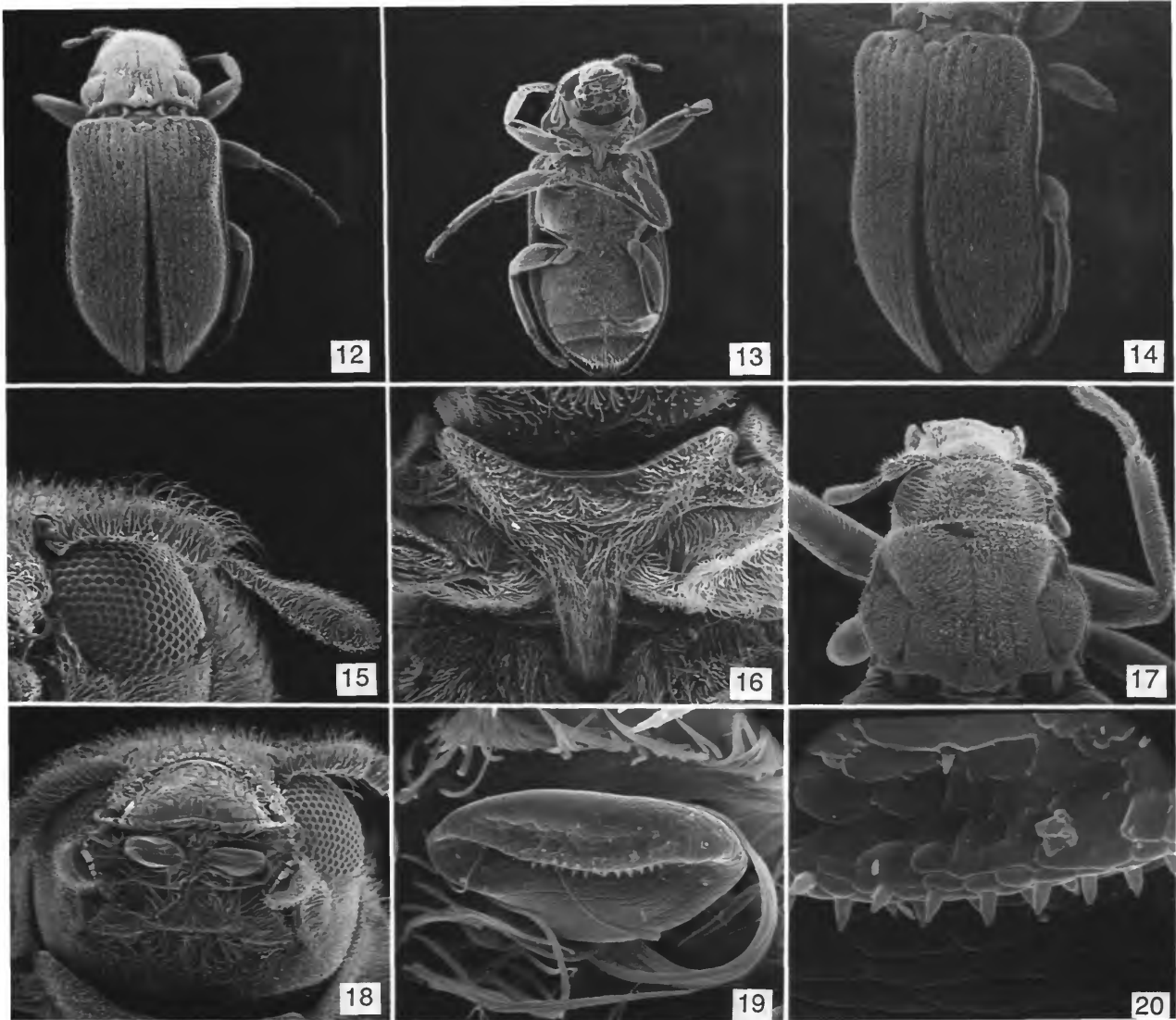
FEMALE.—Similar to male externally. Genitalia as illustrated (Figure 32).

VARIATIONS.—Length and width vary greatly. Males ($n = 5$) range in length from 2.33 to 2.62 mm ($\bar{x} = 2.41$ mm); females ($n = 5$) range in length from 2.54 to 3.23 mm ($\bar{x} = 2.86$ mm). Rarely, elytral striae punctures may be only two-thirds as large and dense as those of holotype.

We have observed a small, whitish, pouch-like structure protruding from the intersegmental membrane between abdominal sterna 3 and 4 of many male and female specimens of *P. clavicornis* preserved in alcohol. The structure appears to be an evaginated gland or bursa and its purpose is unknown. We have not noticed any similar structure on other larvae.

TYPE DATA.—*Lectotype (Male)*: GUATEMALA: [Vera Paz]: Cobán, Champion; deposited in The Natural History Museum, London [examined and designated below].

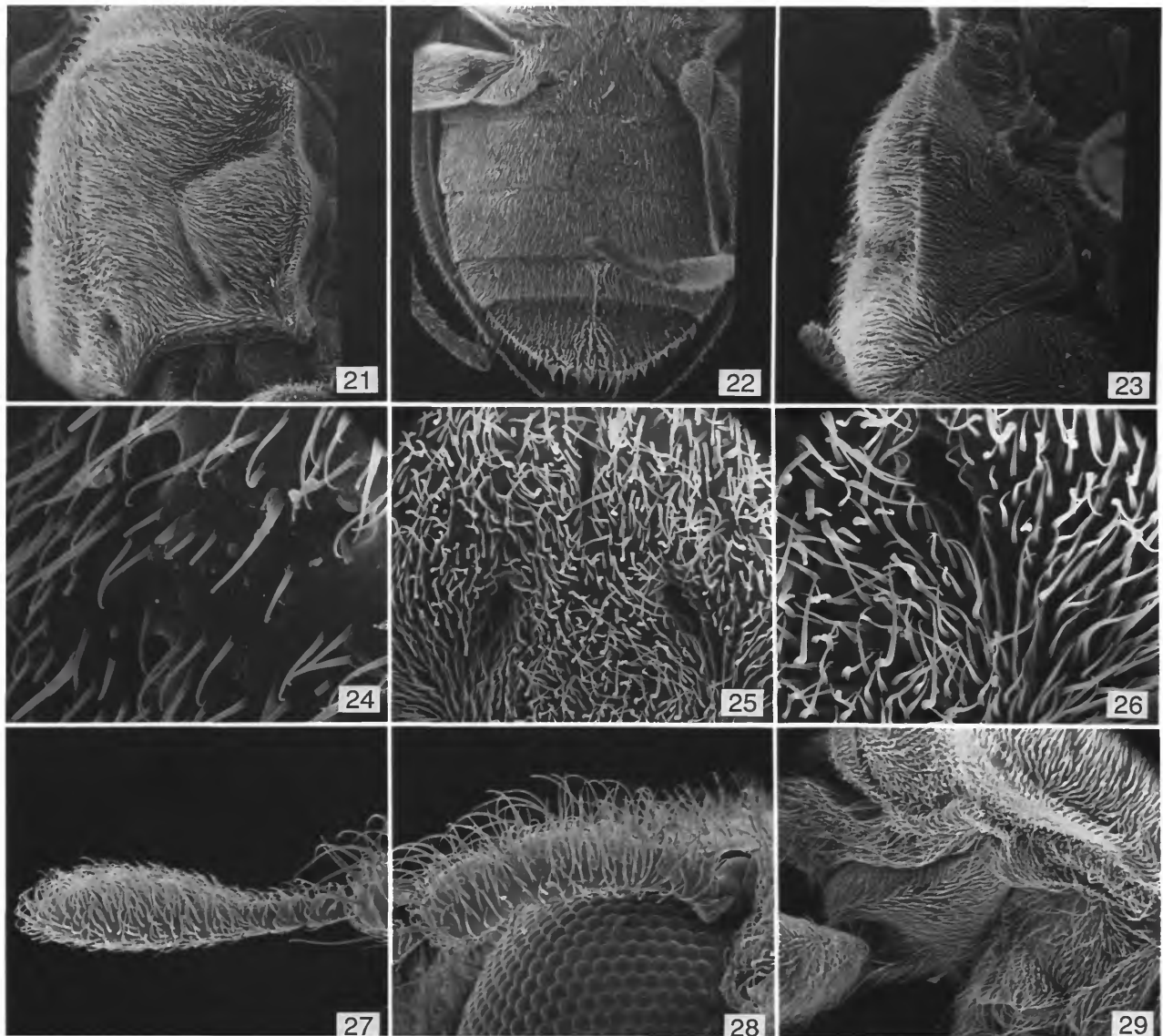
When Sharp (1882) described *Phanocerus clavicornis* he did so from a “series of half-a-dozen individuals” and no type specimen was designated. No lectotype has been designated and we consider all of the specimens Sharp saw to be syntypes. Hinton (1940a) reported examining a “type” of *P. clavicornis* and six other specimens with the same data as the one labeled “type” in The Natural History Museum, London. Christine von Hayek kindly lent us two of the seven syntypes and stated (in litt.) that “I have sent the specimen with type label traditionally regarded as the type. . . .” We designate the specimen bearing the label data “Guatemala Coban (Champion) / Type” as the lectotype of *P. clavicornis* Sharp. An appropriate label has been attached to the lectotype.



FIGURES 12-20.—*Phanocerus clavicornis* Sharp, adult: 12, habitus, dorsal view, $\times 36$; 13, habitus, ventral view, $\times 36$; 14, elytra, dorsal view, $\times 52$; 15, antenna and eye, $\times 220$; 16, prosternum and prosteral process, $\times 170$; 17, head and pronotum, dorsal view, $\times 80$; 18, head, adoral view, $\times 160$; 19, labial palpus, $\times 800$; 20, labial palpus, apex, sensilla, $\times 3450$. (Reduced to 61% for publication.)

Although "Type" was written on an identification label attached to the pin bearing a male specimen, Schaeffer (1911) did not designate a type when he described *Phanocerus hubbardi*. After the specimens were returned to the "United States National Museum" a red type label bearing USNM type number 40294 was attached to that specimen. We have dissected the male labeled "Type," cleared the genitalia, compared it with that of *P. clavicornis* and find them to be

identical. In addition, the characters given by Schaeffer to distinguish *P. hubbardi* from *P. clavicornis*—"smaller, less convex, thorax with feeble subapical lateral impression and series of elytral punctures almost obliterated in about apical half"—are within the range of variations we have seen in *P. clavicornis* from Mexico and Guatemala and we place *P. hubbardi* Schaeffer, 1911, as a junior synonym of *P. clavicornis*. We designate the male with the label data "Jamaica

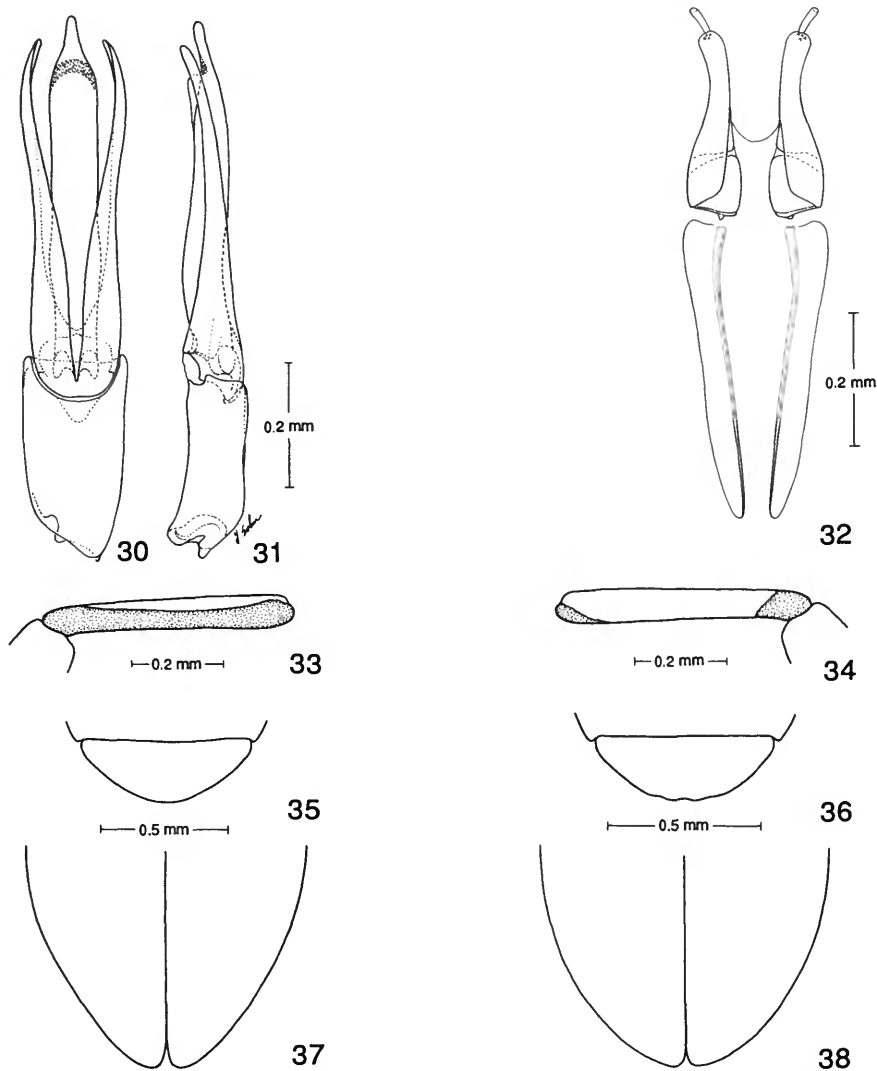


FIGURES 21-29.—*Phanocerus clavicornis* Sharp, adult: 21, pronotum, oblique view, $\times 160$; 22, abdominal sterna, $\times 90$; 23, hypomeron, $\times 200$; 24, elytral pubescence, $\times 1000$; 25, pronotum, basomedial impressions, $\times 500$; 26, basomedial impression, $\times 1000$; 27, antenna, ventral view, apical half, $\times 420$; 28, antenna, ventral view, basal half, $\times 360$; 29, procoxa, lateral view, $\times 230$. (Reduced to 62% for publication.)

W.I. / H.G. Hubbard Collector" as the lectotype of *P. hubbardi* and two additional syntypes with the same label data as paralectotypes. Appropriate labels have been attached to the specimens.

After Darlington (1936) described *Phanocerus helmoides*, a pair of paratypes was deposited in the "United States National Museum." We dissected and cleared the genitalia of the male

and find it to be the same as that of *P. clavicornis*. In addition, we consider Darlington's statement that "the relatively weak convolutions of the prothorax differentiate this from *P. clavicornis*, *P. hubbardi*, and *P. congener*, and give it a slightly helmis-like aspect" to be within the variations of the widespread *P. clavicornis*. As a result of the comparisons we also place *P. helmoides* Darlington (1936) as a junior synonym



FIGURES 30-38.—*Phanocerus clavicornis* Sharp, adult: 30, male genitalia, ventral view; 31, male genitalia, lateral view; 32, female genitalia, ventral view; 33, mesotibia, lateral view, male; 34, mesotibia, medial view, male; 35, abdominal sternum 5, male; 36, abdominal sternum 5, female; 37, elytral apices, male; 38, elytral apices, female.

of *P. clavicornis*.

SPECIMENS EXAMINED.—USA: TEXAS: *Comal County*: [New] Braunfels, Jun 1916, Wickham, 1 spm (NMNH). *Hays County*: San Marcos (near), San Marcos River, 17 Jun 1974, Joe Kolb, 1 spm (NMNH); San Marcos, San Marcos River, 1 May 1983, C.B. Barr, 18 spms (CBB); San Marcos, Rio Vista Park, 29 Apr 1988, C.B. Barr, 21 spms (CBB). *Val Verde County*: Del Rio, Moore Park, San Felipe Creek, 4 Jun 1983, C.B. Barr, 20 spms (CBB); Del Rio, San Felipe Creek, 31 Mar 1985, C.B. Barr, 26 spms (CBB); Devils River, 7 May 1907,

Schwarz and Pratt, 14 spms (NMNH); Devils River, 7 May 1907, Schwarz and Pratt, 1 spm (NMNH).

MEXICO: *Chiapas*: Ocosingo (22 km N), Río Lacanjá, 19 May 1981, P.J. Spangler, 11 spms (NMNH); Palenque, 10 Jul 1981, W.E. Steiner, 8 spms (NMNH); Palenque (48 km S), in Río Tulija, 17 May 1981, P.J. Spangler, 5 spms (NMNH); Tuxtla Gutiérrez (25 mi E), 22 Jul 1964, P.J. Spangler, 1 spm (NMNH). *Colima*: Colima (29 mi NE), 3 Dec 1948, H.B. Leech, 39 spms (CAS). *Guerrero*: Papagayo R., 1937, H.E. Hinton, 1 spm (BMNH). *Hidalgo*: Río Venados, 6 Oct 1979,

P. Rodríguez, 18 spms (UNAM); Río Venados, 6 Oct 1979, P. Carter, 4 spms (UNAM); Río Venados, Aug 1983, E. Mejorada, 121 spms (UNAM). *Nuevo León*: Galeana, Municipio de Galeana, 2210 m, 8 Jul 1938, H. Hoogstraal, 1 spm (CAS); Galeana, Municipio de Galeana, 2210 m, 8 Jul 1938, H. Hoogstraal, 2 spms (INHS). *Puebla*: Tehuacán, 13 Oct 1979, Joaquín Bueno, 7 spms (UNAM). *Querétaro*: Galindo R., 20 Oct 1970, H.E. Hinton, 1 spm (BMNH). *San Luis Potosí*: Huichihuayán Rio, light, Oct 1970, H.E. Hinton, R.E. Woodruff, 1 spm (BMNH); La Cova (23 km C. Valles), Oct 1970, H.E. Hinton, 23 spms (BMNH). *Tamaulipas*: Boca-toma (7 km SSE Gómez Farías), 19–23 Mar 1978, E.G. Riley, 3 spms (LSU); Boca-toma (7 km SSE Gómez Farías), 25–30 Mar 1978, E.G. Riley, 20 spms (LSU); Boca-toma (7 km SSE Gómez Farías), on submerged debris in rapids, spring fed creek, 25–30 Mar 1978, E.G. Riley, 6 spms (UMo); El Encino (w. of), riffles of Río Sabinas at Rancho Cielito, 15 Mar 1983, M.S. Davis, 1 spm (NMNH). *Veracruz*: Catemaco, 7–9 Aug 1964, P.J. Spangler, 2 spms (NMNH); Catemaco (33 km NE), Los Tuxtlas Biological Station, 28 Mar 1990, P. and P. Spangler, 2 spms (NMNH); Catemaco (33 km NE), Laguna Escondida, Los Tuxtlas Biological Station (4 km N), 29 Mar 1990, P. and P. Spangler, 19 spms (NMNH); Coscomatepec (6 km N), Río Jamapa, 2 May 1981, P.J. Spangler, 1 spm (NMNH); Coscomatepec (6 km N), Río Jamapa, 26 May 1981, P.J. Spangler, S. Santiago, 1 spm (NMNH); Coyame, Lake Catemaco, 10–18 Jul 1963, D.R. Whitehead, 1 spm (NMNH); Los Tuxtlas, 14 Jul 1979, J. Bueno, 39 spms (UNAM); Los Tuxtlas, 14 May 1983, P. Rodríguez, 2 spms (UNAM); [Los Tuxtlas area, La Palma], Río La Palma, 6 May 1981, S. Santiago, 21 spms (UNAM); Los Tuxtlas area, Río La Palma (above La Palma), 7 May 1981, P.J. Spangler, S. Santiago, 12 spms (NMNH); Los Tuxtlas area, Río La Palma (above La Palma), 15 May 1981, P.J. Spangler, 20 spms (NMNH); Los Tuxtlas area, Río Máquinas, 5 May 1981, P.J. Spangler, 118 spms (NMNH); [Los Tuxtlas area], Río Máquinas, 5 May 1981, G. Ortega, 63 spms (UNAM); [Los Tuxtlas area], Río Máquinas, 5 May 1981, S. Santiago, 45 spms (UNAM); Los Tuxtlas area, Río Máquinas, 11 May 1981, P.J. Spangler, 23 spms (NMNH); Los Tuxtlas area, Río Máquinas, 13 May 1981, P.J. Spangler, 88 spms (NMNH); Río La Palma, 20 Dec 1978, J. Bueno, 11 spms (UNAM); Río La Palma, 22 Sep 1979, J. Padilla, 25 spms (UNAM).

BELIZE: *Stann Creek*: Cockscomb Wildlife Sanctuary, Kendal (12 km S), South Stann Creek, 26 Apr 1987, P.J. Spangler, R.A. Faitoute, 100 spms (NMNH); same data except 30 Apr 1987, 73 spms (NMNH).

GUATEMALA: *Alta Vera Paz*: Cacao, Trece Aguas, 29 Mar [1906], Schwarz and Barber, 2 spms (NMNH); Cacao, Trece Aguas, 15 Apr [1906], Schwarz and Barber, 1 spm (NMNH); La Tinta (5 mi W), 6 Jun 1974, P.D. Perkins, 15 spms (NMNH). *El Progreso*: Estancia Virgen, Finca La Cajeta, 12 Aug 1965, P.J. Spangler, 6 spms (NMNH). *Guatemala*: Guatemala City (10 mi S), 5 Aug 1965, P.J. Spangler, 1 spm

(NMNH). *San Marcos*: San Marcos, 2 Jul 1957, David Lauck, 1 spm (NMNH). *Santa Rosa*: Río Metapa, Mar 1970, H.B.N. Hynes, 1 spm (BMNH). *Suchitepequez*: Mazatenango, Finca Chitalon, 335 m, 8 Mar 1965, J.M. Campbell, 1 spm [H.E. Hinton collection] (BMNH).

HONDURAS: *El Paraíso*: El Zamorano, in river, 21 Dec 1965, P.H. Freytag, H.J. Harlan, 1 spm (OSU). *Francisco Morazán*: Guaimaca (4 km W), 549 m, Hardy Cent. Amer. Expedition 1968, 28 Aug 1968, A.R. Hardy, L. Espinosa, J.P. Abrayaya, 1 spm (CSDA). *Yoro*: Olanchito (12 km W), 25 May 1949, E.C. Becker, 1 spm (INHS).

COSTA RICA: *Alajuela*: Volcán Poas, near Roble, 9 Jul 1963, C.L. Hogue, 1 spm (LACM). *Cartago*: Tapantí, 1189 m, 25 Jun 1967, P.J. Spangler, 1 spm (NMNH); Turrialba, Jun 1949, K.W. Cooper, 1 spm (UCalB); Turrialba, 22–28 Feb 1965, S.S. and W.D. Duckworth, 22 spm (NMNH); Turrialba, at light, 7–9 Aug 1965, A. Raske, 3 spms (UCalB). *Guanacaste*: Colorado, 31 Mar 1988, W.E. Steiner, J.M. Hill, J.M. Swearingen, J.M. Mitchell, 6 spms (NMNH). *Heredia*: Puerto Viejo, La Selva Field Station, 21–28 Mar 1988, W.E. Steiner, J.M. Hill, J.M. Swearingen, J.M. Mitchell, 1 spm (NMNH); Vara Blanca, 1920 m, 24 Jun 1967, P.J. Spangler, 3 spms (NMNH). *Limón*: La Lola near Matina, 11 Mar 1965, S.S. and W.D. Duckworth, 1 spm (NMNH); Monte Verde, 1520 m, flight intercept trap, 18–25 Jun 1983, D.H. Lindeman, 2 spms (CMN); Monte Verde, 1520 m, unbaited pit trap, 3 Jul 1983, D.H. Lindeman, 1 spm (CMN); Monte Verde, 1520 m, flight trap, 9–13 Jul 1983, D.H. Lindeman, 2 spms (CMN); Río Hondo, km 10, Ruta Siquirres-Puerto Limón, 27 Apr 1984, J. Bueno S., 50 spms (UNAM). *San José*: San Isidro (16 mi S), 2 Jul 1967, P.J. Spangler, 1 spm (NMNH); Santa María de Dota, Río, 1550 m, 29 Apr 1984, J. Bueno S., 1 spm (UNAM).

PANAMA: *Bocas del Toro*: Chagres, Río Teribe, 23 Apr 1985, R.W. Flowers, 3 larvae (NMNH); Miramar, Laguna de Chiriquí, 82°15'W 9°N, fallen roots, sea level stream behind sawmill, 25°C, 2 May 1985, R.W. Flowers, 3 spms (NMNH); Ojo de Agua, stream I, 152 m, 24.5°C, 4 May 1985, R.W. Flowers, 1 spm [+ 8 larvae] (NMNH); pipeline road at Quebrada Canaza, 91 m, 18 May 1985, R.W. Flowers, 5 spms (NMNH); pipeline road, stream I, trib of Río Guabo, lt [light trap], 14 May 1985, R.W. Flowers, 4 spms (NMNH); Zegla, Río Teribe at Zegla, 20 Apr 1985, R.W. Flowers, 1 spm (NMNH). *Canal Zone*: Barro Colorado Is., wet debris, small stream, 5 Feb 1976, A. Newton, 2 spms (MCZ); Gamboa (4 mi NW), flood debris along river, 23 Feb 1975, Lawrence, Erwin, 1 spm (MCZ); Gamboa (6.7 mi NW), Río Mendoza, flood debris along river, 19 Feb 1976, A. Newton, 1 spm (MCZ); Paraíso, 29 Jan 1911, E.A. Schwarz, 1 spm (NMNH); Río Frijoles Parque Nacional, 24 Jan 1981, P. Soto, M. Muñoz, R. González, 4 spms (UPan). *Chiriquí*: Boquete (3 km NE), from brook, 1250 m, 29 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 1 spm (NMNH); Caldera, 1 Jun 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 38 spms (NMNH); David (9 km N), waterfall at Balneario San Francisco, 31 May

1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 18 spms (NMNH); El Velo near El Mirador, in Nat'l Park, 1646 m, 19 Dec 1977, R.W. Flowers, 7 spms (NMNH); Río Caldera at Bajo Lino, 1067 m, 17 Dec 1977, R.W. Flowers, 1 spm (NMNH); Santa Clara, Hartmann's Finca, 15–18 Jun 1985, E. Riley, D. Rider, 1 spm (LSU). *Cocle*: El Valle, 829 m, 24 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 39 spms (NMNH); El Valle, 829 m, 26 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 112 spms (NMNH); El Valle, 829 m, 27 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 76 spms (NMNH). *Panama*: Cerro Azul, Hidroeléctrica, Río Indio, 9 Jun 1985, E. Riley, D. Rider, 4 spms (LSU).

WEST INDIES: CUBA: *Cienfuegos*: Buenos Aires, Trinidad Mts., 762–1067 m, 8–14 May 1936, P.J. Darlington, 7 spms (MCZ); San Blas and vic., Trinidad Mts., 305–914 m, 9 May 1936, P.J. Darlington, 26 spms (MCZ). *Guantánamo*: Upper Ovando R., eastern Oriente, 305–610 m, 17–20 Jul 1936, P.J. Darlington, 7 spms (MCZ). *Isla de Pinos*: Arroyo La Talega, 22 May 1973, L. Botosaneanu, 9 spms (NMNH). *Oriente*: Arroyo Jaiba, near Palenque, 31 Mar 1969, V. Decu, 2 spms (NMNH); Charco Redondo, Arroyo de Los Berros, 19 Mar 1973, L. Botosaneanu, 2 spms (ZMA); El Rabon, 19 Mar 1973, L. Botosaneanu, 1 spm (NMNH); Matías, Río Mogote, 21 Mar 1973, V. Decu, 3 spms (NMNH); Matías, Río Mogote, Mar 1973, L. Botosaneanu, 3 spms (NMNH); Mayari, Arroyo Guayabo, 27 Feb 1973, V. Decu, 1 spm (NMNH); Pinares de Mayari, 2 Mar 1973, L. Botosaneanu, 1 spm (NMNH); Rangel, Nov 1966, I. García, 1 spm (NMNH); Río Yumuri, 30 Feb 1973, L. Botosaneanu, 2 spms (NMNH). *Pinar del Río*: Río Cuyaguaje, at Sumidero, 5 Jun 1969, V. Decu, 1 spm (NMNH); Soroa, from leaf packs in small stream, 27–29 Apr 1983, P.J. Spangler, I. Fernández, 5 spms (NMNH). *Santiago de Cuba*: Daiquirí, 30 May 1936, P.J. Darlington, 1 spm (MCZ); Hongolosonga, 7 Jul 1936, P.J. Darlington, 6 spms (MCZ); Pico Turquino (S. side), 457 m, 25 Jun 1936, P.J. Darlington, 10 spms (MCZ). *Villa Clara*: Habanillo Falls, Trinidad Mts., 30 Apr 1936, P.J. Darlington, 1 spm (MCZ).

DOMINICAN REPUBLIC: *Duarte*: S[an] F[rancisco] de Macoris (NE of), Nagua River, Jul 1938, P.J. Darlington, 5 spms (MCZ). *La Vega*: Constanza, 914–1219 m, Aug 1938, P.J. Darlington, 16 spms (MCZ); Constanza (10 km S), 9 Nov 1984, P.J. Spangler, R.A. Faitoute, 1 spm (NMNH); Constanza (10 km S), 10 Nov 1984, P.J. Spangler, R.A. Faitoute, 2 spms (NMNH); Constanza (10 km S), 11 Nov 1984, P.J. Spangler, R.A. Faitoute, 1 spm [+ 1 larva] (NMNH); Constanza to Jarabacoa, 610–1219 m, Aug 1938, P.J. Darlington, 17 spms (MCZ); El Río (3 km NE), 12 Nov 1984, P.J. Spangler, R.A. Faitoute, 12 spms (NMNH); El Río (24 km NE), 12 Nov 1984, P.J. Spangler, R.A. Faitoute, 11 spms [+ 2 larvae] (NMNH); El Río (30 km E), 7 Nov 1984, P.J. Spangler, R.A. Faitoute, 3 spms (NMNH); Jarabacoa, 457–1219 m, Aug 1938, P.J. Darlington, 1 spm (MCZ); Jarabacoa, collected in irrigation ditch, 13 Nov 1984, P.J. Spangler, R.A. Faitoute, 1 spm [+ 2

larvae] (NMNH); Jarabacoa, 13 Nov 1984, P.J. Spangler, R.A. Faitoute, 7 spms [+ 1 larva] (NMNH). *Puerto Plata*: Pto. Plata (25 km S), Jun 1938, P.J. Darlington, 10 spms (MCZ). *San Cristóbal*: Villa Altigracia, Jul 1938, P.J. Darlington, 14 spms (MCZ). *Santiago*: Santiago (S of), ft. hills, Cord. Cent., Jun 1938, P.J. Darlington, 14 spms (MCZ).

HAITI: *Department du Sud*: Camp Perrin, Ravine du Sud, 10 Sep 1981, P.J. Spangler, R.A. Faitoute, 6 spms (NMNH); Cayes Jacundi, karst spring, 18°16'02"N 72°23'41"W, 15 Nov 1979, L. Botosaneanu, Notenboom, 3 spms (ZMA); La Hotte, 10–24 Oct 1934, 732 m, P.J. Darlington, 11 spms (MCZ); La Hotte, 610–1219 m, Oct 1936, P.J. Darlington, 2 spms [paratypes of *P. helmoides*] (NMNH); La Hotte, NE foothills, 610–1219 m, 10–24 Oct 1934, P.J. Darlington, 1 spm [determined as *P. hubbardi* by P.J. Darlington] (INHS); Marcelline (5 km NE), at Saint Mathurine, 11 Sep 1981, P.J. Spangler, R.A. Faitoute, 2 spms (NMNH).

JAMAICA: No additional locality, H.G. Hubbard, 3 spms (NMNH) [lectotype and paralectotypes of *P. hubbardi* Schaeffer]. *St. Andrew Parish*: Chestervale, Clyde River, 18 Sep 1963, W.L. Peters and T.H. Farr, 1 spm (NMNH); Chestervale, Yallahs River, 24–25 Jul 1962, T.H. Farr, O. and R. Flint, 3 spms (NMNH); Hardwar Gap, 1.1 mi SW crossing Dick's Pond Trail, 17 Sep 1963, W.L. Peters, T.H. Farr, 1 spm (NMNH). *St. Elizabeth Parish*: Balaclava, sta 399, on veg. debris coll'd from leaf litter, 14 Feb 1937, Chapin and Blackwelder, 138 spms [ident. as *P. hubbardi* Schaeffer by Schaeffer] (NMNH); Black R., 15 Feb [1937], Chapin and Blackwelder, 3 spms (NMNH).

PUERTO RICO: Caribbean National Forest, El Yunque, 488 m, ex trib. Río de la Mina, 14 Jun 1990, J.V. McHugh, P.R. Fraissinet, PF90-0160, 6 spms (NMNH); Caribbean National Forest, El Yunque, 370 m [ex woody polypores on log], trib. Río de la Mina, 13 Jun 1990, J.V. McHugh, P.R. Fraissinet, PF90-0145, 2 spms (NMNH); Consumo, 19 Nov 1939, H. Ayquabiba, 1 spm (INHS); El Verde Field Station, Quebrada Prieta, 370 m, malaise trap, 6–10 Feb 1990, O.S. Flint, Jr., 36 spms (NMNH); El Yunque, 914 m, May 1938, P.J. Darlington, 32 spms (MCZ); La Catalina, Luquillo Mts., 15 Apr 1929, G[arcía]-Díaz, 2 spms [Musgrave coll'n] (INHS); Las Marías, 9 May 1931, S.T. Danforth, 1 spm (INHS); Las Marías, Río Cañas, 3 Jan 1933, S.T. Danforth, 5 spms [Musgrave coll'n] (INHS); Luquillo Experimental Forest, open riffle, sample #3, K. Buzby, 17 larvae (NMNH); Luquillo Experimental Forest, Quebrada trib. Mamayas, 10 Jul 1991, E.C. Masteller, 9 spms (NMNH); Araneae, Q Toronja, leaf pack, sample #5, K. Buzby, 3 spms (NMNH); Luquillo Mts., picnic grounds, 17 Feb 1929, G[arcía]-Díaz, 1 spm [Musgrave coll'n] (INHS); Luquillo Nat'l Forest, on dead palm leaves in rapid stream, 9 Sep 1935, W.A. Hoffman, 18 spms (NMNH); Maricao, 30 May 1938, P.J. Darlington, 30 spms (MCZ); Maricao, fish hatchery, 8–11 Aug 1961, O.S. Flint, P.J. Spangler, 8 spms (NMNH); Maricao Forest, 610–914 m, 30 May–2 Jun 1938, P.J. Darlington, 3 spms (MCZ); Maricao River, Jul 1960, J. Maldonado C., 6

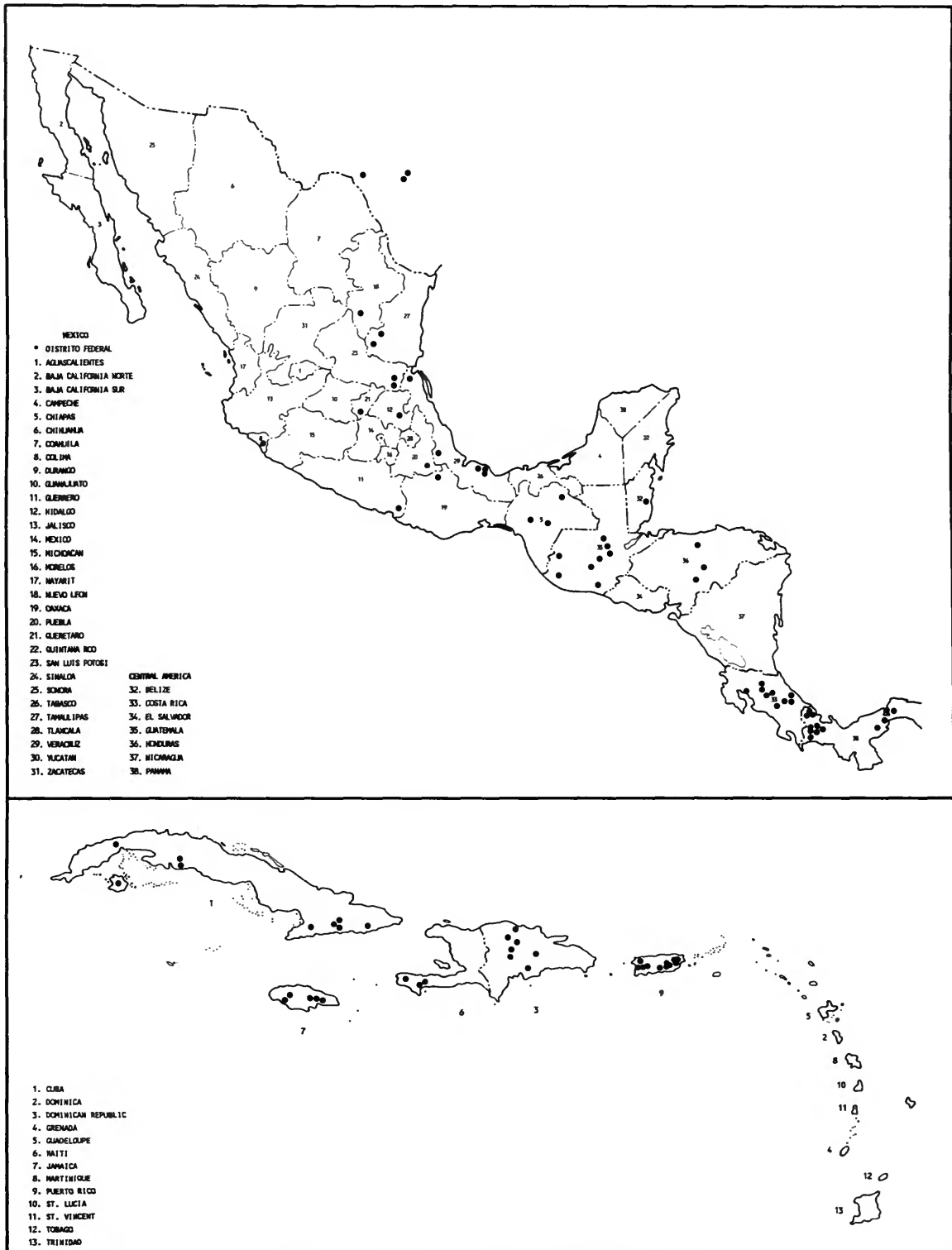


FIGURE 39.—*Phanocerus clavicornis* Sharp, known distribution.



FIGURE 40.—*Phanocerus clavicornis* Sharp, biotope; Río La Palma, at La Palma, Veracruz, Mexico.

spm (NMNH); Mayaguez, 22 Nov 1939, F. Toro, 1 spm (INHS); Mayaguez, 26 Nov 1939, H. Ayquabiba, 1 spm (INHS); Río Anasco, 11 Aug 1961, O.S. Flint, P.J. Spangler, 1 spm (NMNH); Río Blanco, 7 Mar 1935, J.G. Needham, 2 spms [Musgrave coll'n] (INHS); Yimaz Riv., Florida, 17 Feb 1929, J. García-Díaz, 2 spms [Musgrave coll'n] (INHS).

DISTRIBUTION (Figure 39).—*Phanocerus clavicornis* is the most widely dispersed larvae species known from the Western Hemisphere. It ranges from the United States of America, southern Texas, through Mexico and Central America, into the Greater Antilles (Cuba, Hispaniola, Jamaica, and Puerto Rico), and was reported from the state of Santa Catarina in Brazil by Hinton (1940a). Undoubtedly, the species will be found much more widely distributed in South America.

HABITAT.—Specimens of *Phanocerus clavicornis* are most often found on rocks and leaf packs in shallow streams (<75 cm) (Figure 40). Adult specimens are often found resting above water in aggregations of ~25 on vertical surfaces of moderately large rocks. Adults and larvae may be found together in numbers of >100 in leaf packs that are mostly submerged. When adults were found in deeper streams or rivers (~1.5 m) they were in leaf packs that were no more than 40–50 cm under water.

In Belize, 12 km west of Kendal, in South Stann Creek, 100 adults and 25 larvae were collected from a leaf pack lodged against a mostly submerged sapling. The stream was about 15 m wide, up to 45 cm deep, with a substrate of sand, gravel, and rocks. Colorimetric water chemistry analyses provided the following data: oxygen, 6 ppm; pH, 5; hardness, 0. The water was clear and 27.5°C and the air temperature was 29.5°C when the readings were made.

Associated with the adults and larvae in the leaf pack in Belize were: Coleoptera: Dryopidae: *Dryops*, 51 adults; Lutrochidae: *Lutrochus*, 74 adults; Elmidae: *Heterelmis*, 63 adults, 41 larvae. Other aquatic and semiaquatic beetle genera collected in this biotope were: Elmidae: *Austrolimnius*, *Cylloepus*, *Hexacylloepus*, *Macrelmis*, *Microcylloepus*, *Neocylloepus*, *Neoelmis*, *Stenhelmoides*, *Xenelmis*; Hydrophilidae: *Chaetarthria*, *Enochrus*; Microsporidae: *Microsporus*; Psephenidae: *Psephenops*? (larvae). In addition, the following aquatic Heteroptera were collected from that productive site: Gerridae: *Metrobates*, *Potamobates*, *Rheumatobates*, *Telmatometra*; Naucoridae: *Cryphocricos*, *Limnocoris*, *Pelocoris*; Mesoveliidae: *Mesovelgia*, *Mesoveloidea*; Veliidae: *Microvelia*, *Oiovelia*, and *Rhagovelia*.

2. *Phanocerus congener* Grouvelle

FIGURES 41-50

Phanocerus congener Grouvelle, 1898:46.—Zaitzev, 1908:289; 1910:8.—Leng and Mutchler, 1914:423.—Darlington, 1936:73.—Blackwelder, 1944:273.—Hinton, 1971:253.

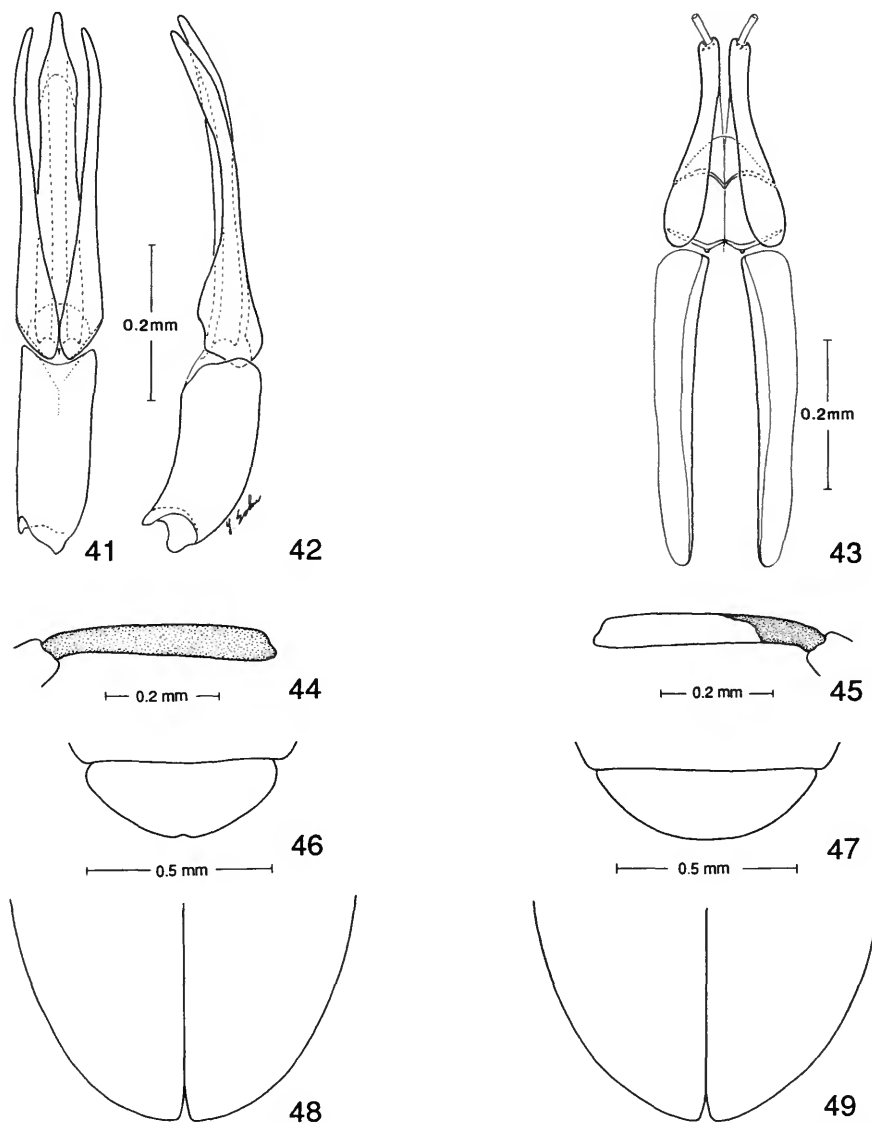
DIAGNOSIS.—Length, 2.13 to 2.45 mm. Pronotum subquadrate, moderately convex; anterolateral angles broad, explanate. Known only from the Lesser Antilles.

REDESCRIPTION (MALE).—*Body Form and Size:* Elongate,

subparallel, moderately convex. Length, 2.15 mm; greatest width, across humeri, 0.85 mm.

Color: Cuticle reddish black to pale brown; mouthparts, basal antennal segments and legs paler brown. Dorsal surface with partly erect brownish hair-like setae and more dense and finer hair-like setae that are golden in certain lights.

Head: Without distinct impressions. Punctate; punctures contiguous to separated by diameter of puncture. Eyes narrowed posteriorly; lateral and posterior margins around eyes with very long, stout, black setae that curve across eye and



FIGURES 41-49.—*Phanocerus congener* Grouvelle: 41, male genitalia, ventral view; 42, male genitalia, lateral view; 43, female genitalia, ventral view; 44, mesotibia, lateral view, male; 45, mesotibia, medial view, male; 46, abdominal sternum 5, male; 47, abdominal sternum 5, female; 48, elytral apices, male; 49, elytral apices, female.

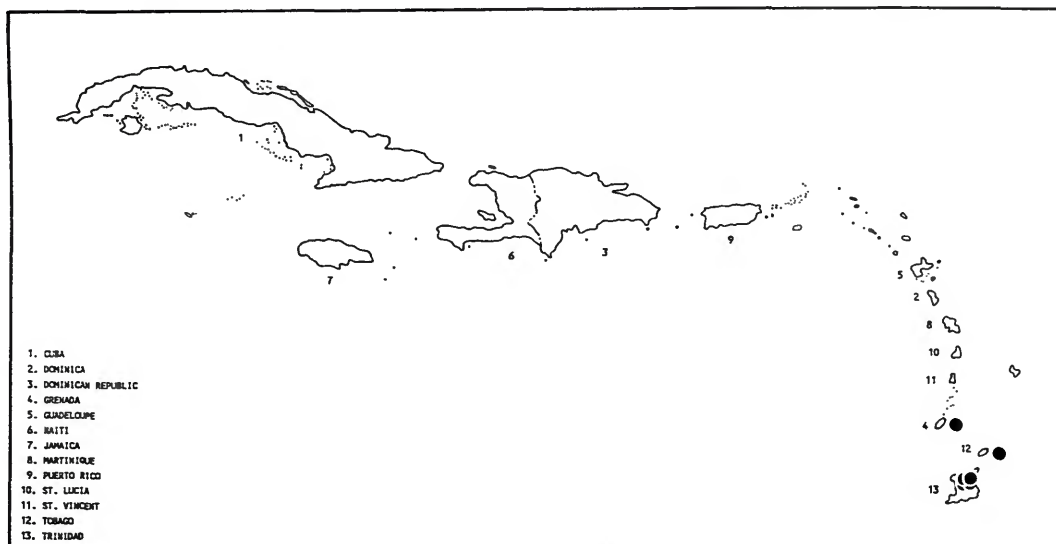


FIGURE 50.—*Phanocerus congener* Grouvelle, known distribution.

generally meet about middle of eye. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin broadly, shallowly, arcuately emarginate, and angle on each side broadly rounded; anterior margin, except middle, with a dense fringe of long, golden yellow, hair-like setae; a tuft of longer and denser hair-like setae on each side behind angle. Gula, at anterior margin, $\frac{4}{5}$ as broad as submentum; sides converging and posterior margin about $\frac{1}{3}$ as wide as submentum. Submentum with anterior margin truncate.

Thorax: Pronotum broader than long (0.73 mm : 0.54 mm); broadest at basal two-fifths; base broader than apex; surface similarly but more sparsely punctate than head. Scutellum flat, broader than long; base broadly arcuate and coming to a rounded point posteriorly. Elytron 1.50 mm long and 0.42 mm wide. Elytra between humeri and apical two-fifths nearly parallel; humeri slightly gibbous; each apex slightly rounded and apices conjointly rounded; lateral margins smooth; intervals flat and surface punctate as pronotal disc; striae lightly impressed but narrower and slightly deeper toward apex; discal strial punctures round to subquadrate, separated longitudinally by about a diameter, and $\frac{1}{3}$ – $\frac{1}{2}$ as broad as intervals; punctures becoming slightly finer laterally and much finer toward apex; diameter of punctures on apical fourth about equal to width of adjacent interval. Prosternum moderately short in front of anterior coxae. Metasternum with a shiny, impressed, median, longitudinal line extending entire length.

Abdomen: Apical margin of sterna 5 and 6 broadly rounded.

Genitalia: As illustrated (Figures 41, 42).

FEMALE.—Similar to male externally. Genitalia as illustrated (Figure 43).

VARIATIONS.—Length and width vary; males ($n = 8$) range in length from 2.18 to 2.30 mm ($\bar{x} = 2.11$ mm); females ($n = 8$) range in length from 2.13 to 2.45 mm ($\bar{x} = 2.32$ mm).

SPECIMENS EXAMINED.—WEST INDIES: GRENADA: Balthazar, windward side, H.H. Smith (BMNH) [holotype, sex undetermined]; Vendome (near), high altitude stream above Vendome, 21 Jul 1973, A.D. Harrison, 2 spms (NMNH).

TRINIDAD: *St. George County:* Acono River, Maracas Valley, 16 Nov 1989, M. Alkins-Koo, 8 spms (UWI); Arima River, cascade, Sep 1984, V. Jones, 1 spm (UWI); Arima River, cascade, Apr 1985, V. Jones, 1 spm (UWI); Guanapo River, 2 Nov 1989, M. Alkins-Koo, 9 spms (UWI); Marianne Riv., lower stream, 1989, V. Jones, 2 spms (NMNH).

DISTRIBUTION (Figure 50).—*Phanocerus congener* is known from Grenada, St. Vincent, Tobago, and Trinidad in the Lesser Antilles. The records of the species from St. Vincent and Tobago are from Hinton (1971); we have not seen those specimens but do not question his data.

HABITAT.—The specimens collected from Grenada by A.D. Harrison were obtained from a “high altitude stream above Vendome—shaded torrential stream.”

The specimens collected from Trinidad by Mary Alkins-Koo were found in association with the following genera and species of elmid beetles: *Heterelmis simplex codrus* Hinton, *Hexacyloepus smithi* (Grouvelle), *Macrelmis clypeatus* (Hinton), *Microcyloepus carinatus* Hinton, and *Neoelmis pusio* Hinton.

Pharceonus, new genus

DIAGNOSIS.—Length, 3.5 mm or less. Pronotum with a transverse, bisinuate, subbasal impression and a transverse bisinuate impression at the apical third (Figures 4, 55).

ADULT.—Body elongate, subparallel, slightly constricted at midlength, and moderately convex (Figures 52-54). Integument clothed, for the most part, with dense, moderately long, usually recumbent hydrofuge pubescence.

Head partly retracted into pronotum but not beyond the basal portion of the submentum. Mouthparts visible. Maxillary palpus, 4 segmented. Labial palpus, 3 segmented. Antenna, 11 segmented. Clypeus transversely rectangular; frontoclypeal suture deep, extending between bases of antennae; anterolateral angles broadly rounded. Labrum transversely rectangular; anterior margin subtruncate; anterolateral angles broadly rounded.

Pronotum (Figures 4, 55) widest at midlength; anterior margin moderately arcuate over base of head; convex across anterior third, laterally, discally on each side of median impression, and medially behind subbasal impression; a transverse, bisinuate impression at apical third; a sublateral impression on each side extending posteriorly from an anterolateral fovea almost to base; sublateral impressions, turning toward midline at base, uniting basomedially, and extending anteriorly to transverse apical impression; a short longitudinal carina mediad of each subfoveate posterolateral angle. Hypomeron oblique. Scutellum flat and ovoid. Elytron without accessory stria; intervals flat except extreme base of interval 3 slightly raised; humeri swollen. Hind wing (Figure 51) without radial cross vein; without anal cell; anal vein 2 with branches 1 and 2 fused; anal vein 1 short, present only distally and not connected to cubito-anal cross vein; cubito-anal cross vein not joining anal vein 2 to cubitus. Prosternum in front of procoxae about three-fourths length of procoxa, flat, and in same plane as prosternal process. Prosternal process slender; 4

times as long as wide; with low, broad carina on meson; apex acute. Mesosternum with a deep broad depression on midline for reception of prosternal process. Metasternum depressed between mesocoxae; anterior third of disc slightly convex; with narrow, glabrous, longitudinal groove on midline; posterior two-thirds of disc shallowly depressed adjacent to groove. Epipleuron oblique until posterior margin of abdominal sternum 3 then inflexed horizontally.

Abdomen with a longitudinal carina extending from each metacoxal cavity to hind margin of sternum 1. Sterna 1-3 slightly convex in both sexes.

TYPE SPECIES.—*Pharceonus volcanus* Spangler and Santiago, new species.

ETYMOLOGY.—*Pharceonus* is an anagram of its sister genus *Phanocerus*; gender, masculine.

3. *Pharceonus volcanus*, new species

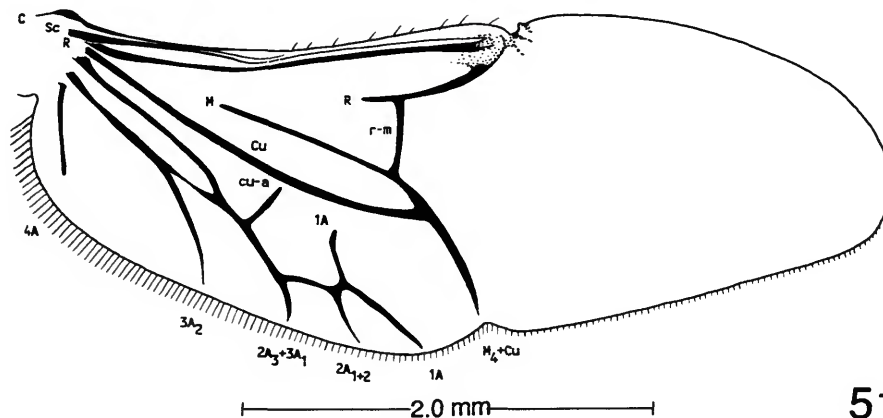
FIGURES 51-78

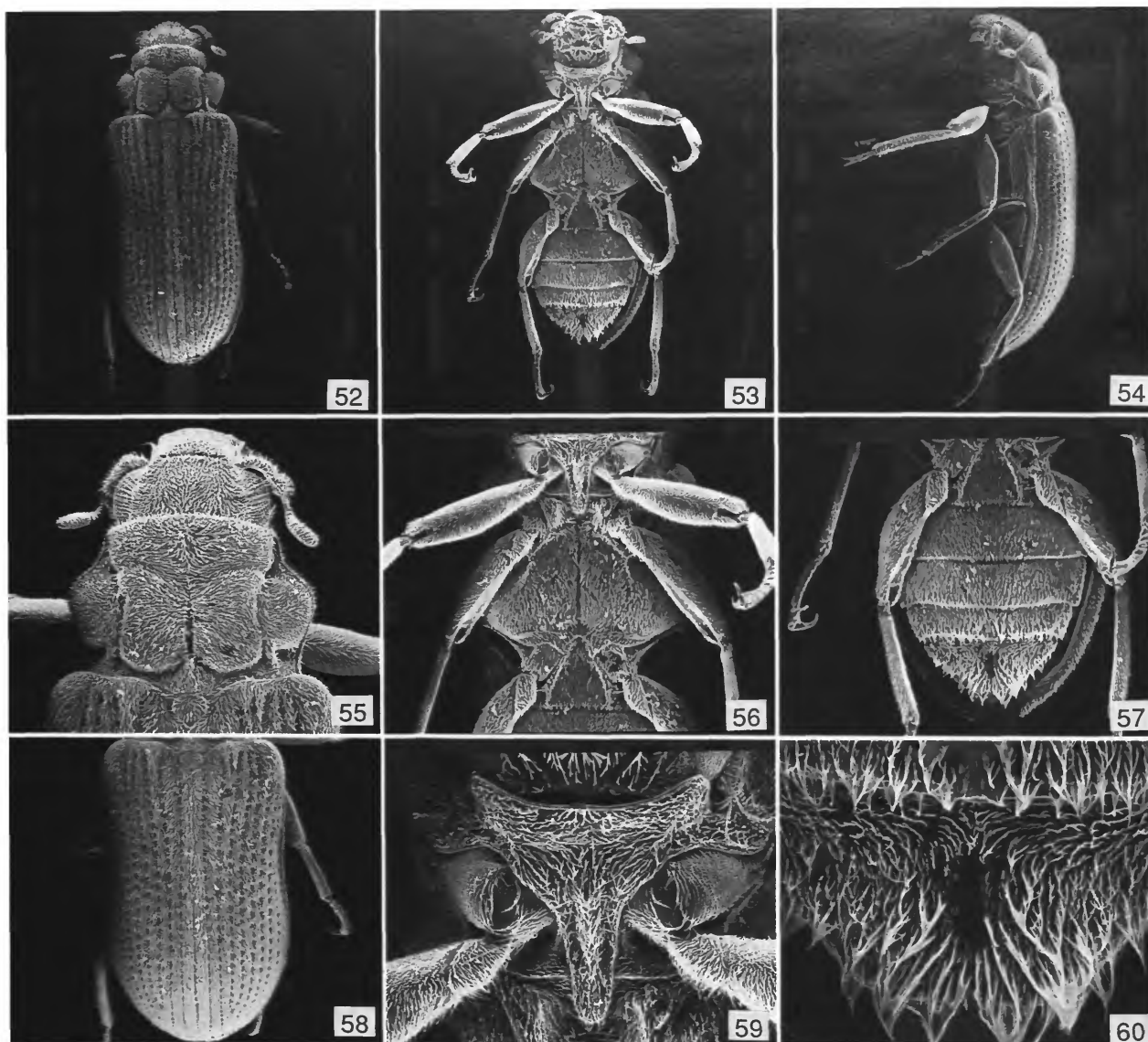
DIAGNOSIS.—The single species known in the genus; may be recognized by its small size and the distinctive pronotal impressions described under the generic description (Figures 4, 55).

HOLOTYPE (MALE).—*Body Form and Size*: Elongate, subparallel, moderately convex. Length, 3.16 mm; greatest width, across humeri, 1.18 mm.

Color: Cuticle reddish black to pale brown; mouthparts, basal antennal segments, and legs paler brown. Dorsal surface with semi-erect, brownish, hair-like setae and more dense and finer hair-like setae that are golden in certain lights.

Head: Without distinct impression except deep frontoclypeal suture. Punctate, punctures coarse and separated by puncture diameter. Eyes slightly narrowed posteriorly; lateral and posterior margins around eyes with very long, stout, black, curved setae; setae directed toward middle of eye. Antenna

FIGURE 51.—*Pharceonus volcanus*, new species, hind wing.

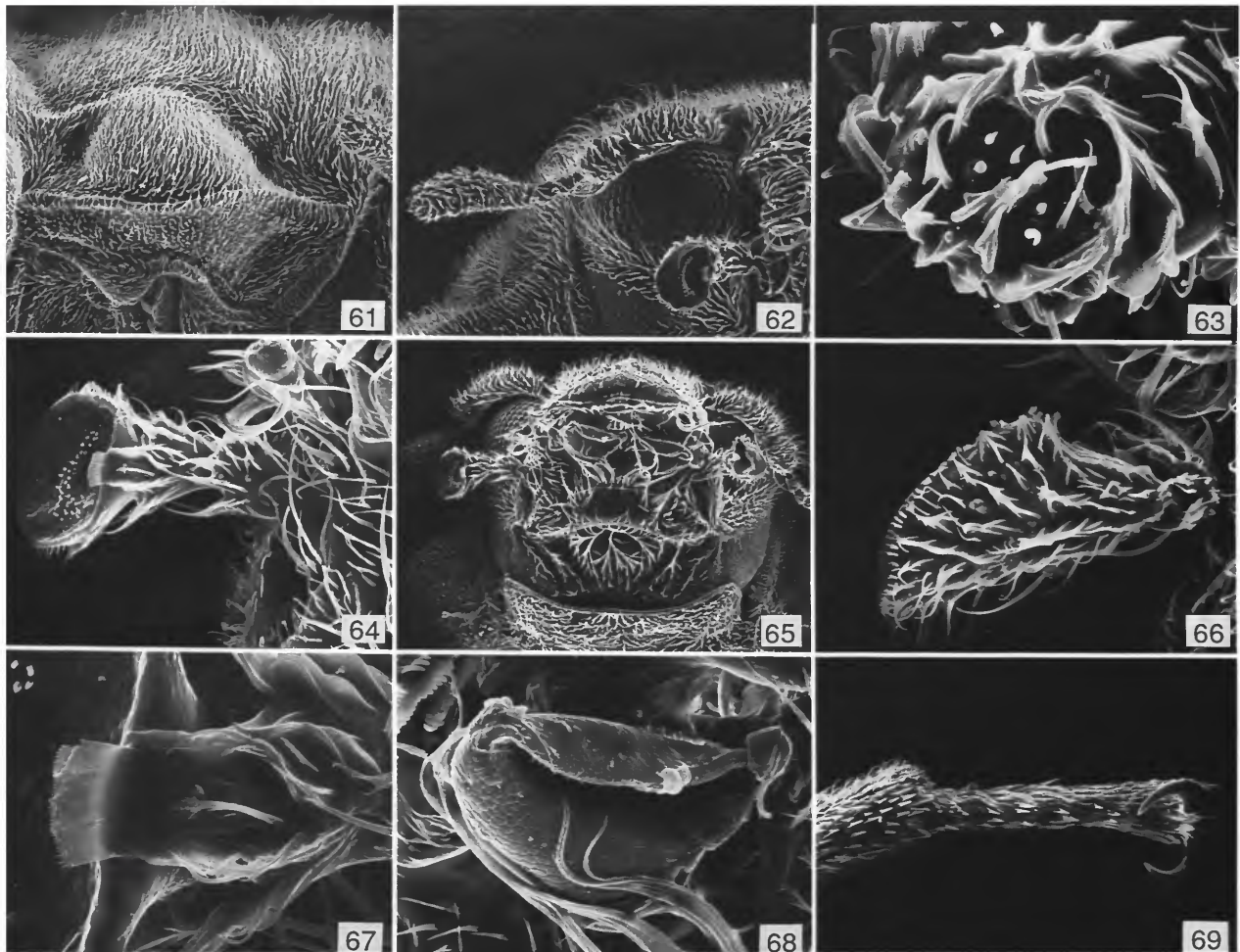


FIGURES 52-60.—*Pharceonus volcanus*, new species, adult: 52, habitus, dorsal view, $\times 27$; 53, habitus, ventral view, $\times 27$; 54, habitus, lateral view, $\times 27$; 55, head and pronotum, dorsal view, $\times 67$; 56, thorax, ventral view, $\times 50$; 57, abdomen, ventral view, $\times 50$; 58, elytra, $\times 41$; 59, prosternum and prosteral process, $\times 90$; 60, apical abdominal segment, $\times 200$. (Reduced to 61% for publication.)

densely pubescent; basal segment longest, thick, curved; segment 2 round; segments 3-5 very slender; segments 6-11 swollen, forming a compact club. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin broadly, shallowly, arcuately emarginate, and angle on each side broadly rounded; anterior margin, except middle, with a dense fringe of long, yellowish, hair-like setae;

a tuft of longer and denser, curved, hair-like setae on each side. Maxillary palpus as illustrated (Figures 62, 64-67). Labial palpus as illustrated (Figure 68). Gula with anterior margin emarginate and slightly wider than submentum; sides converging and posterior margin about $\frac{1}{3}$ as wide as submentum. Submentum with anterior margin truncate.

Thorax: Pronotum broader than long (0.93 mm : 0.73



FIGURES 61–69.—*Pharceonus volcanus*, new species, adult: 61, pronotum, lateral view, hypomerion, $\times 154$; 62, antenna, eye, and maxillary palpus, $\times 140$; 63, sensilla, antennal apex, ventral view, $\times 1200$; 64, maxillary palpus, $\times 350$; 65, mouthparts, $\times 900$; 66, maxillary palpus, dorsal view, $\times 550$; 67, maxillary palpus, apex, $\times 1200$; 68, labial palpus, apex, $\times 600$; 69, protarsus and tarsal claws, $\times 180$. (Reduced to 61% for publication.)

mm); broadest at basal two-fifths; base broader than apex; surface similarly but more finely punctate than head. Scutellum flat and ovoid. Elytron 2.3 mm long, 0.59 mm wide. Elytra nearly parallel between humeri and apical two-fifths; humeri swollen; each apex gently rounded and apices conjointly rounded; lateral margins smooth; intervals with surface punctate as pronotal disc; striae deeply impressed and extending from base to apex; striae 3 and 4 uniting subapically; discal strial punctures round, diameter $\frac{1}{3}$ – $\frac{1}{2}$ the width of interval, and separated longitudinally by 2 to 3 times puncture diameter; punctures becoming much closer apically. Prosteronum moderately short in front of anterior coxae; slightly shorter than length of procoxa. Metasternum with a shiny, impressed,

median, longitudinal line extending for entire length.

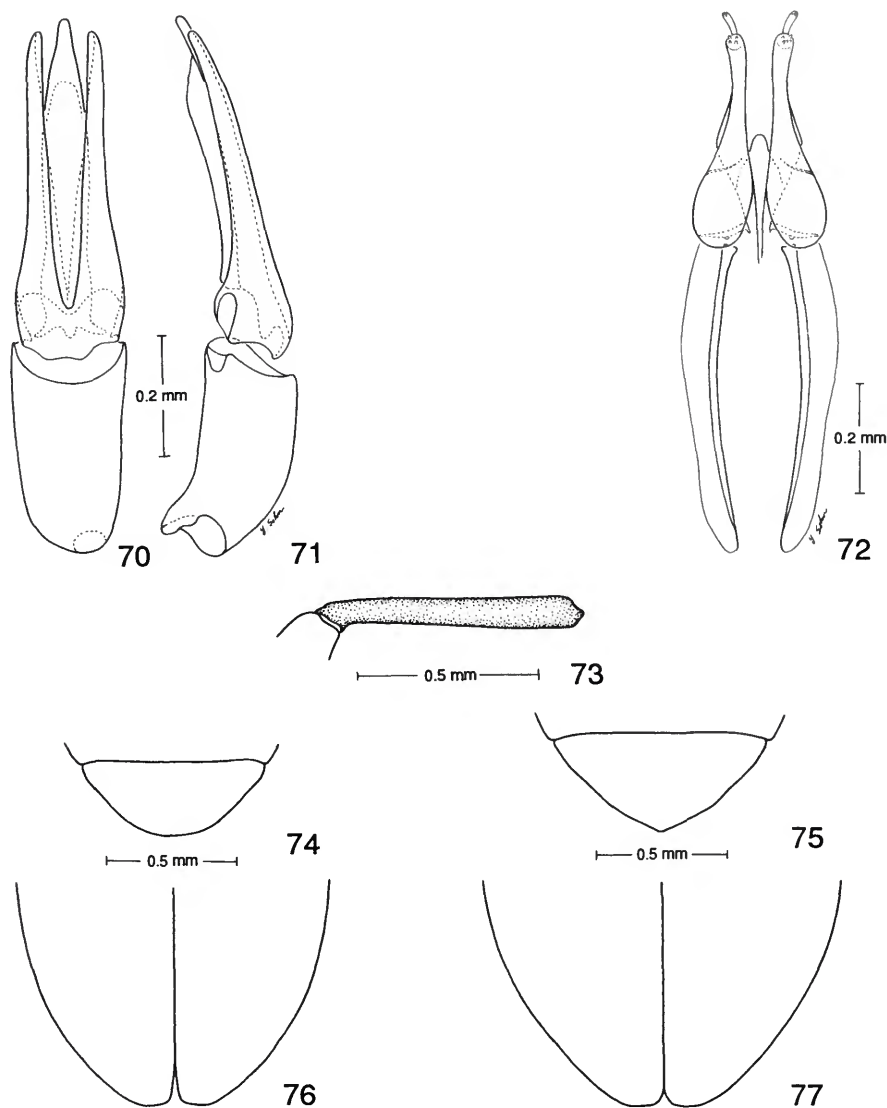
Abdomen: With 5 visible sterna. Sternum 1 with short longitudinal carina extending from each metacoxal cavity to posterior margin of sternum. Apical margin of sterna 5 and 6 broadly rounded.

Genitalia: As illustrated (Figures 70, 71).

FEMALE.—Externally, similar to male. Genitalia as illustrated (Figure 72).

VARIATIONS.—The only variation observed among the three specimens is in size; the two males (length, 3.1 mm) are smaller than the single female (3.5 mm).

TYPE DATA.—*Holotype (Male):* PANAMA: *Chiriquí:* Volcán (26 km W), 1380 m, small brook at culvert, 3 Jun 1983,



FIGURES 70-77.—*Pharceonus volcanus*, new species, adult: 70, male genitalia, ventral view; 71, male genitalia, lateral view; 72, female genitalia, ventral view; 73, mesotibia, lateral view, male; 74, abdominal sternum 5, male; 75, abdominal sternum 5, female; 76, elytral apices, male; 77, elytral apices, female.

P.J. Spangler, R.A. Faitoute, W.E. Steiner; deposited in the National Museum of Natural History, Smithsonian Institution.

Allotype: Same data as holotype.

Paratype: Same data as holotype, 1 male, coated for SEM study.

ETYMOLOGY.—Named *volcanus* for Volcán, Panama, the small village near Volcán de Chiriquí and close to the type locality.

DISTRIBUTION (Figure 78).—*Pharceonus volcanus* is known

only from the type locality in Panama.

HABITAT.—The type specimens were collected from a small brook with a gravel and rocky substrate. The brook was about 35 cm wide and 3–20 cm deep; the water was tumbling down a steep hillside and drained into a culvert beneath the road. The beetles were collected in a sunny spot by stirring up the rocks by hand and allowing the washings to drain into an insect net. The water was clear and had a pH 5.5.

Other aquatic and semiaquatic beetles associated with this

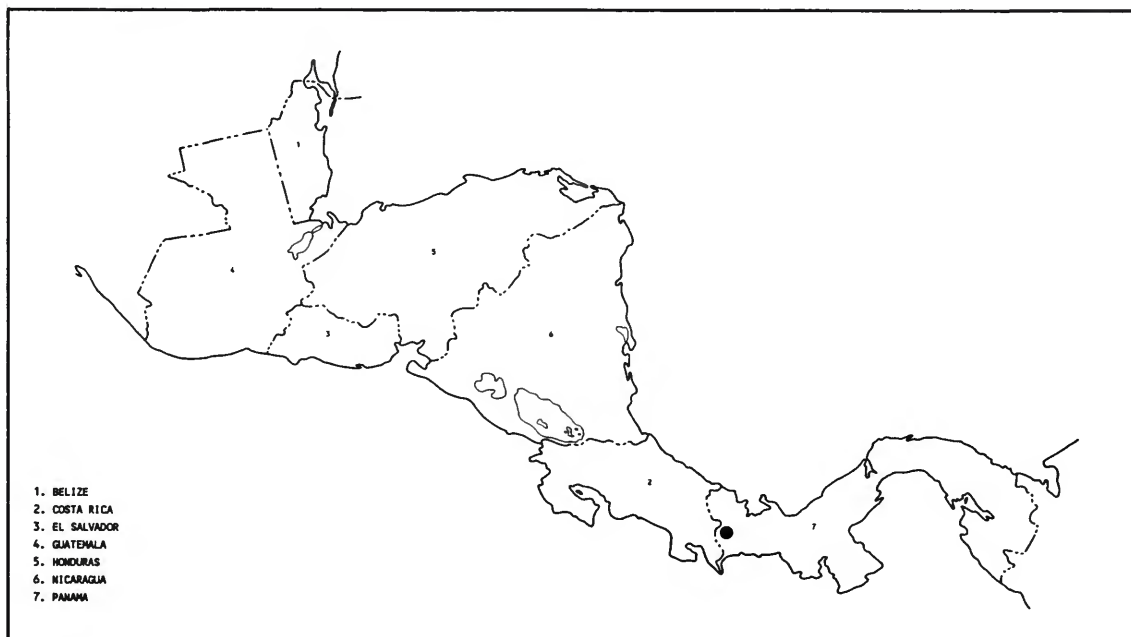


FIGURE 78.—*Pharceonus volcanus*, new species, known distribution.

new genus were: Elmidae: *Austrolimnius*, *Disersus* (larvae), *Heterelmis*, *Hexanchorus* (larvae), *Macrelmis*, *Microcylloepus*; Dryopidae: *Elmoparnus*; Hydraenidae: *Ochthebius*; Hydrophilidae: *Paracymus*; Psephenidae: an eubriid; Ptilodactylidae: *Anchytarsus palpalis* (Champion); and Limnichidae.

Hexanchorus Sharp, 1882

Hexanchorus Sharp, 1882:127 [type species: *Hexanchorus gracilipes* Sharp; by monotypy]; 1887:775.—Zaitzev, 1908:228; 1910:7.—Hinton, 1935:176; 1937a:95; 1939:142; 1940a:231; 1940b:142.—Blackwelder, 1944:272.—Legros, 1947:86.—Brown, 1965:151; 1972:13; 1975:150; 1981a:77; 1981b:137.—Spangler, 1966:413.—Bertrand, 1972:495.—Spangler and Santiago, 1987:4.

Xexanchorus.—Grouvelle, 1896:78 [misspelling].

Xenanchorus.—Blackwelder, 1944:272 [misspelling].

Hexanochorus.—Hinton, 1971:252 [misspelling].

DIAGNOSIS.—Length, 2.82–4.70 mm. Pronotum with transverse impression across apical third; without arcuate sublateral or medial impressions (Figures 5, 129).

ADULT.—Length less than 4.70 mm. With deep transverse impression across the apical third of the pronotum; without arcuate sublateral impressions (Figures 5, 129).

Body elongate, subparallel, and moderately convex (Figures 126–128). Integument clothed for the most part with dense, moderately long, usually recumbent hair-like setae.

Head partly retracted into pronotum but not beyond the basal portion of the submentum. Mouthparts visible. Maxillary

palpus, 4 segmented. Labial palpus, 3 segmented. Antenna, 11 segmented. Labrum transversely rectangular; apical margin subtruncate or shallowly emarginate at middle; anterolateral angles broadly rounded.

Pronotum widest at basal third then narrowing anteriorly, becoming evenly arcuate over head; base trisinate, broadly on each side of and much more narrowly in front of scutellum; with a deep transverse impression on apical third. Hypomeron vertical. Scutellum flat, ovate. Elytra with punctate striae; without accessory stria. Hind wing (Figure 79) without radial cross vein; without anal cell; with first and second branches of anal vein 2 fused; anal vein 1 present only apically; cubito-anal cross vein incomplete or complete and joining cubitus to anal vein 1. Prosternum short. Prosternal process elongate, broad at base and tapering; apex acute. Mesosternum with a deep depression on midline for the reception of prosternal process. Metasternum with disc concave and a narrow, longitudinal impression on midline. Epipleuron oblique until posterior margin of sternum 3 then inflexed horizontally. All legs with a distinctive, apicoventral, long, erect, hair-like seta on tarsal segment 4; seta about $\frac{1}{2}$ as long as last tarsal segment.

Abdominal sterna 1–3 with disc concave in males and slightly convex in females. Sternum 5 emarginate apicomediaally.

LARVA (BY ASSOCIATION) (Figures 80–83).—Length to 5.23 mm; greatest width 1.54 mm. Body elongate, subcylindrical, ovate or subovate. Margins of all segments moderately

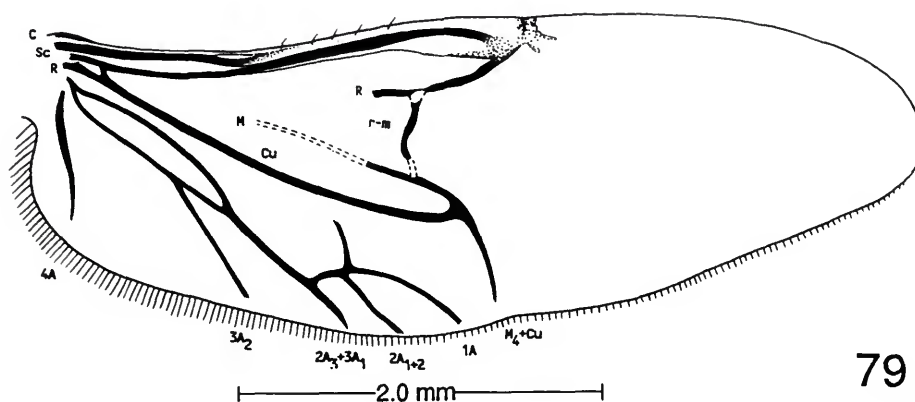


FIGURE 79.—*Hexanchorus gracilipes* Sharp, hind wing.

expanded laterally. Prothoracic, mesothoracic, metathoracic, and abdominal terga without rows of low, seta-bearing tubercles.

Head with 6 stemmata on each side; with tooth on anterior margin between base of antenna and clypeus; frontoclypeal suture well developed. Antenna, 3 segmented. Mandibles symmetrical; with 3 obtuse apical teeth; prostheca long, slender, and densely hirsute. Maxilla with palpus 4 segmented; stipes without palpifer; galea and lacinia separate and apex of each densely spinose. Labium with palpus 2 segmented; prementum with a palpiger; postmentum undivided. Gula well developed.

Pronotum, mesonotum, and metanotum with or without a gibbosity on each side of and adjacent to midline. Prosternum with medial, large, triangular cervical sclerite; episternum long and broad in front of coxal cavities; epimeron divided into 2 sclerites; sternellum large and triangular; without posteromedial sclerite, thus procoxal cavities open posteriorly. Mesosternum and metasternum each with an episternal sclerite, a single epimeral sclerite, and an undivided transverse sclerite in front of coxae.

Abdomen without tergopleural sclerites; terga 1–7 each with 2 moderate posteromedial gibbosities; tergum 8 with a large posteriorly directed gibbosity on each side of meson, each gibbosity with an apical spiracle-bearing tubercle; with sternopleural sclerites on segments 1–6; segment 7 with partial sternopleural suture. Abdominal segments 7 and 8 forming sclerotized rings. Abdominal tergum 9 with apex rounded; midline moderately ridged. Operculum tapering to moderately broad, rounded apex.

Spiracles present on mesothorax and abdominal segments 1–8. Mesothoracic spiracles present anterolaterally; opening on large tubercles. Abdominal spiracles present laterally on posterior third of segments 1–7; opening on apices of large tubercles. Abdominal segment 8 with spiracles present on

apices of median gibbosities and opening on large tubercles.

Variations: In early instars of specimens identified, by association, as *H. gracilipes* (Figures 80, 81), the thoracic and abdominal segments are without gibbosities. Middle instars have 2 partially developed gibbosities on abdominal segment 8; and late instars have 2 large distinct gibbosities on abdominal segment 8; each gibbosity with an apical, spiracle-bearing tubercle.

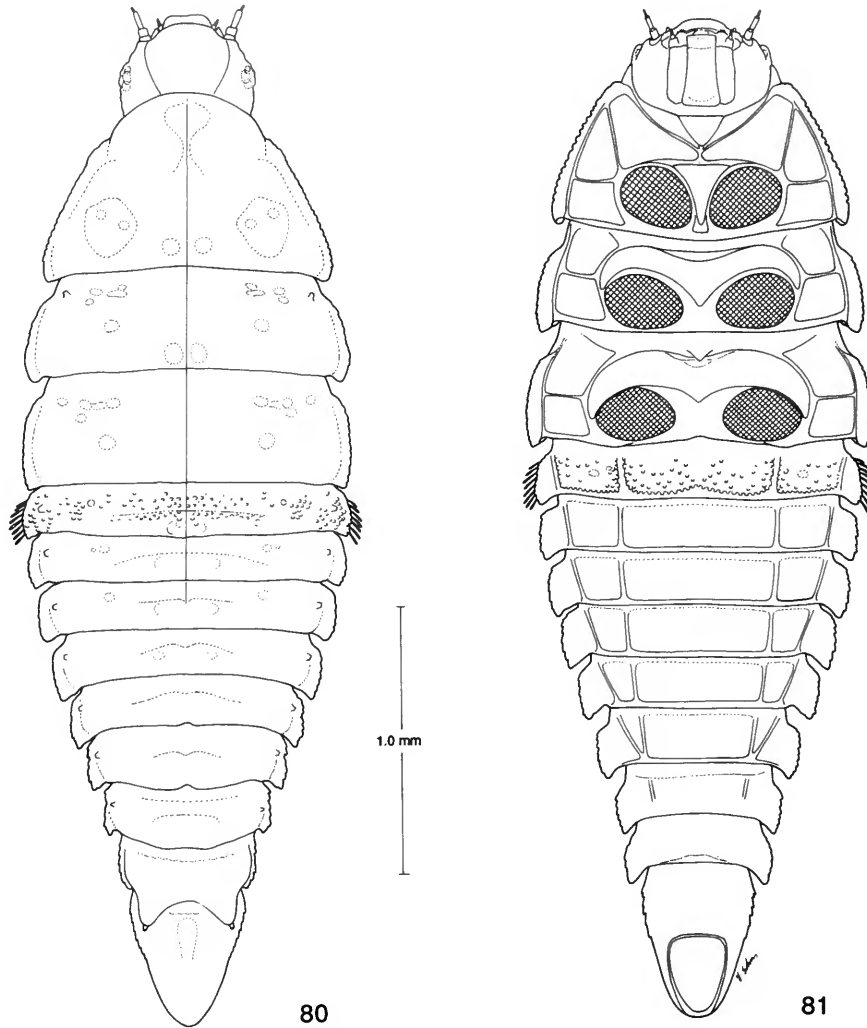
The assumed late instars of *H. caraibus* (Figures 82, 83) have 2 large distinct gibbosities present only on abdominal segment 8.

Comments: The larval description above is that of a larva presumed to be a last instar larva of *Hexanchorus gracilipes* because it was collected with adults and presumed early instar larvae of that species from Mexico, Veracruz, Los Tuxtlas area, Río Maquínas, 11 May 1981, by P.J. Spangler. Specimens are deposited in the National Museum of Natural History, Smithsonian Institution.

The illustrated larva of *H. caraibus* (Figures 82, 83) is identified by association and was collected with adults of that species from St. Vincent, Grand Bonhomme Mt, British West Indies, 1 Jul 1971, by A.D. Harrison. We are confident that this identification is correct because *H. caraibus* is the only known species of the genus to occur in the Lesser Antilles. That specimen and additional presumed larvae of *H. caraibus* are deposited in the National Museum of Natural History, Smithsonian Institution.

Of the six species of *Hexanchorus* known from Middle America, only the assumed larvae of *H. gracilipes* and *H. caraibus* are known.

The distinctive, moderately compressed, elongate-ovate larva of *Hexanchorus gracilipes* was first described, illustrated, and included in a key to larvae of the genera of Elmidae by Hinton (1940a) in his study of Mexican elmids. Hinton (1940b) also included the genus in a key to the larvae of the genera of Elmidae of Peru. Subsequently, Spangler (1966) reported a



FIGURES 80, 81.—*Hexanchorus gracilipes* Sharp, larva: 80, dorsal view; 81, ventral view.

larva of *Hexanchorus tibialis* Hinton from Peru; Hinton (1971) included the larva of *Hexanchorus caraibus* (Coquerel) in a key to the adults and larvae of the Elmidae of Trinidad and Tobago;

and Bertrand (1972) keyed, discussed, and illustrated the larva of *Hexanchorus*.

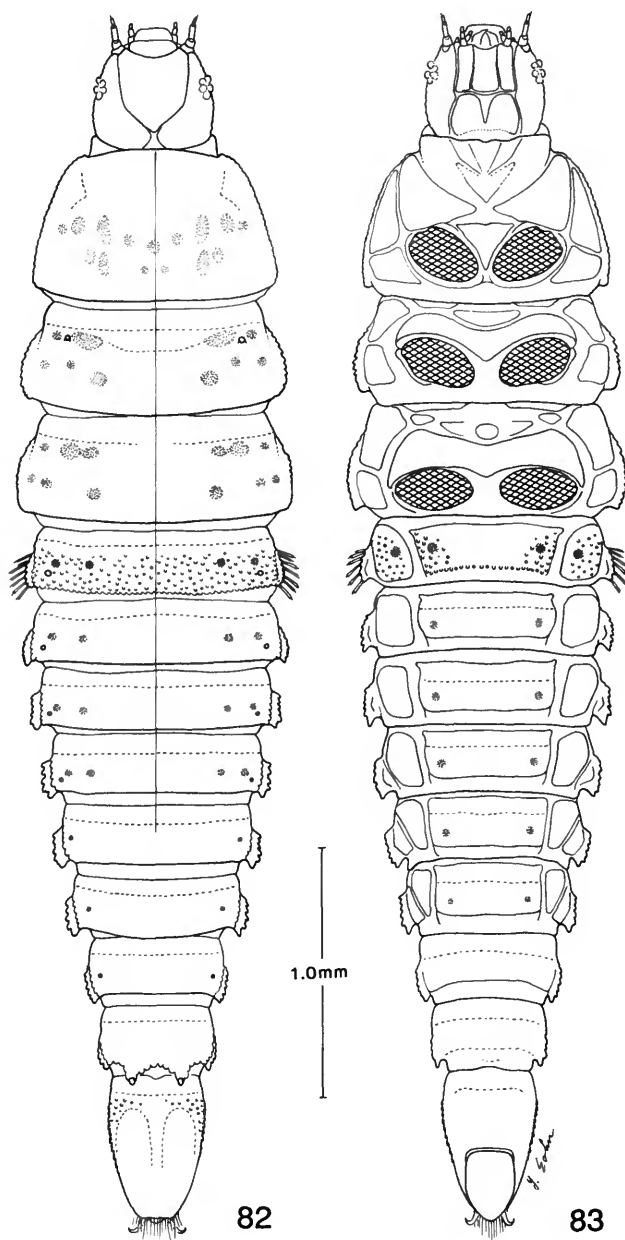
Key to the Species of *Hexanchorus* of Mexico, Central America, and the West Indies

- 1. Mesotibia with lateral pubescent area on basal third to three-fourths [Figure 87] 4. *H. crinitus*, new species
- Mesotibia with lateral pubescent area only at extreme base [Figure 98] 2
- 2. Mesotibia with medial pubescent area about 3 times as long as that on lateral surface [Figures 99, 109, 119] 3
- Mesotibia with medial pubescent area short, about as long as that on lateral surface [Figures 148, 160] 5

3. Elytral striae ending subapically. Pronotum finely, densely punctate. Median lobe of male genitalia narrow on apical third [Figures 95, 96] 5. *H. usitatus*, new species
Elytral striae ending at apical fifth. Pronotum finely or coarsely and moderately densely punctate. Median lobe of male genitalia narrow or broad 4
4. Pronotum finely, moderately densely punctate. Median lobe of male genitalia narrow; parameres emarginate basolaterally; basal piece spinous apicolaterally [Figures 105, 106] 6. *H. emarginatus*, new species
Pronotum coarsely, moderately densely punctate. Male genitalia with median lobe broad; parameres and basal piece not as above [Figures 115, 116] 7. *H. browni*, new species
5. Scutellum strongly convex. Male protarsus not expanded apicomedialely, without tuft of long setae apicomedialely [Figure 152]. Male genitalia, in lateral view, with apex of median lobe hooked; apices of parameres rounded [Figures 144, 145] 8. *H. gracilipes* Sharp
Scutellum flat or only slightly raised. Male protarsus expanded apicomedialely, with tuft of dense long setae apicomedialely [Figure 164]. Male genitalia with apex of median lobe, in lateral view, not hooked; apices of parameres angular [Figures 156, 157] 9. *H. caraiibus* (Coquerel)

Clave para las Especies de *Hexanchorus* de México, Centroamérica y El Caribe

1. Mesotibia con el área pubescente lateral ocupando el tercio basal o hasta las tres cuartas partes [Figura 87] 4. *H. crinitus*, especie nueva
Mesotibia con el área pubescente lateral ocupando solamente el extremo basal [Figura 98] 2
2. Mesotibia con el área pubescente medial con una longitud aproximada 3 veces mayor a la de la superficie lateral [Figuras 99, 109, 119] 3
Mesotibia con el área pubescente medial corta, aproximadamente de la misma longitud que el área pubescente lateral [Figuras 148, 160] 5
3. Estrías elitrales terminando subapicalmente. Pronoto con puntuaciones finas y densas. Lóbulo medio de los genitalia del macho angosto en el tercio apical [Figuras 95, 96] 5. *H. usitatus*, especie nueva
Estrías elitrales terminando en la quinta porción apical. Pronoto con puntuaciones finas o gruesas pero moderadamente densas. Lóbulo medio de los genitalia del macho angosto o ancho 4
4. Pronoto con puntuaciones finas y moderadamente densas. Lóbulo medio de los genitalia del macho angosto; parámetros emarginados basolateralmente; pieza basal espinosa apicolateralmente [Figuras 105, 106] 6. *H. emarginatus*, especie nueva
Pronoto con puntuaciones gruesas y moderadamente densas. Genitalia del macho con el lóbulo medio amplio; parámetros y pieza basal no como la descrita antes [Figuras 115, 116] 7. *H. browni*, especie nueva
5. Escutelo fuertemente convexo. Protarso del macho no expandido apicomedialely, sin mechón de sedas largas apicomedialely [Figura 152]. Genitalia del macho, en vista lateral, con el ápice del lóbulo medio en forma de gancho; ápices de los parámetros redondeados [Figuras 144, 145] 8. *H. gracilipes* Sharp
Escutelo plano o solo ligeramente elevado. Protarso del macho expandido apicomedialely, con un mechón denso de sedas largas apicomedialely [Figura 164]. Genitalia del macho con el ápice del lóbulo medio, en vista lateral, no en forma de gancho; ápices de los parámetros en forma angular [Figuras 156, 157] 9. *H. caraiibus* (Coquerel)



FIGURES 82, 83.—*Hexanchorus caraibus* (Coquerel), larva: 82, dorsal view; 83, ventral view.

4. *Hexanchorus crinitus*, new species

FIGURES 84–94

DIAGNOSIS.—The elongate pubescent area on the lateral and medial surfaces of the mesotibia (Figures 87, 88) will distinguish this species from all other species of *Hexanchorus*

known from Middle America.

HOLOTYPE (MALE).—*Body Form and Size:* Elongate, subparallel, moderately convex. Length, 3.60 mm; width (across elytral humeri), 1.19 mm.

Color: Cuticle black to reddish black; basal antennal segments 1 and 2, mouthparts, trochanters, base of femora, mesotibiae, and claws paler. With fine, short, reddish brown, hair-like setae dorsally; some of these setae often with a greenish iridescence. Ventral surface with golden yellow hair-like setae.

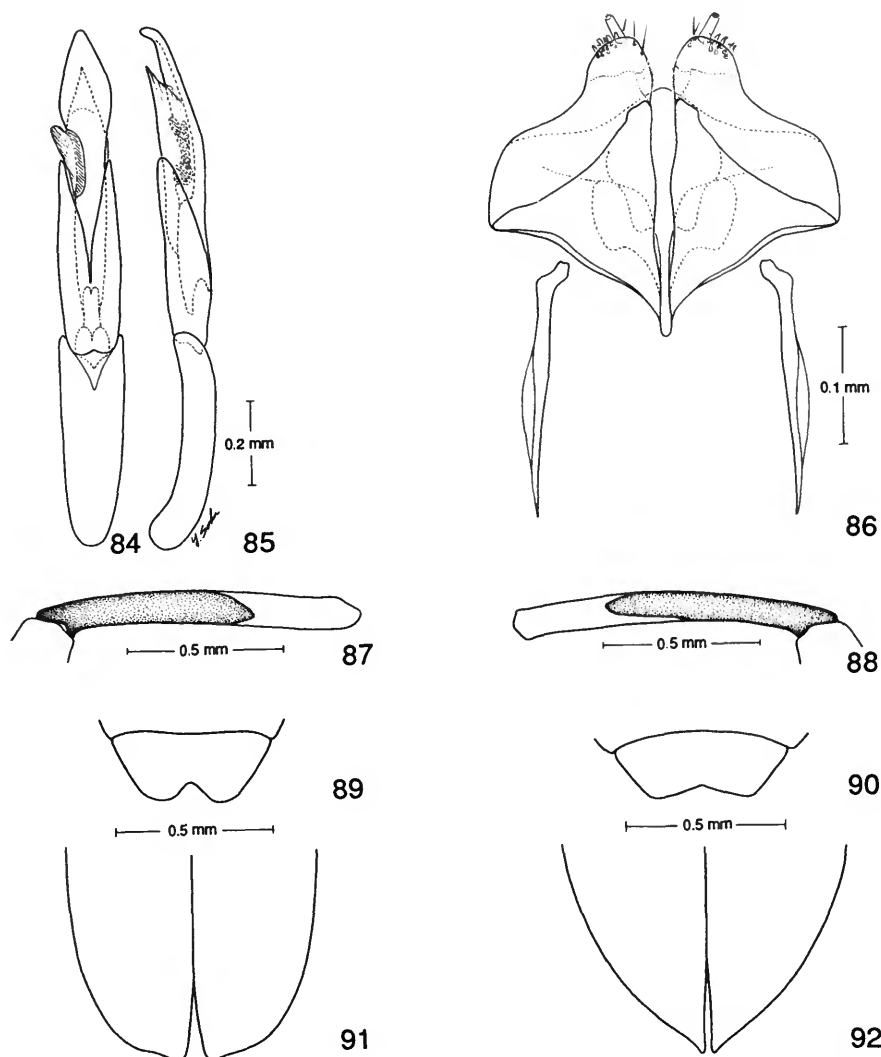
Head: Without distinct impressions. Surface microreticulate, with dense fine punctures and sparse coarse punctures; fine punctures separated by distance equal to puncture diameter and coarse punctures confluent to separated by 1–3 times puncture diameter. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin very shallowly and arcuately emarginate at middle; angle on each side broadly rounded. Eyes narrowed posteriorly and bordered by long black curved setae that arise near dorsal and ventral sides of eyes and extend toward middle of eye. Antenna pubescent; numerous setae on basal segments 1 and 2 long, longer than width of segments; segments of club compact, with dense setae; most setae on club shorter than $\frac{1}{2}$ width of segments.

Thorax: Pronotum broader than long (0.95 mm : 0.77 mm); base broader than apex; surface punctate as head; with most coarse punctures separated by their diameter or less. Scutellum slightly longer than broad; moderately convex; on same plane as adjacent elytral intervals. Elytron 2.56 mm long, 0.52 mm wide; more than 3 times as long as pronotum. Elytra broadest across humeri but only slightly broader than at apical third; inner side of apex rounded; lateral margins smooth; humeri moderately gibbous; sutural interval raised on posterior five-sixths, other intervals flat; punctures on intervals no larger than finest punctures of head and pronotum and separated by 2–5 times puncture diameter; mid-discal striae punctures round to subquadrate, $\frac{1}{3}$ – $\frac{1}{2}$ as broad as intervals, and separated longitudinally by puncture diameter or less; punctures becoming finer and intervals becoming broader basally; punctures becoming slightly finer laterally; apically punctures becoming finer and striae shallower, effaced on apical sixth. Prosternum shallowly concave medially. Prosternal process long, moderately broad, concave medially. Protibiae slightly curved inward near apical third. Mesotibiae with dense pubescence covering basal two-thirds laterally and medially (Figures 87, 88).

Abdomen: Entire disc of sterna 1–4 deeply concave. Sternum 1 with indistinct carina on each side of concavity extending slightly behind coxal cavity. Apicomedial margin of sternum 5 deeply and broadly emarginate (Figure 89).

Genitalia: As illustrated (Figures 84, 85).

FEMALE.—Externally similar to male except inner apex of each elytron slightly turned upward at an angle to general surface. Metasternal disc not as deeply and less extensively



FIGURES 84-92.—*Hexanchorus crinitus*, new species, adult: 84, male genitalia, ventral view; 85, male genitalia, lateral view; 86, female genitalia, ventral view; 87, mesotibia, lateral view, male; 88, mesotibia, medial view, male; 89, abdominal sternum 5, male; 90, abdominal sternum 5, female; 91, elytral apices, male; 92, elytral apices, female.

concave. Abdominal sterna 1-3 convex, not concave; apicomedial margin of sternum 5 shallowly and broadly emarginate (Figure 90). Genitalia as illustrated (Figure 86).

VARIATIONS.—There are differences in size and slight differences in punctuation. Males ($n = 7$) range in length from 3.14 to 3.60 mm ($\bar{x} = 3.30$); females ($n = 7$) range from 3.16 to 3.61 mm ($\bar{x} = 3.48$ mm). In many specimens the greenish iridescence of the fine pubescence on the dorsal surface is not obvious.

TYPE DATA.—*Holotype (Male)*: COSTA RICA: *San José*: San Isidro (16 mi S), 2 Jul 1967, P.J. Spangler; deposited in the

National Museum of Natural History, Smithsonian Institution.

Allotype: Same data as holotype.

Paratypes: Same data as holotype, 6 spms. COSTA RICA: *Heredia*: Puerto Viejo (1 km S), 4-5 Jun 1984, E. Riley, D. Rider, D. LeDoux, 1 spm (LSU). *Puntarenas*: Canoas (4 mi W), stream, 10 Nov 1966, H.P. Brown, 3 spms (HPB); Palmar Sur (southeast of), Río Olla Cinco, 9 Nov 1966, H.P. Brown, 7 spms (HPB); Puntarenas (northwest of), 3 Nov 1966, H.P. Brown, 129 spms (HPB); Volcán, Río Cacao, 8 Nov 1966, H.P. Brown, 1 spm (HPB). *San José*: Río Union and Pan American Hiway, 22 Jun 1972, C.L. Hogue, 3 spms (LACM).

PANAMA: *Bocas del Toro*: Punta Pena, Río Guarumo, 76 m, 27°C, 28 May 1985, R.W. Flowers, 4 spms (NMNH); Zegla, Río Changuinola, light, 25 Apr 1985, R.W. Flowers, 1 spm (NMNH); Zegla, Río Changuinola, light, 26 Apr 1985, R.W. Flowers, 2 spms (NMNH). *Chiriquí*: Guabalá (south of), 14 Nov 1966, H.P. Brown, 8 spms (HPB). *Cocle*: El Valle, 829 m, 27 May 1983, P.J. Spangler, R.A. Faitoute, 4 spms (NMNH); Machuca (near), trib. of Río Grande, 25 Jun 1968, H.P. Brown, 506 spms (HPB). *Panamá*: Chepo (west of), Río Chico, 21 Jun 1968, H.P. Brown, 28 spms (HPB); Chorrera (west of), small río, 12 Nov 1966, H.P. Brown, 11 spms (HPB); Pacora, Río Cabra, 23 Nov 1971, H.P. Brown, 44 spms (HPB).

ETYMOLOGY.—The specific name is from the Latin *crinitus* ("hairy") in reference to the extensive pubescent area on the lateral surface of the mesotibia (Figure 87).

DISTRIBUTION (Figure 93).—This species is presently known only from Costa Rica and Panama.

HABITAT.—Specimens of this species have been found on the downstream sides of rocks and above the water level at the air-water interface in small streams (1–5 m wide).

The specimens from El Valle, Panama, were collected at an altitude of 820 m from an unshaded part of a stream that was bordered by forest on one side and grassland on the other. The stream was clear, 1–2 m wide, about 65 cm deep in some pools, and had a sand, gravel, and rocky substrate; velocity was about 30 cm/second. Colorimetric water chemistry tests provided the following data: oxygen, 9 ppm; pH, 5.5; hardness, 0. The water

temperature was 23.5°C and the air temperature was 29°C when the data were obtained.

At the biotope (Figure 94) at El Valle, Panama, *H. crinitus* was collected in association with the following aquatic insects: Coleoptera: Elmidae: *Austrolimnius*, *Cylloepus*, *Disersus*, *Heterelmis*, *Hexacylloepus*, *Macrelmis*, *Neocylloepus*, *Phanocerus*, *Stenelmoides*, *Xenelmis*; Limnichidae; Psephenidae: *Psephenops*. Heteroptera: Ochteridae: *Ochterus*; Naucoridae: *Cryphocricus*; Belostomatidae: *Abedus*; Veliidae: *Microvelia*, *Rhagovelia*; Gerridae.

5. *Hexanchorus usitatus*, new species

FIGURES 95–104

DIAGNOSIS.—Pronotum finely, densely punctate. Elytral striae long, ending subapically. Mesotibia with lateral pubescent area only at extreme base. The structure of the male genitalia (Figures 95, 96) is distinctive and will distinguish the males from other species.

HOLOTYPE (MALE).—*Body Form and Size*: Elongate, subparallel, moderately convex. Length, 4.04 mm; greatest width (across humeri), 1.49 mm.

Color: Cuticle reddish brown to blackish brown; basal antennal segments 1 and 2, mouthparts, coxae, trochanters, base of femora, mesotibiae, and claws paler. With fine, short, reddish brown, hair-like setae dorsally; some of these setae

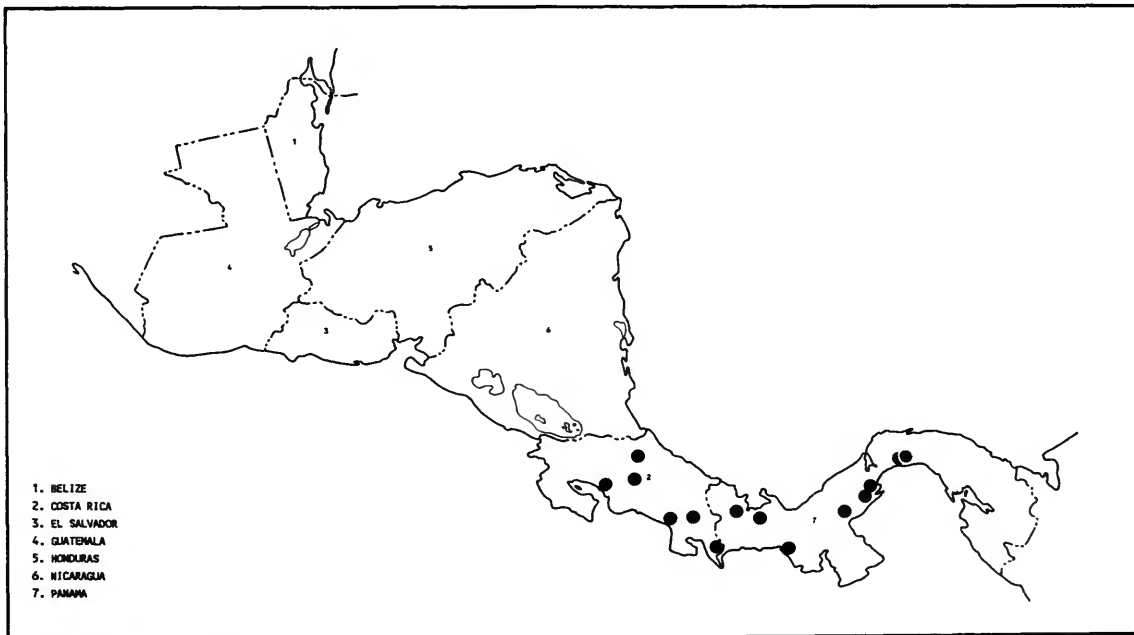


FIGURE 93.—*Hexanchorus crinitus*, new species, known distribution.



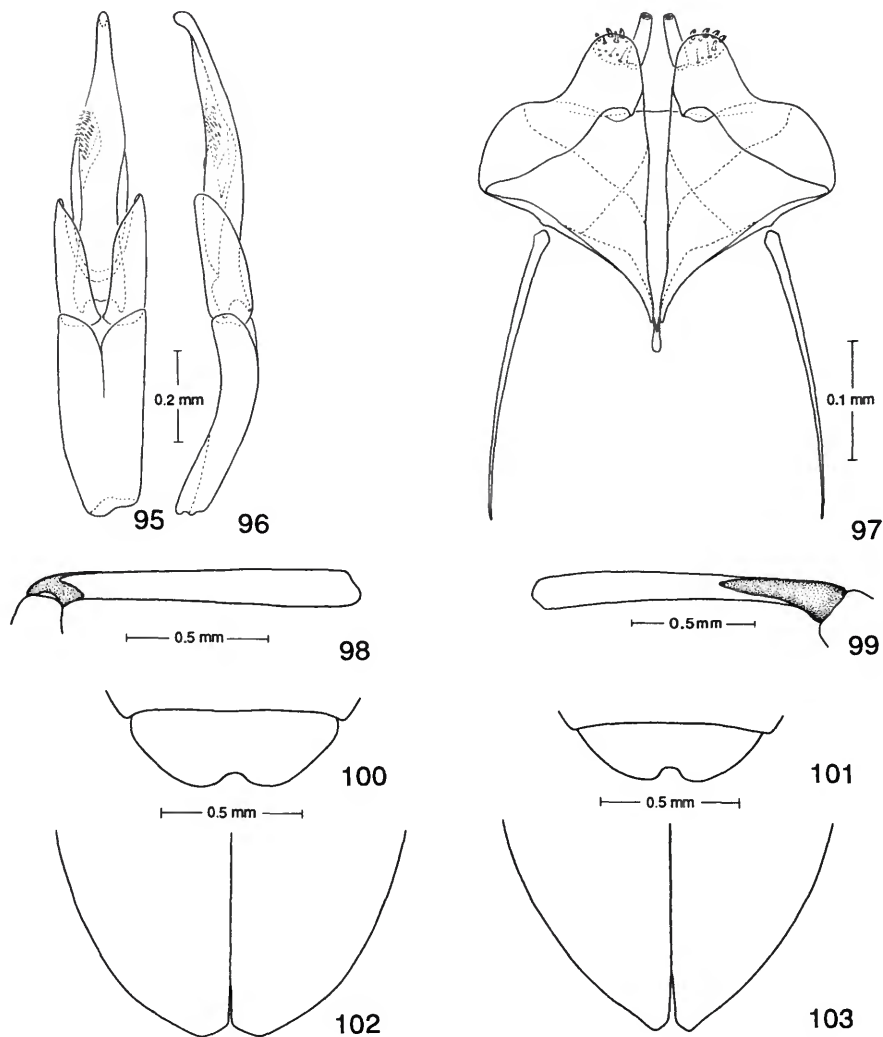
FIGURE 94.—*Hexanchorus crinitus*, new species, biotope; El Valle, Coclé Province, Panama. (Photo by W.E. Steiner)

with a greenish iridescence. Ventral surface with golden yellow, hair-like setae.

Head: Without distinct impressions. Surface microreticulate, with dense fine punctures and sparse coarse punctures; fine punctures separated by a puncture diameter; coarse punctures confluent to separated by 1–2 times puncture diameter. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin slightly

arcuate; angle on each side broadly rounded. Eyes narrowed posteriorly and bordered by long, black, curved setae that arise near dorsal and ventral sides of eyes and extend toward middle of eye. Antenna pubescent; numerous setae on basal segments 1 and 2 long, longer than width of segments; segments of club compact, with dense short setae and a few longer setae; sparse, longer setae of club about $\frac{1}{2}$ width of segments.

Thorax: Pronotum broader than long (1.16 mm : 0.94



FIGURES 95-103.—*Hexanchorus usitatus*, new species, adult: 95, male genitalia, ventral view; 96, male genitalia, lateral view; 97, female genitalia, ventral view; 98, mesotibia, lateral view, male; 99, mesotibia, medial view, male; 100, abdominal sternum 5, male; 101, abdominal sternum 5, female; 102, elytral apices, male; 103, elytral apices, female.

mm); base broader than apex; broadest along basal half; surface punctate as head; with most coarse punctures separated by puncture diameter or less. Scutellum about as long as broad; moderately convex; on same plane as adjacent elytral intervals. Elytron 3.20 mm long, 0.75 mm wide. Elytra more than 3 times as long as pronotum; widest across humeri but only slightly broader than at apical third; inner side of apex rounded; lateral margins smooth; humeri moderately gibbous; sutural interval slightly raised on posterior two-thirds, other intervals flat; punctures on intervals no larger than finest punctures of head and pronotum and separated by 2-3 times puncture diameter;

mid-discal stria punctures round, separated longitudinally by $1/2-2$ times puncture diameter and $1/4-1/3$ as broad as intervals; punctures becoming finer and intervals becoming broader basally; punctures becoming slightly finer laterally; apically punctures becoming finer and striae shallower until effaced on apical sixth. Prosternum shallowly concave medially. Prosternal process long, moderately broad. Protibiae slightly curved inward near apical third. Mesotibiae with dense pubescence covering a narrow basolateral area (Figure 98) and basal third of medial area (Figure 99).

Abdomen: Entire disc of sterna 1 and 2 and three-fourths of

sternum 3 deeply concave. Sternum 1 with carina on each side of concavity extending to posterior fourth or fifth. Apicomedial margin of sternum 5 deeply and broadly emarginate (Figure 100).

Genitalia: As illustrated (Figures 95, 96).

FEMALE.—Externally similar to male except inner apex of each elytron slightly turned upward at an angle to general surface. Protibiae slightly less curved than those of male. Metasternal disc not as deeply and less extensively concave. Abdominal sterna 1–3 convex ventrally, not concave; apicomedial margin of sternum 5 deeply and narrowly emarginate (Figure 101). Genitalia as illustrated (Figure 97).

VARIATIONS.—There are differences in size and slight differences in punctuation. Males ($n = 11$) range from 3.19 to 4.70 mm in length ($\bar{x} = 3.88$ mm); females ($n = 8$) range from 3.20 to 4.70 mm ($\bar{x} = 3.90$ mm). In many specimens the greenish iridescence of the fine hairs on the dorsal surface is indistinct.

TYPE DATA.—*Holotype (Male)*: PANAMA: *Cocle*: El Valle, 829 m, 26 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner; deposited in the National Museum of Natural History, Smithsonian Institution.

Allotype: Same data as holotype.

Paratypes: Same data as holotype, 10 spms. COSTA RICA: *Alajuela*: Alajuela (3 mi N), small río, 20 Nov 1966, H.P. Brown, 68 spms (HPB); Barranca (west of), 4 Nov 1966, H.P. Brown, 1 spm (HPB); Grecia (east of), Río Rosales, 22 Nov 1966, H.P. Brown, 84 spms (HPB); Volcán Poas, near

Roble, 9 Jul 1983, C.L. Hogue, 10 spms (LACM). *Cartago*: La Suiza, 17 Jun 1967, O.S. Flint and Ortiz, 25 spms (NMNH). *Guanacaste*: Cañas, Río Cañas, 3 Nov 1966, H.P. Brown, 89 spms (HPB); Colorado, 31 Mar 1988, W.E. Steiner, J.M. Swearingen, J.M. Mitchell, 2 spms (NMNH). *Heredia*: Barba (north of), stream, 20 Nov 1966, H.P. Brown, 169 spms (HPB). *Limón*: Guápiles (4 km de), Río Santa Clara, 26 Apr 1984, J. Bueno, 3 spms (UNAM). *Puntarenas*: Esparta (east of), Río Jesús, 4 Nov 1966, H.P. Brown, 3 spms (HPB). *San José*: Grecia (2 mi W), Río Trojas, 18 Jun 1972, C.L. Hogue, 10 spms (LACM); Peñas Blancas (south of), Río Cabalceta, 23 Nov 1966, H.P. Brown, 6 spms (HPB); San Isidro de General (2.7 mi S), Río Peje and Pan Am[erican] Hiway, 22 Jun 1972, C.L. Hogue, 3 spms (LACM).

PANAMA: *Bocas del Toro*: Pipeline road, Trib. of Río Guabo, 25 May 1985, R.W. Flowers, 1 spm (NMNH); Punta Pena, Río Guarumo, 76 m, 27°C, 28 May 1985, R.W. Flowers, 1 spm (NMNH); Zegla, Río Changuinola, light, 26 Apr 1985, R.W. Flowers, 1 spm (NMNH). *Chiriquí*: Bambito, Río Chiriquí, 16 Nov 1966, H.P. Brown, 3 spms (HPB); Bambito, Río Chiriquí Viejo, 2 Jun 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 5 spms (NMNH); Boquete, Río Caldera, 15 Nov 1966, H.P. Brown, 24 spms (HPB); Cerro Punta, 23 Jun 1968, H.P. Brown, 45 spms (HPB); Cerro Punta, Río Chiriquí, 17 Nov 1966, H.P. Brown, 8 spms (HPB); Cuenca Fortuna, Quebrada Arena, 1067 m, 24 May 1985, R.W. Flowers, 1 spm (NMNH); Cuenca Fortuna, Quebrada Arena, 5 Jun 1985, R.W. Flowers, 1 spm (NMNH); Cuenca Fortuna, Quebrada Honda,

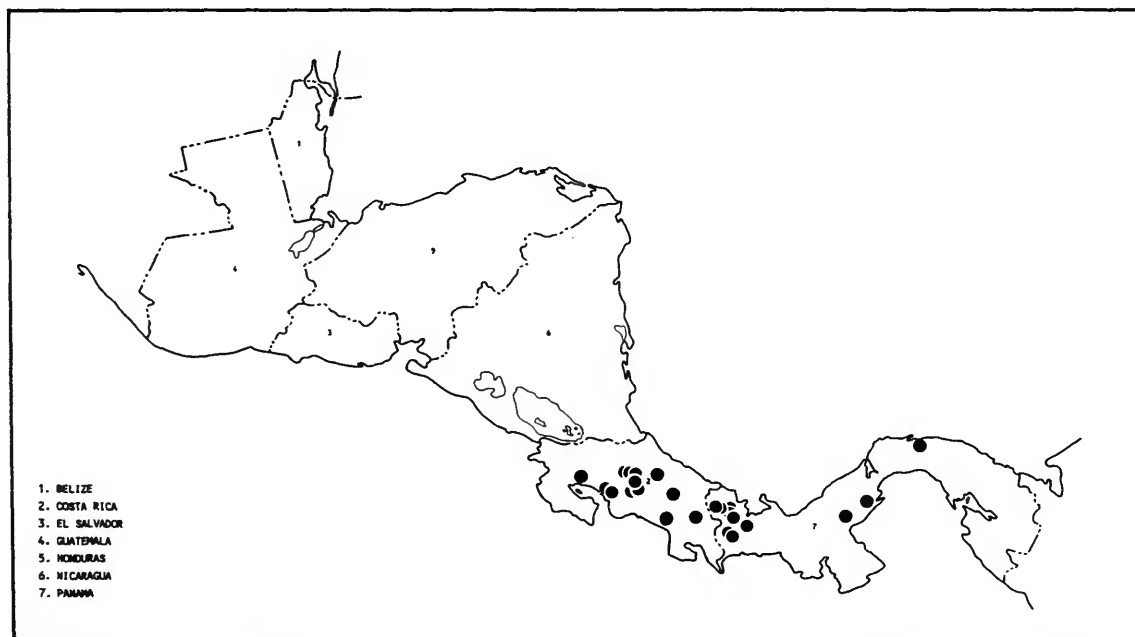


FIGURE 104.—*Hexanchorus usitatus*, new species, known distribution.

17 May 1985, R.W. Flowers, 4 spms (NMNH); Cuenca Fortuna, stream north of lake at pipeline road, 1128 m, 4 Apr 1985, R.W. Flowers, 2 spms (NMNH); Guabalá (south of), 14 Nov 1966, H.P. Brown, 3 spms (HPB); Horqueta, 24 Jun 1968, H.P. Brown, 1 spm (HPB); Presa Fortuna, lake, 1158 m, light, 15 May 1985, R.W. Flowers, 2 spms (NMNH). *Cocle*: El Valle, 829 m, 26 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 9 spms (NMNH); Machuca (near), trib. of Río Grande, 25 Jun 1968, H.P. Brown, 1 spm (HPB). *San Blas*: Campamento Nusagandi (25 km S), 1 May 1987, D. Quintero, H. Herrera, R. Cambra, 1 spm (UPan).

ETYMOLOGY.—The specific name is from the Latin *usitatus* ("common") because, externally, it resembles many of the other species of *Hexanchorus*.

DISTRIBUTION (Figure 104).—This species is presently known only from Costa Rica and Panama.

HABITAT.—Specimens of this species were collected at 1770 m at Bambito, Panama, in the Río Chiriquí Viejo. The stream was clear, unshaded, shallow (~0.3–1 m), about 15 m wide, and had a gravel and rock substrate with occasional boulders intermixed. Colorimetric water chemistry tests provided the following data: oxygen, 9 ppm; pH, 6; hardness, 0. The water temperature was 18° C and the air temperature was 26.5° C when the data were obtained.

The following aquatic and semiaquatic Coleoptera were found in association with *H. usitatus* in the Río Chiriquí Viejo: Elmidae: *Onychelmis longicollis* Sharp, *Heterelmis*, and *Hexacylloepus*; Ptilodactylidae: *Anchytarsus palpalis* (Champion), larvae.

6. *Hexanchorus emarginatus*, new species

FIGURES 105–114

DIAGNOSIS.—Pronotum finely, moderately densely punctate and mesotibia with lateral pubescent area only at extreme base (Figure 108). The most diagnostic character for recognizing *H. emarginatus* is the male genitalia, which have a basolateral emargination on each paramere and a basal piece with a spinous process apicolaterally (Figures 105, 106).

HOLOTYPE (MALE).—*Body Form and Size*: Elongate, subparallel, moderately convex. Length, 3.19 mm; width (across elytral humeri), 1.21 mm.

Color: Head and pronotum black; basal antennal segments 1 and 2, mouthparts, trochanters, base of femora, tibiae, and claws paler. Elytron reddish brown; covered with fine, short, reddish brown, hair-like setae; setae often with a greenish iridescence. Ventral surface with golden yellow, hair-like setae.

Head: Without distinct impressions. Surface microreticulate; with dense fine punctures and sparse coarse punctures; fine punctures separated by puncture diameter; coarse punctures confluent to separated by 1–3 times puncture diameter. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin shallowly

emarginate at middle; angle on each side broadly rounded. Eyes narrowed posteriorly and bordered by long, black, curved setae that arise near dorsal and ventral sides of eyes and extend toward middle of eye. Antenna pubescent; setae on basal segments 1 and 2 long, longer than width of segments; segments of club compact, with dense setae; most setae on club shorter than $1/2$ width of segments.

Thorax: Pronotum broader than long (0.95 mm : 0.77 mm); base wider than apex; surface punctate as head; with most coarse punctures separated by puncture diameter or less. Scutellum slightly wider than long, moderately convex, on same plane as adjacent elytral intervals. Elytron 2.49 mm long, 0.60 mm wide. Elytra more than 3 times as long as pronotum; widest across humeri, but only slightly wider than width at apical third; inner side of apex rounded; lateral margins smooth; humeri moderately gibbous; sutural interval raised on posterior two-thirds, other intervals flat; punctures on intervals no larger than finest punctures of head and pronotum and separated by 2–3 times puncture diameter; mid-discal striae punctures round, separated longitudinally by $1/2$ –2 times puncture diameter, and $1/3$ – $1/2$ as wide as intervals; punctures becoming finer and intervals becoming broader basally; punctures becoming slightly finer laterally; apically punctures becoming finer and striae becoming shallower, effaced on apical sixth. Prosternum shallowly concave medially. Prosternal process long, moderately broad. Protibiae slightly curved inward near apical third. Mesotibiae with lateral area of hydrofuge pubescence restricted very narrowly to base (Figure 108); medial pubescent area extending about $1/3$ length of tibia (Figure 109).

Abdomen: Sterna 1 and 2 with entire disc deeply concave. Sternum 3 with three-fourths of disc concave. Sternum 1 with carina on each side of concavity extending to posterior fourth. Sternum 5 with apicomedial margin deeply and broadly emarginate (Figure 110).

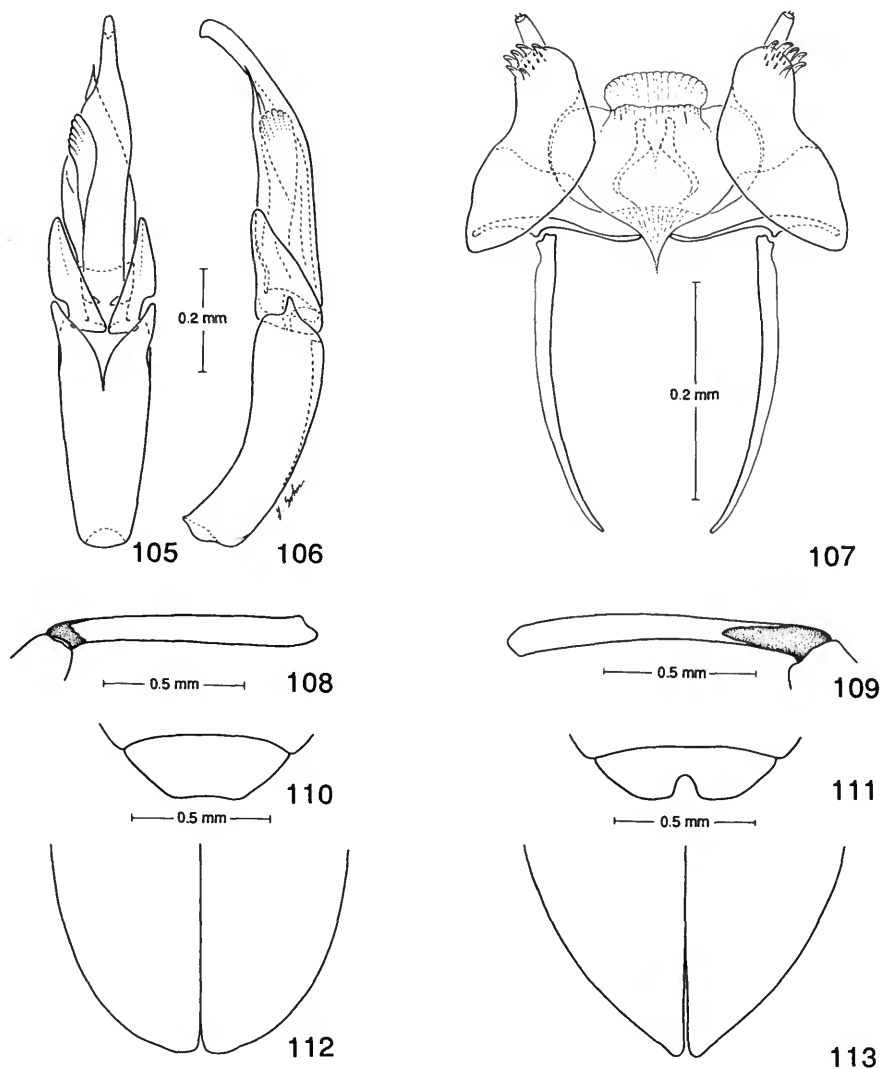
Genitalia: As illustrated (Figures 105, 106).

FEMALE.—Externally similar to male except inner apex of each elytron strongly turned upward at an angle to general surface. Protibiae slightly less curved than those of male. Metasternal disc not as deeply and less extensively concave. Abdominal sterna 1–3 convex, not concave; sternum 5 with apicomedial margin deeply, narrowly emarginate (Figure 111). Genitalia as illustrated (Figure 107).

VARIATIONS.—There are differences in size and slight differences in punctation. Males ($n = 10$) range in length from 3.18 to 3.65 mm ($\bar{x} = 3.37$ mm); females ($n = 7$) range from 3.51 to 3.85 mm ($\bar{x} = 3.61$ mm). In many specimens the greenish iridescence of the fine hairs on the dorsal surface is not present.

TYPE DATA.—*Holotype (Male)*: COSTA RICA: *San José*: San Isidro (16 mi S), 2 Jul 1967, P.J. Spangler; deposited in the National Museum of Natural History, Smithsonian Institution.

Allotype: Same data as holotype.



FIGURES 105-113.—*Hexanchorus emarginatus*, new species, adult: 105, male genitalia, ventral view; 106, male genitalia, lateral view; 107, female genitalia, ventral view; 108, mesotibia, lateral view, male; 109, mesotibia, medial view, male; 110, abdominal sternum 5, male; 111, abdominal sternum 5, female; 112, elytral apices, male; 113, elytral apices, female.

Paratypes: Same data as holotype, 3 spms. COSTA RICA: *Alajuela*: Barranca (west of), 4 Nov 1966, H.P. Brown, 8 spms (HPB). *Guanacaste*: Puntarenas (northwest of), 3 Nov 1966, H.P. Brown, 26 spms (HPB). *Puntarenas*: Volcán, Río Cacao, 8 Nov 1966, H.P. Brown, 40 spms (HPB); Volcán (northwest of), Río Convento, 8 Nov 1966, H.P. Brown, 284 spms (HPB).

PANAMA: *Chiriquí*: Bodega (south of), 24 Jun 1968, H.P. Brown, 44 spms (HPB); Concepción (west of), Río Guigala, 18 Nov 1966, H.P. Brown, 76 spms (HPB); Guabalá (south of), 14

Nov 1966, H.P. Brown, 32 spms (HPB); Pueblo Nuevo, Río Cochea, 15-16 Nov 1966, H.P. Brown, 139 spms (HPB).

ETYMOLOGY.—From the Latin *emarginatus* ("notched") in reference to the notched posterolateral angle of each paramere (Figure 105) (in ventral view).

DISTRIBUTION (Figure 114).—This species is known only from Costa Rica and Panama.

HABITAT.—The holotype was collected from a small stream, 1-1½ m wide and 15-30 cm deep, with sand and rubble substratum.

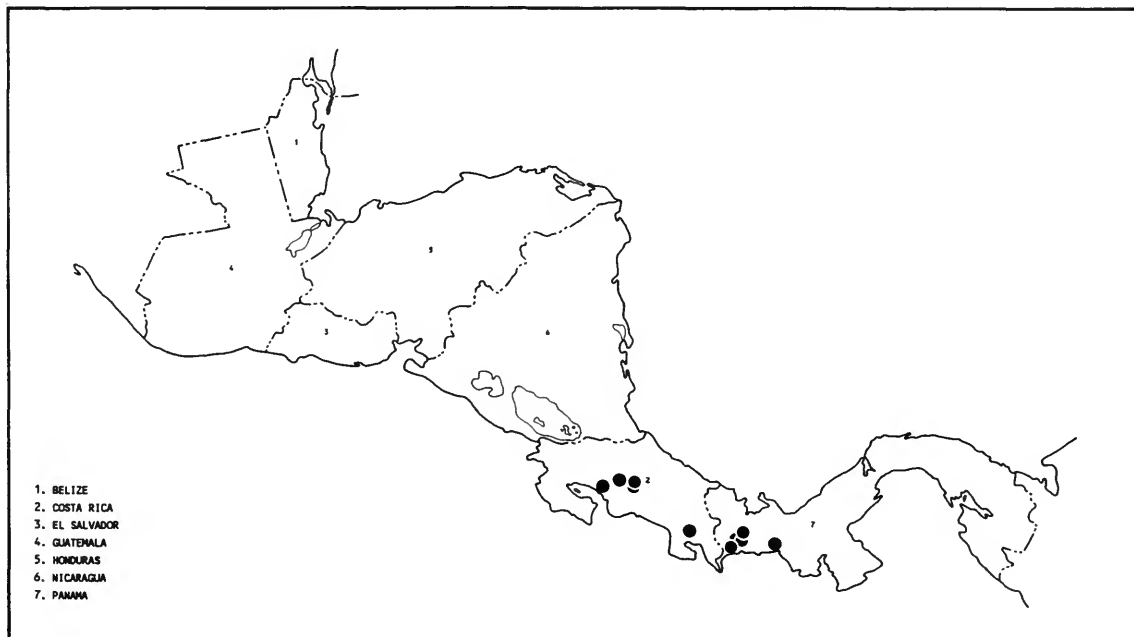


FIGURE 114.—*Hexanchorus emarginatus*, new species, known distribution.

7. *Hexanchorus browni*, new species

FIGURES 115–125

DIAGNOSIS.—Pronotum coarsely, moderately densely punctate. Mesotibia with lateral pubescent area only at extreme base (Figure 118); medial pubescent area about 3 times as long as that on lateral surface (Figure 119). Elytral striae ending at apical fifth. Male genitalia diagnostic; with median lobe broad; parameres (Figure 115) without basolateral emarginations; and basal piece without apical spinous process (Figure 116).

HOLOTYPE (MALE).—*Body Form and Size:* Elongate, subparallel, moderately convex. Length, 3.09 mm; width (across elytral humeri), 1.14 mm.

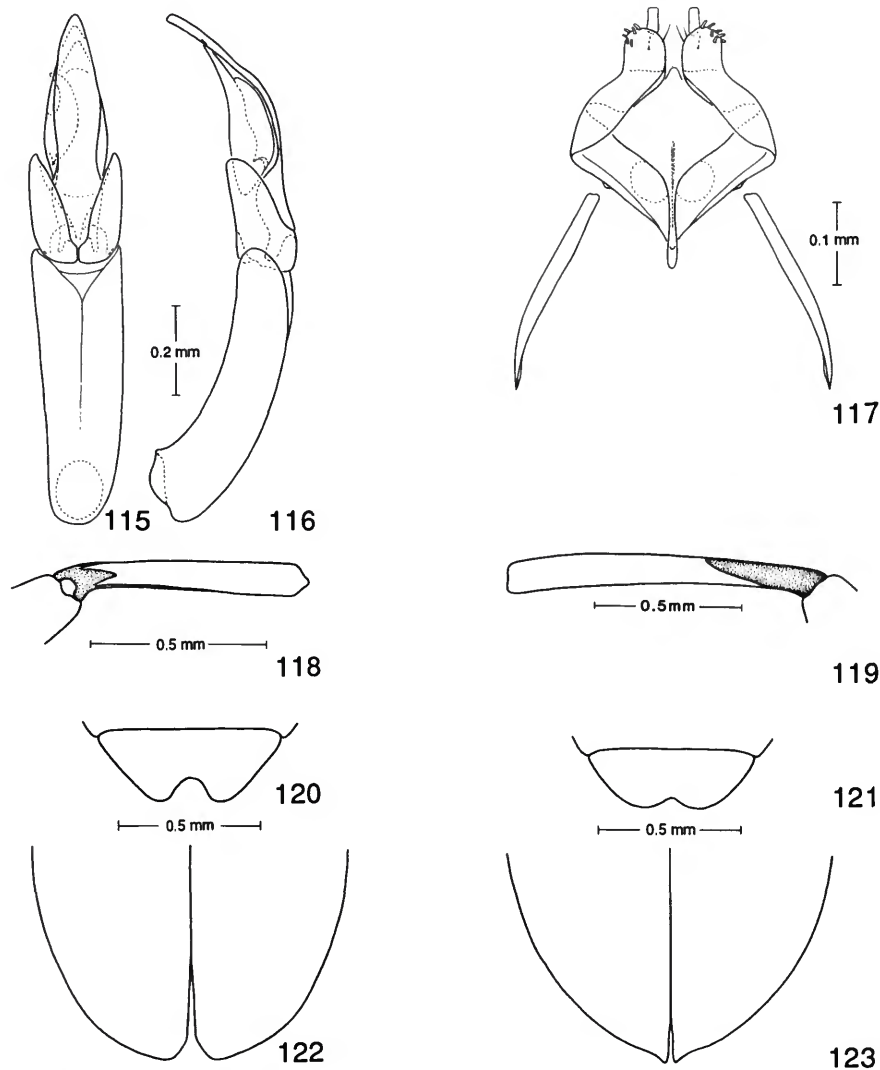
Color: Cuticle black to dark reddish brown; basal antennal segments 1 and 2, mouthparts, trochanters, base of femora, mesotibiae, and claws paler. With fine, short, reddish brown, hair-like setae dorsally; setae on hypomerion and sides of pronotum without a greenish iridescence. Ventral surface with golden yellow, hair-like setae.

Head: Without distinct impressions. Surface microreticulate; with dense fine punctures and sparse coarse punctures; fine punctures separated by puncture diameter and coarse punctures confluent to separated by 1–3 times puncture diameter. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin slightly arcuate; angle on each side broadly rounded. Eyes narrowed posteriorly and bordered by long black setae that arise near

dorsal and ventral sides of eyes and extend toward middle of eye. Antenna pubescent; longer setae on basal segments 1 and 2 longer than width of segments; segments of club compact, with dense short setae and sparse longer setae; longer setae on club shorter than $\frac{1}{2}$ width of segments.

Thorax: Pronotum broader than long (0.91 mm : 0.75 mm); base broader than apex; broadest at basal two-fifths; with shallow basomedial impressions; surface punctate as head; with most coarse punctures separated by puncture diameter or less. Scutellum slightly longer than broad; moderately convex, not elevated above adjacent elytral intervals. Elytron 2.31 mm long, 0.57 mm wide. Elytra more than 3 times as long as pronotum; broadest point across humeri but only slightly broader than at apical third; inner side of apex rounded; lateral margins smooth; humeri moderately gibbous; sutural interval raised on posterior four-fifths, other intervals flat; coarse punctures on intervals very sparse, no larger than coarse punctures of head and pronotum; interval punctures separated by 2–5 times puncture diameter; mid-discal striae punctures round, separated longitudinally by $\frac{1}{2}$ –2 times puncture diameter, and $\frac{1}{3}$ – $\frac{1}{2}$ as broad as intervals; punctures becoming slightly finer laterally; punctures and striae becoming shallower apically, effaced on apical sixth. Prosternum slightly concave medially. Prosternal process long, moderately broad. Protibiae slightly curved inward near apical third. Mesotibiae with pubescence only at extreme base laterally (Figure 118).

Abdomen: Sterna 1, 2, and three-fourths of sternum 3 with



FIGURES 115-123.—*Hexanchorus browni*, new species, adult: 115, male genitalia, ventral view; 116, male genitalia, lateral view; 117, female genitalia, ventral view; 118, mesotibia, lateral view, male; 119, mesotibia, medial view, male; 120, abdominal sternum 5, male; 121, abdominal sternum 5, female; 122, elytral apices, male; 123, elytral apices, female.

disc deeply concave. Sternum 1 with carina on each side of concavity extending to posterior fifth. Sternum 5 with apicomedial margin deeply and narrowly emarginate (Figure 120).

Genitalia: As illustrated (Figures 115, 116).

FEMALE.—Externally similar to male except inner apex of each elytron turned upward at an angle to general surface. Metasternal disc not as deeply and less extensively concave. Abdominal sterna 1-3 convex, not concave. Abdominal sternum 5 with apicomedial margin shallowly and moderately

narrowly emarginate (Figure 121). Genitalia as illustrated (Figure 117).

VARIATIONS.—There are minor differences in size and slight differences in punctuation. Males ($n = 11$) range in length from 2.86 to 3.74 mm ($\bar{x} = 3.37$ mm); females ($n = 5$) range from 2.94 to 3.43 mm ($\bar{x} = 3.25$ mm). The greenish iridescence of the fine hairs on the dorsal surface is visible only in certain light.

TYPE DATA.—*Holotype (Male):* PANAMA: Chiriquí: David (9 km N), waterfalls at Balneario San Francisco, 31 May

1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner; deposited in the National Museum of Natural History, Smithsonian Institution.

Allotype: Same data as holotype.

Paratypes: Same data as holotype, 496 spms. MEXICO: Veracruz: Catemaco, 7–9 Aug 1964, P.J. Spangler, 23 spms (NMNH).

COSTA RICA: *Puntarenas*: Canoas (4 mi W), stream, 10 Nov 1966, H.P. Brown, 131 spms (HPB); Volcán, Río Cacao, 8 Nov 1966, H.P. Brown, 4 spms (HPB). *San José*: Río Peje, Pan American Hiway, 23 Jun 1977, C.L. Hogue, 4 spms (LACM).

PANAMA: *Canal Zone*: Barro Colorado Island, 30 Jun 1987, D. Quintero, R. Rodríguez, R. Cambra, 2 spms (UPan). *Chiriquí*: Bambito, 2 Jun 1983, 1770 m, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 2 spms (NMNH); Boquete, 16–17 Jul 1967, O.S. Flint, Jr., 1 spm (NMNH); Caldera, 1770 m, 1 Jun 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 6 spms

(NMNH); Concepción (west of), Río Guigala, 18 Nov 1966, H.P. Brown, 34 spms (HPB); Cuenca Fortuna, Quebrada Honda, 16 May 1985, R.W. Flowers, 1 spm (NMNH); David (northeast of), 24 Jun 1968, H.P. Brown, 12 spms (HPB); Dolega (south of), 24 Jun 1968, H.P. Brown, 6 spms (HPB); Guabalá (south of), 14 Nov 1966, H.P. Brown, 10 spms (HPB); Horqueta, 24 Jun 1968, H.P. Brown, 1 spm (HPB); Pueblo Nuevo, Río Cochea, 15–16 Nov 1966, H.P. Brown, 2 spms (HPB). *Cocle*: El Valle, 26 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 11 spms (NMNH); El Valle, 27 May 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 2 spms (NMNH); El Valle, 10–13 Jun 1985, E. Riley, D. Rider, 4 spms (LSU); El Valle, Río Anton–Los Mozos, 20 May 1987, D. Quintero, R. Cambra, J. Tovar, R. Rodríguez, 2 spms (UPan); Machuca (near), trib. of Río Grande, 25 Jun 1968, H.P. Brown, 8 spms (HPB); Penonomé (west of), Río Churubé, 12 Nov 1966, H.P. Brown, 4 spms (HPB). *Herrera*: Los Pozos, 22 Oct 1952, Blanton, 1 spm (NMNH). *Panamá*: Cerro Azul,

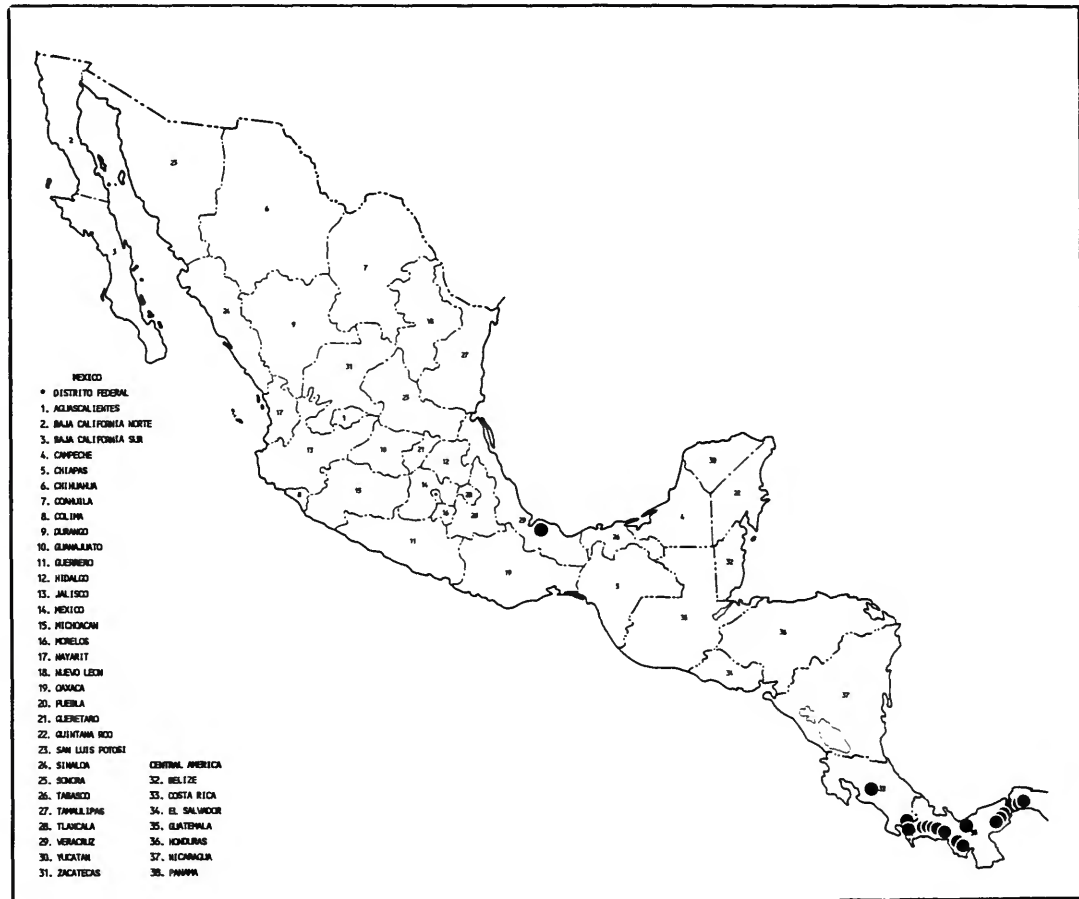


FIGURE 124.—*Hexanchorus browni*, new species, known distribution.



FIGURE 125.—*Hexanchorus browni*, new species, type locality biotope: Panama, Chiriquí, David (9 km north), waterfalls at Balneario San Francisco. (Photo by W.E. Steiner)

Hidroeléctrica, Río Indio, 9 Jun 1985, E. Riley, D. Rider, 62 spms (LSU); Chepo (west of), Río Chico, 21 Jun 1968, H.P. Brown, 4 spms (HPB); Chorrera (west of), small río, 12 Nov 1966, H.P. Brown, 12 spms (HPB); Pacora (north of), Río Cabra, 23 Nov 1971, H.P. Brown, 142 spms (HPB); Pacora (north of), Río Pacora, 26 Jun 1968, H.P. Brown, 16 spms (HPB). *Veraguas*: Jorones (near), 13 Nov 1966, H.P. Brown,

8 spms (HPB); Soná (east of), 13 Nov 1966, H.P. Brown, 7 spms (HPB).

ETYMOLOGY.—This species is dedicated to our friend, colleague, and “riffle beetle buff,” Harley P. Brown, in recognition of his many contributions to the systematics of dryopoid beetles and generous loans and gifts for this and other studies.

DISTRIBUTION (Figure 124).—This species is known from Costa Rica, Mexico, and Panama.

HABITAT.—Specimens of this species have been found, often in large numbers, above the water level on the sides of rocks and waterfalls in small to large streams (0.65–30 m wide).

The large series from the type locality (Figure 125) were collected from a shaded margin of the river. The river was about 15 m wide and 35–65 cm deep except for a pool that was about 2¹/₂ m deep and directly below the falls; the substrate was composed of sand, gravel, and rocks; the velocity was about 48 cm/second.

Other aquatic insects collected at the type locality along with this species were: Coleoptera: Elmidae: *Phanocerus*, *Microcylloepus*, *Heterelmis*; Psephenidae: *Psephenops*; Lutrochidae: *Lutrochus*. Heteroptera: Naucoridae: *Cryphocricus*, *Ambrysus*; Veliidae: *Rhagovelia*; Hebridae: *Hebrus*.

8. *Hexanchorus gracilipes* Sharp

FIGURES 126–155

Hexanchorus gracilipes Sharp, 1882:128; 1887:775.—Zaitzev, 1908:288; 1910:7.—Hinton, 1935:177; 1937a:96; 1940a:233.—Blackwelder, 1944:272.

Hexanchorus gracilipes.—Grouvelle, 1896:77 [misspelling].

Hexanchorus gracilipes orientalis Zaragoza, 1982:354 [new synonym].

DIAGNOSIS.—Scutellum strongly convex. Mesotibia with lateral pubescent area only at extreme base (Figure 147) and medial pubescent area short, about as long as that on lateral surface (Figure 148). Male genitalia, in lateral view, with apex of median lobe hooked; apices of parameres rounded (Figures 144, 145).

REDESCRIPTION (MALE).—*Body Form and Size*: Elongate, subparallel, moderately convex. Length, 3.5 mm; width (across elytral humeri), 1.36 mm.

Color: Cuticle black to reddish black; basal antennal segments 1 and 2, mouthparts, trochanters, base of femora, tibiae, and claws paler. With fine, short, reddish brown, hair-like setae dorsally; setae on hypomeron and sides of pronotum with a greenish iridescence. Ventral surface with golden yellow, hair-like setae.

Head: Without distinct impressions. Surface microreticulate, with dense fine punctures and sparse coarse punctures; fine punctures separated by distance equal to puncture diameter and coarse punctures confluent to separated by 1–3 times puncture diameter. Clypeus with anterior margin truncate; angle on each side broadly rounded. Labrum with anterior margin shallowly and arcuately emarginate at middle; angle on each side broadly rounded. Eyes narrowed posteriorly and bordered by long black curved setae that arise near dorsal and ventral sides of eyes and extend toward middle of eye. Antenna pubescent; setae on basal segments 1 and 2 long, longer than width of segments; segments of club compact, with dense

setae; setae on club shorter than ¹/₂ width of segments. Maxillary palpus as illustrated (Figures 137, 138). Labial palpus as illustrated (Figures 139, 140).

Thorax: Pronotum broader than long (1.10 mm : 0.87 mm); broadest point at basal two-fifths; base broader than apex; surface punctate as head; with most coarse punctures separated by their diameter or less. Scutellum slightly longer than broad; moderately convex, distinctly elevated above the adjacent elytral intervals. Elytron 2.62 mm long, 1.36 mm wide. Elytra, 3 times as long as pronotum; broadest point across humeri but only slightly broader than broadest point at apical third; inner side of apex rounded; lateral margins smooth; humeri moderately gibbous; sutural interval raised on posterior two-thirds, other intervals flat; punctures on intervals no larger than finest punctures of head and pronotum and separated by 2–5 times puncture diameter; mid-discal striae punctures round to subquadrate, separated longitudinally by less than diameter of puncture, and ¹/₃–¹/₂ as broad as intervals; punctures becoming finer and intervals becoming broader basally; punctures becoming slightly finer laterally; apically punctures becoming finer and striae shallower, effaced on apical sixth. Prosternum shallowly concave medially. Prosternal process long, moderately broad. Protibiae slightly curved inward near apical third. Mesotibiae with fine, short, nearly longitudinal carina on inner apex.

Abdomen: Entire disc of sterna 1 and 2, and anterior three-fourths of sternum 3 deeply concave. Sternum 1 with carina on each side of concavity extending to posterior fourth or fifth. Apicomedial margin of sternum 5 deeply and broadly emarginate.

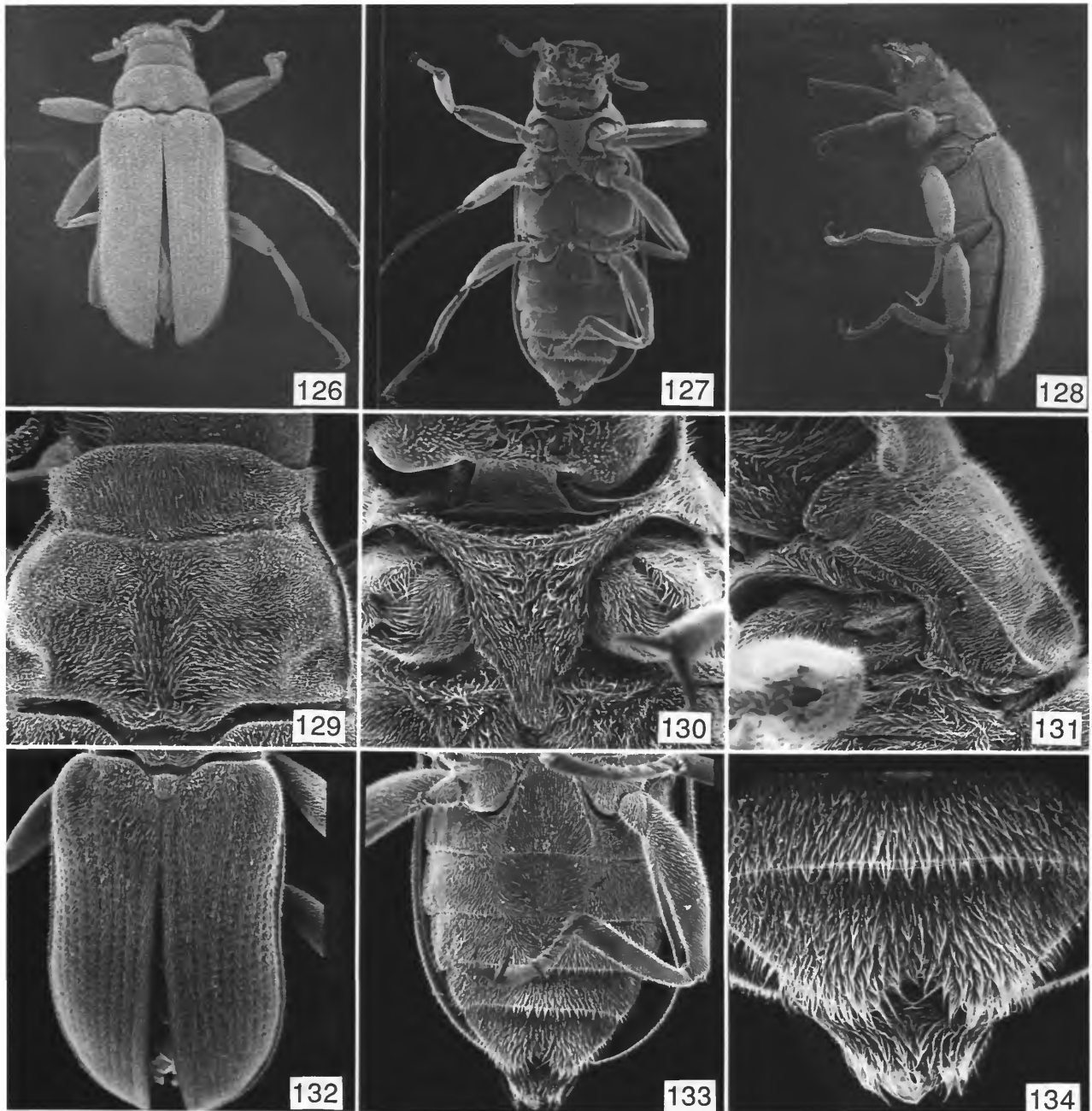
Genitalia: As illustrated (Figures 144, 145).

FEMALE.—Externally similar to male except inner apex of each elytron slightly turned upward at an angle to general surface. Protibiae slightly less curved than those of male. Mesotibiae without carina on inner apex. Metasternal disc not as deeply and less extensively concave. Abdominal sterna 1–3 convex, not concave; apicomedial margin of sternum 5 shallowly and moderately narrowly emarginate. Genitalia as illustrated (Figure 146).

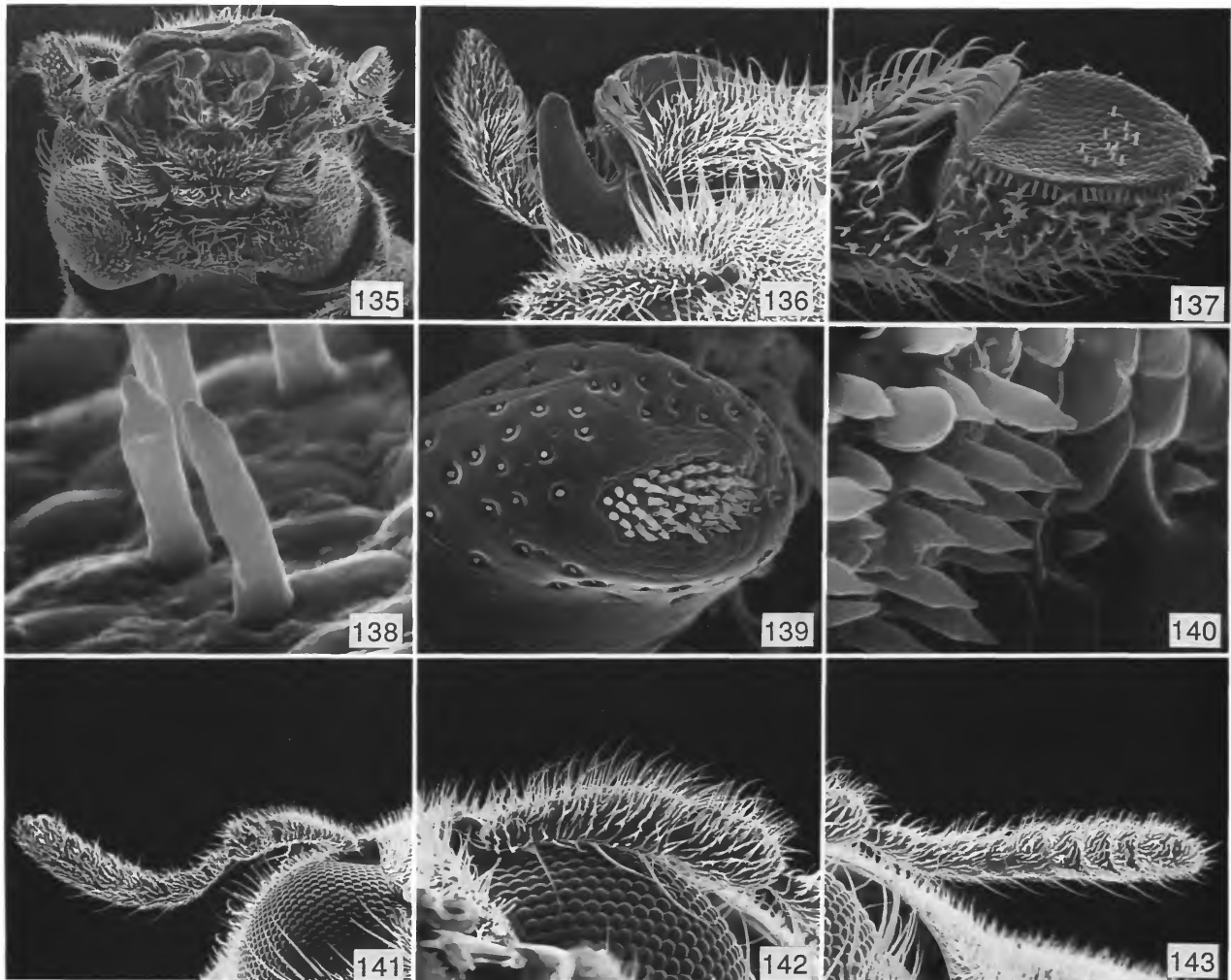
VARIATIONS.—There are differences in size and slight differences in punctation. In many specimens the greenish iridescence of the fine pubescence on the dorsal surface is not present. A few individuals have elytral interval 3 slightly convex in the discal region. Males ($n = 5$) range in length from 3.23 to 3.50 mm ($\bar{x} = 3.39$); females ($n = 5$) range from 3.59 to 3.83 mm ($\bar{x} = 3.73$ mm).

TYPE DATA.—*Lectotype* (Male): MEXICO: [Puebla]: Chinantla Sallé; deposited in The Natural History Museum, London (BMNH); here designated.

When Sharp (1882) described *Hexanchorus gracilipes* he did so from a “few specimens” and no type was designated. Christine von Hayek reported (in litt.) that there were six syntype specimens of that species in The Natural History



FIGURES 126-134.—*Hexanchorus gracilipes* Sharp, adult: 126, habitus, dorsal view, $\times 25$; 127, habitus, ventral view, $\times 25$; 128, habitus, lateral view, $\times 25$; 129, pronotum, $\times 80$; 130, prosternal process, $\times 100$; 131, hypomeron and procoxa, $\times 95$; 132, elytra, $\times 40$; 133, abdomen, $\times 47$; 134, abdominal sterna 4, 5, 6, $\times 120$. (Reduced to 69% for publication.)



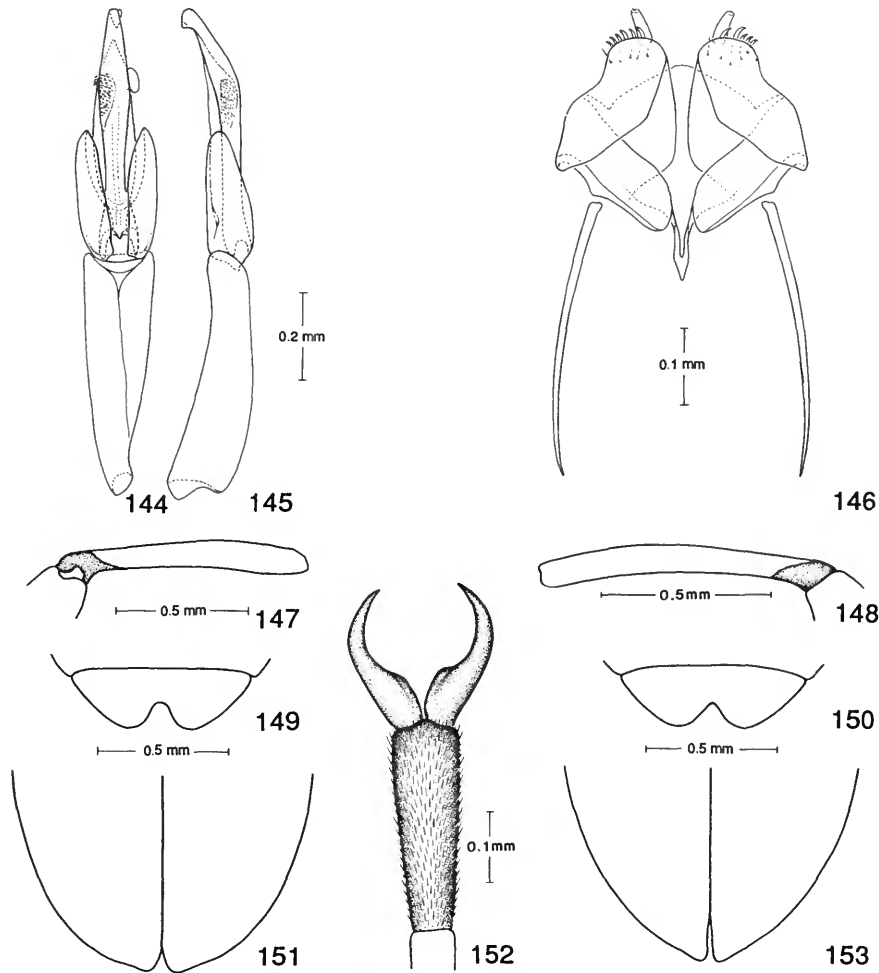
FIGURES 135-143.—*Hexanchorus gracilipes* Sharp, adult: 135, head, mouthparts, $\times 100$; 136, left mandible, $\times 180$; 137, maxillary palpus, apical segment, $\times 600$; 138, maxillary palpus, sensilla, $\times 10,200$; 139, labial palpus, apex, $\times 1400$; 140, labial palpus, sensilla, $\times 10,000$; 141, antenna, ventral view, $\times 130$; 142, antenna, ventral view, basal half, $\times 260$; 143, antenna, ventral view, apical half, $\times 200$. (Reduced to 61% for publication.)

Museum, London, and she kindly lent two male syntypes to us.

One of the specimens lent to us has the following data: [1] "*Hexanchorus gracilipes* / Chinantla. Mexico Sallé / σ "—all hand printed on the card on which the specimen is mounted; [2] "SYNTYPE"—printed on a blue and white disc; and [3] "Sp. figured"—printed on a label. This specimen has all legs and antennae intact and the male genitalia was partly extruded. We

have dissected, cleared, and examined the genitalia of this specimen and then placed the genitalia in glycerine in a microvial now attached to the pin on which the specimen is mounted. We here designate this specimen as the lectotype of *H. gracilipes* Sharp and have so labeled it.

The other syntype lent to us is in poor condition and the genitalia is not evident. Although "Type" is hand printed on the



FIGURES 144-153.—*Hexanchorus gracilipes* Sharp, adult: 144, male genitalia, ventral view; 145, male genitalia, lateral view; 146, female genitalia, ventral view; 147, mesotibia, lateral view, male; 148, mesotibia, medial view, male; 149, abdominal sternum 5, male; 150, abdominal sternum 5, female; 151, elytral apices, male; 152, protarsus, apical segment, male; 153, elytral apices, female.

card on which this specimen is mounted, we do not consider this to be a valid type and chose the syntype discussed above as the lectotype. This specimen is recorded under specimens examined.

SPECIMENS EXAMINED.—MEXICO: *México*: Temascaltepec, Real de Arriba, 11 Jul [19]33, H.E. Hinton, R.L. Usinger, 2 spms (UCaIB). *Puebla*: Chinantla, Sallé, 1 spm (BMNH). *Veracruz*: Balzapote, 5 May 1981, G. Ortega, 1 spm (UNAM); Catemaco, 7-9 Aug 1964, P.J. Spangler, 38 spms (NMNH); Los Tuxtlas area, above La Palma, Río La Palma, 7-14 May 1981, C.M. and O.S. Flint, 19 spms (NMNH); Los Tuxtlas area, above La Palma, Río La Palma, 13 May 1981, P.J. Spangler, 16 spms (NMNH); Los Tuxtlas area,

Río La Palma, 22 Sep 1979, J. Padilla, 2 spms (UNAM); Los Tuxtlas area, Río Máquinas, 5 May 1981, S. Santiago, 1 spm (UNAM); Los Tuxtlas area, Río Máquinas, 11 May 1981, P.J. Spangler, 17 spms (NMNH); Los Tuxtlas area, Río Máquinas, 13 May 1981, P.J. Spangler, 45 spms (NMNH); Río La Palma, 6 May 1981, S. Santiago, 2 spms (UNAM).

GUATEMALA: *Suchitepequez Department*: Puente Ixtapa, 28 Jun 1966, O.S. Flint and M.A. Alberto Ortiz, 3 spms (NMNH).

DISTRIBUTION (Figure 154).—This species is presently known only from Guatemala and Mexico.

HABITAT.—Adult specimens of this species have been found, often in large numbers, above the water level and at the

air-water interface on rocks in small to large streams (1-30 m wide). At times, adults are found underwater on the downstream side of rocks and, when submerged, they are completely surrounded by a film of air. Adults and larvae appear to feed on the periphyton growing near the water level on rocks.

Specimens of *H. gracilipes* were numerous in the Río La Palma (Figure 155) near Los Tuxtlas Biological Station in the state of Veracruz, near Catemaco, Mexico. The Río La Palma varied in width from 5-15 m and had a depth to about 66 cm. The stream was clear, shaded most of the day, and had a substrate of gravel, rocks, and boulders. Colorimetric water chemistry tests provided the following data: oxygen, 12 ppm; pH, 6; hardness, 2.5. The water temperature was 24°C and the air temperature was 34.5°C when the data were obtained.

The following aquatic and semiaquatic Coleoptera were found in association with *H. gracilipes* in the Río La Palma: Elmidae: *Phanocerus*, *Macrelmis*, *Hexacylloepus*, *Heterelmis*; Dryopidae: *Helichus*; Psephenidae: *Psephenops*; Lutrochidae:

Lutrochus; Ptilodactylidae: *Anchytarsus*.

BIOLOGY.—Hinton (1940a) reported that the eggs of *H. gracilipes* are nearly round, have a diameter of about 0.30 mm, and a densely reticulate surface. As may be seen from an examination of their gut contents, the larvae feed on decaying vegetable material during the time they are in the water. When the larvae are mature they crawl out of the water and burrow under the algal or moss matting, often more than 3 feet above the water level. Under the matting, they construct a small cell in which they pupate.

Unlike adults of *Phanocerus* that are often found in leaf packs underwater, specimens of *Hexanchorus* are found on rock surfaces primarily at the air-water interface and sometimes under water.

On several occasions we have observed numerous adults of *H. gracilipes* flying rapidly above rocks that were continually bathed in fast flowing water. Because of their fast flight and small size, their activity could not be definitely ascertained.

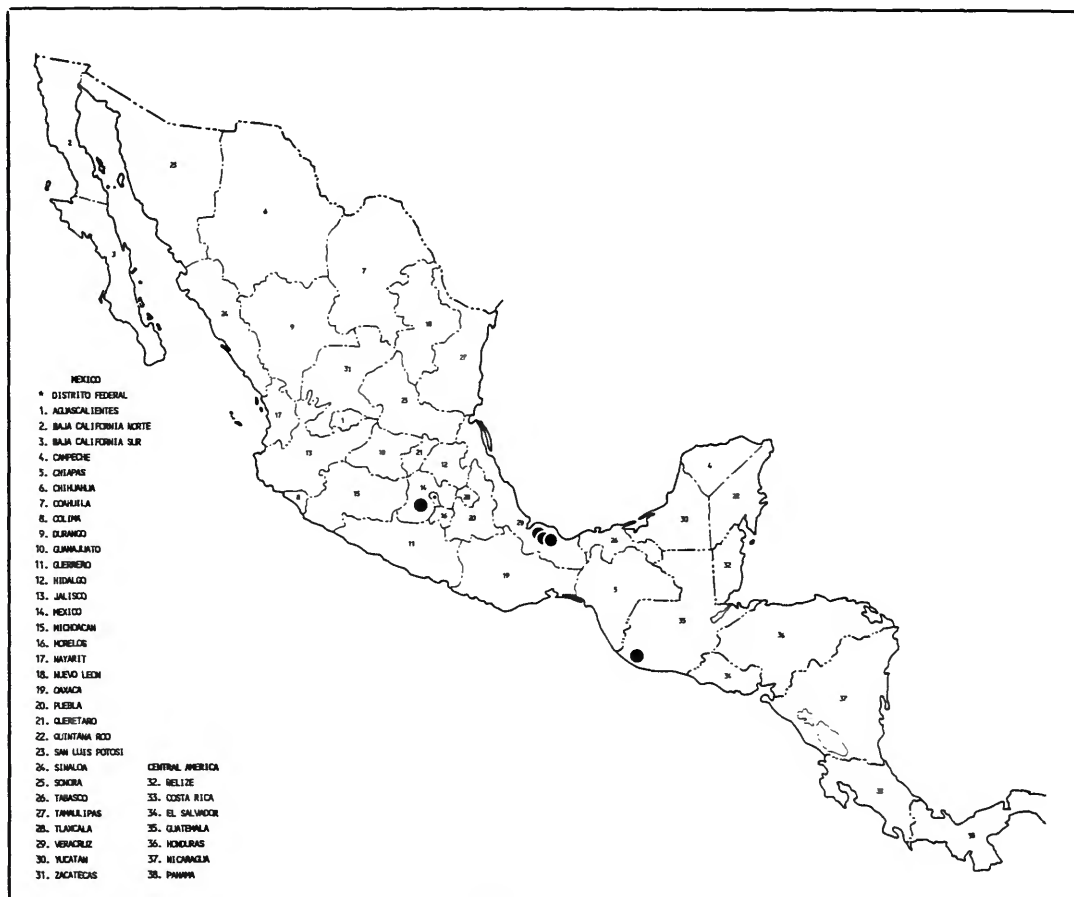


FIGURE 154.—*Hexanchorus gracilipes* Sharp, known distribution.



FIGURE 155.—*Hexanchorus gracilipes* Sharp, biotope; Río La Palma, at La Palma, Veracruz, Mexico.

However, they seemed to fly into and out of the current of water as it poured over vertical surfaces on the downstream side of the rocks. Adults could be easily located on the vertical rock surfaces by spotting the silvery "air bubble" formed as the hydrofuge cuticular pubescence repelled the water. As soon as the beetles released their tenacious grip on the rocks, they were carried away by the current and the "bubble" immediately disappeared. Seemingly, the beetles get carried to the water's surface and then appear to fly up and away from it. Spangler also observed the same behavior by *H. caraibus* on the island of Dominica.

Adults of *H. gracilipes* placed in a jar of water were covered with a bubble of air as they crawled about over a submerged stick provided as a foothold.

9. *Hexanchorus caraibus* (Coquerel)

FIGURES 156-167

Potamophilus caraibus Coquerel, 1851:601.

Xexanchorus caraibus.—Grouvelle, 1896:77 [misspelling].

Hexanchorus caraibus.—Zaitzev, 1908:288; 1910:7.—Leng and Mutchler, 1914:423.—Darlington, 1936:73.—Hinton, 1937a:96; 1940a:233.—Blackwelder, 1944:272.—Legros, 1947:86.

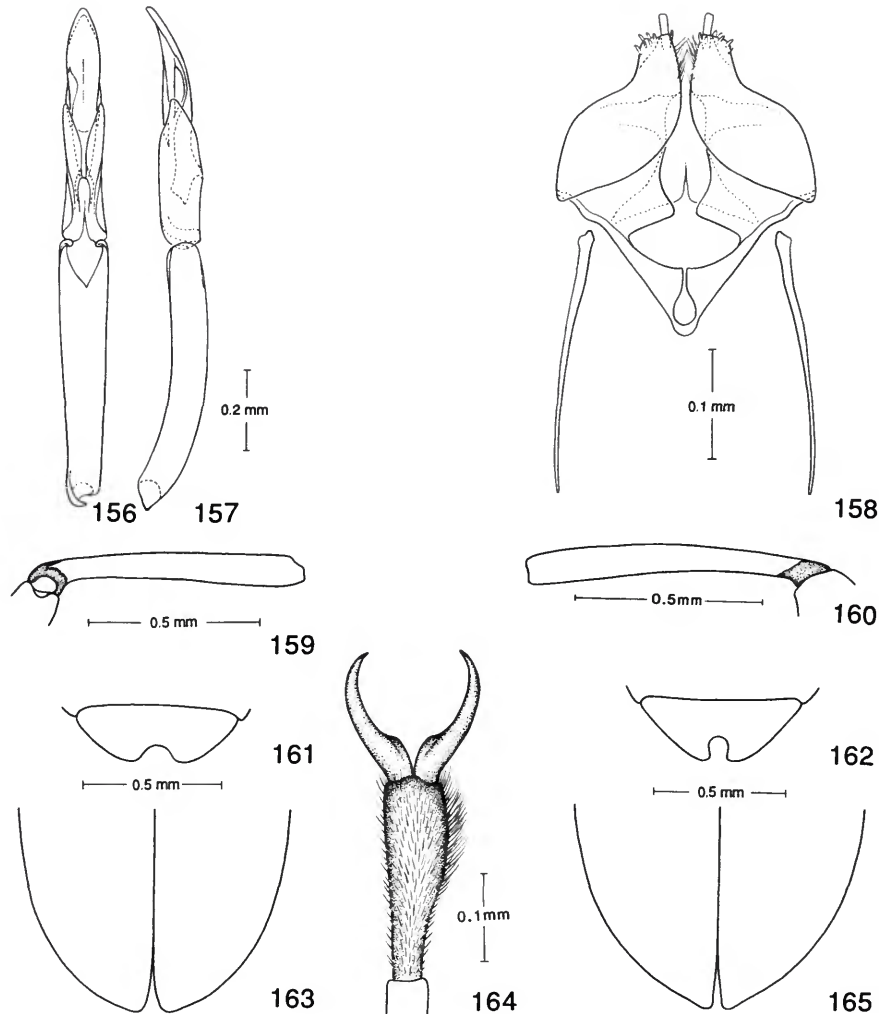
Hexanochorus caraibus.—Hinton, 1971:252 [misspelling].

DIAGNOSIS.—Scutellum flat or only slightly raised. Mesotibia with lateral pubescent area only at extreme base (Figure 159). Mesotibia with medial pubescent area short (Figure 160), about as long as that on lateral surface. The males of this species may be distinguished from all other known species of the genus by the protarsus, which is expanded and bears a tuft of long setae apicomediaally (Figure 164). Male genitalia, in lateral view, with apex of median lobe not hooked; apices of parameres rounded (Figures 156, 157).

REDESCRIPTION (MALE).—*Body Form and Size:* Elongate, subparallel, moderately convex. Length, 3.16 mm; greatest width (across elytral humeri), 1.18 mm.

Color: Cuticle black to reddish black; mouthparts, trochanters, base of femora, tibiae, and claws paler. With fine, short, reddish brown, hair-like setae dorsally; often with a greenish iridescence. Ventral surface with golden yellow, hair-like setae.

Head: Without distinct impressions. Surface with fine and coarse punctures; punctures separated by 1-3 times puncture diameter; coarse punctures sparse. Clypeus with anterior margin subtruncate; angle on each side broadly rounded. Labrum with anterior margin subtruncate; angle on each side broadly rounded. Eyes narrowed posteriorly and protected by



FIGURES 156-165.—*Hexanchorus caraibus* (Coquerel), adult: 156, male genitalia, ventral view; 157, male genitalia, lateral view; 158, female genitalia, ventral view; 159, mesotibia, lateral view, male; 160, mesotibia, medial view, male; 161, abdominal sternum 5, male; 162, abdominal sternum 5, female; 163, elytral apices, male; 164, protarsus, apical segment, male; 165, elytral apices, female.

long, curved, black setae that arise near dorsal and ventral sides of eyes and meet above the eye at middle.

Thorax: Pronotum broader than long (0.84 mm : 0.62 mm); base broader than apex; surface less densely punctate than head; with fine and coarse punctures; coarse punctures separated by 1-3 times puncture diameter. Scutellum slightly longer than broad; moderately convex; on same plane as adjacent elytral intervals. Elytron 2.31 mm long, 0.59 mm wide. Elytra more than 3 times as long as pronotum; broadest across humeri but only slightly broader than at apical third; inner side of apex rounded; lateral margins smooth; humeri moderately gibbous; sutural interval raised on posterior

two-thirds, other intervals flat; punctures on intervals no larger than finest punctures of head and pronotum, punctures separated by 2-4 times puncture diameter; punctures of mid-discal striae round, separated longitudinally by 2-4 times puncture diameter and $1/4-1/3$ as broad as intervals; punctures becoming finer and intervals becoming broader basally; punctures becoming slightly finer laterally; apically punctures becoming finer until effaced on apical sixth. Prosternum shallowly concave medially. Prosternal process long, moderately broad, concave medially. Protibiae slightly curved inward near apical third. Mesotibiae, except extreme base, glabrous laterally and medially. Last segment of protarsus (Figure 164)

expanded and with a tuft of long setae apicomediaally.

Abdomen: Sterna 1 and 2 with entire disc concave. Sternum 3 with anterior half deeply concave. Sternum 1 with discal carina extending to posterior fourth or fifth. Apicomedial margin of sternum 5 moderately broadly, deeply emarginate (Figure 161).

Genitalia: As illustrated (Figures 156, 157).

FEMALE.—Externally similar to male except inner apex of each elytron slightly turned upward at an angle to general surface. Last segment of protarsus without tuft of long setae on medial surface apically. Metasternal disc not as deeply and less extensively concave. Abdominal sterna 1–3 convex ventrally, not concave; sternum 5 with apical margin very narrowly and deeply emarginate (Figure 162). Genitalia as illustrated (Figure 158).

VARIATIONS.—In addition to differences in size there are frequent differences in punctures and striae. Males ($n = 5$) range in length from 2.82 to 3.16 mm ($\bar{x} = 2.97$ mm); females ($n = 5$) range in length from 2.96 to 3.21 mm ($\bar{x} = 3.11$ mm). On some specimens the elytral stria punctures on the basal half are coarser and denser than those on other specimens. Striae become effaced near the midlength on some specimens and become effaced at the apical third on others. In many specimens the greenish iridescence of the fine hair-like setae on the dorsal surface is visible only in certain light.

COMPARATIVE NOTES.—The tuft of setae on the apical half of the medial surface of the moderately swollen last protarsal segment of the males and the structure of the male genitalia will separate males of *H. caraibus* from males of all other described species.

TYPE DATA.—We have not seen the type material that should be in the Muséum National d'Histoire Naturelle, Paris. However, all specimens of *Hexanchorus* that we have seen from the West Indies represent one species and we are confident that they are *H. caraibus*.

SPECIMENS EXAMINED.—WEST INDIES: DOMINICA: Bells (east of), D'Leau Manioc, 192 m, 8 Dec 1965, J.P. Morrison, 5 spms (NMNH); Bells (south of), D'Leau Mome Laurient, 8 Dec 1965, J.P. Morrison, 58 spms (NMNH); Bells (south of), Mome Laurient, 192 m, 8 Dec 1965, J.P. Morrison, 43 spms (NMNH); Boeri Lake, 10 Nov 1964, Bredin-Archbold-Smithsonian Biological Survey of Dominica, P.J. Spangler, 2 spms (NMNH); Clarke Hall, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 5–11 Oct 1964, P.J. Spangler, 4 spms (NMNH); Clarke Hall, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 11–16 Dec 1964, P.J. Spangler, 69 spms (NMNH); Deux Branches, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 19 Nov 1964, P.J. Spangler, 1 spm (NMNH); Fond Figue, 107 m, 5 Nov 1965, J.P. Morrison, 72 spms (NMNH); Fond Figue, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 1 Dec 1964, P.J. Spangler, 1 spm (NMNH); Fond Figue River, 23 Jan 1965, W.W. Wirth, 4 spms (NMNH); Fond Figue River, light trap, 13 Mar 1965, W.W. Wirth, 1 spm (NMNH); Geneva Estate, 9 Dec 1964, Bredin-Archbold-Smithsonian Biological Survey of Dominica, P.J. Spangler, 4 spms (NMNH); Geneva River, 10 m, 14 Apr 1979, F. Starmühlner, 1 spm (NMNH); LaPlaine, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 23 Nov 1964, P.J. Spangler, 1 spm (NMNH); Laudat (Trafalgar Falls), 400 m, 12 Apr 1979, F.

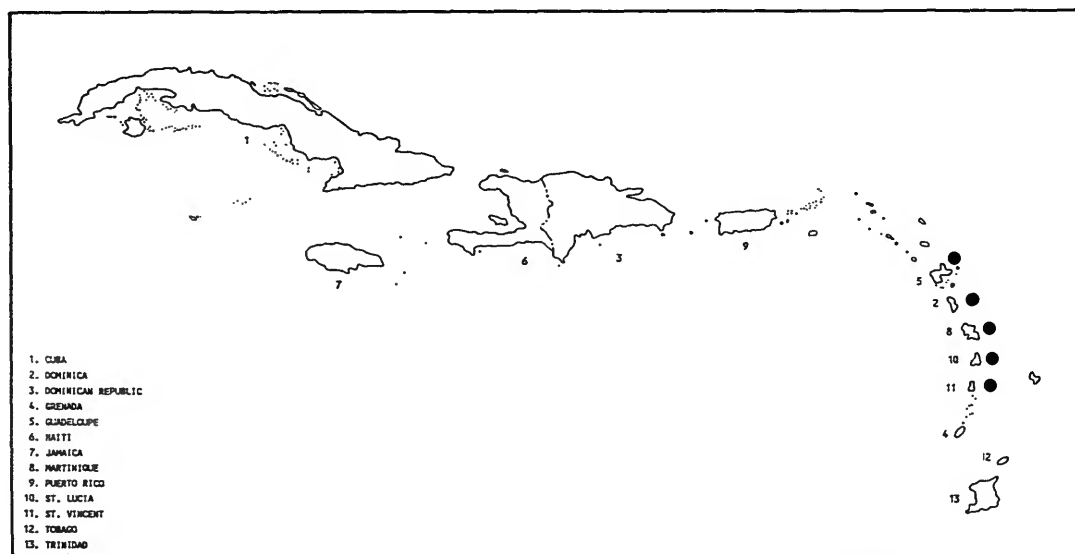


FIGURE 166.—*Hexanchorus caraibus* (Coquerel), known distribution.

Starmühlner, 3 spms (NMNH); Layou River, 70 m, 12 Apr 1979, F. Starmühlner, 1 spm (NMNH); Morne Nichols, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 9 Nov 1964, P.J. Spangler, 2 spms (NMNH); Morne Nichols, Bredin-Archbold-Smithsonian Biological Survey of Dominica, 20 Nov 1964, P.J. Spangler, 21 spms (NMNH); New Springfield Plantation, Check Hall River, 400 m, 9 Apr 1979, F. Starmühlner, 3 spms (NMNH); Pont Casse (2.2 mi E), 14 Apr 1964, O.S. Flint, Jr., 7 spms (NMNH); Pont Casse (2.2 mi E), 1 May 1964, O.S. Flint, Jr., 29 spms (NMNH); Pont Casse (2.2 mi E), 3 May 1964, O.S. Flint, Jr., 4 spms [+ 29 larvae] (NMNH); Pont Casse (3.5 mi N), Bredin-Archbold-Smithsonian Biological Survey of Dominica, 4 Dec 1964, P.J. Spangler, 1 spm (NMNH); Pont Casse (3.5 mi N), Bredin-Archbold-Smithsonian Biological Survey of Dominica, 5 Dec 1964, P.J. Spangler, 35 spms (NMNH); Springfield Estate, 20-26 Jul 1963, O.S. Flint, Jr., 131 spms [+ 40 larvae] (NMNH); Trois Pitons (Trafalgar Falls), 400 m, 12 Apr 1979, F. Starmühlner, 4 spms (NMNH).

GUADELOUPE: Chute du Carpet, 600 m, 27 Mar 1979, F. Starmühlner, 1 spm (NMNH); Grand Rivier des Vieux Habitants, 215 m, 31 Mar 1979, F. Starmühlner, 3 spms

(NMNH); l'Habitée (west of Capes Terres), 180 m, 16 Mar 1979, F. Starmühlner, 10 spms (NMNH); Rivier Bras de David (near Domaine Duclos), Rivier Belle Eau, 100 m, 8 Mar 1979, F. Starmühlner, 3 spms (NMNH).

MARTINIQUE: Ajoupa Baillou, Rivier du Gorge de la Falaise, 300 m, 24 Apr 1979, F. Starmühlner, 15 spms (NMNH); Alma (near), Rivier Blanche, 423 m, 19 Apr 1979, F. Starmühlner, 18 spms (NMNH); Rivier Lezard, 8 Apr 1979, F. Starmühlner, 1 spm (NMNH); Rivier Lezard, 128 m, 25 Apr 1979, F. Starmühlner, 17 spms (NMNH); St. Pierre to Morne Rouge, 160 m, 26 Apr 1979, F. Starmühlner, 15 spms (NMNH).

SAINT LUCIA: Cul de Sac River, at milepost 9, 29 Jul 1963, O.S. Flint and Cadet, 6 spms (NMNH).

SAINT VINCENT: Buccament Valley, Delaware River, Leeward Coast, 18 Feb 1971, A.D. Harrison, 1 spm (NMNH); Caratal River, rocky and torrential, 76 m, 9 Mar 1971, A.D. Harrison, 6 spms (NMNH); Grand Bonhomme Mt., mountain stream, 396 m, 1 Jul 1971, A.D. Harrison, 3 spms (NMNH); Grand Sable River, stony run, windward coast, 107 m, 18 Mar 1971, A.D. Harrison, 3 spms (NMNH); South Coast, Calliagua River, 7 Feb 1971, A.D. Harrison, 1 spm (NMNH).

DISTRIBUTION (Figure 166).—This species is known from



FIGURE 167.—*Hexanchorus caraiibus* (Coquerel), biotope; Layou River at Clark Hall, Dominica; river in flood stage.

various islands of the Lesser Antilles and we have seen specimens from Dominica, Guadeloupe, Martinique, Saint Lucia, and Saint Vincent.

HABITAT.—Specimens of this species have been collected in many small to large streams (1–25 m wide) and are often found in large numbers at the air-water interface. When submerged they are completely surrounded by a bubble of air. Spangler found this to be the dominant species of water beetle in the streams of Dominica (Figure 167) when he collected there in 1964.

Pseudodisersus Brown, 1981

Disersus.—Hinton, 1940a:230; 1940b:142 [larva misidentified in key].
Pseudodisersus Brown, 1981a:98 [type species: *Pseudodisersus coquereli* Brown, 1981a:100, by original designation; now a junior synonym of *Pseudodisersus goudotii* (Guérin-Méneville, 1843:18)]; 1981b:137.—Spangler and Santiago, 1987:29.

DIAGNOSIS.—Length, to 7.34 mm. Pronotum with arcuate sublateral impressions, a transverse impression at apical third, 2 robust tubercles basomedially, and bidentate posterolateral angles (Figures 6, 171).

ADULT.—Body elongate, subparallel, and moderately convex. Integument clothed with dense, fine, usually recumbent, hair-like setae.

Head partly retracted into pronotum. Maxillary palpus, 4 segmented. Labial palpus, 3 segmented. Antenna, 11 segmented. Labrum transversely rectangular; apical margin broadly arcuate; anterolateral angles broadly rounded.

Pronotum widest at base; narrowed anteriorly; sides narrowly rimmed; posterior angles bidentate; posterior margin raised medially; base emarginate in front of scutellum; with a deep, anterior, transverse impression and a distinct, median, longitudinal impression extending from base to anterior transverse impression. Hypomeron vertical. Scutellum moder-

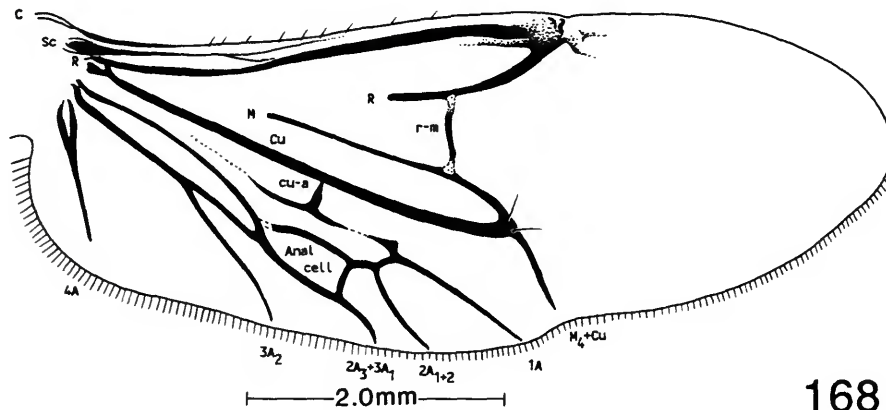
ately convex, triangular. Elytra with punctate striae; without accessory stria. Hind wing (Figure 168) without radial cross vein; with closed anal cell; with anal vein 1 interrupted between cubito-anal cross vein and wing margin; anal vein 2 with branches 1 and 2 fused; first branch of anal vein 3 joining third branch of anal vein 2 on posterior margin of anal cell slightly distad to base of cell. Prosternum in front of procoxae short, as long as width of basal protarsal segment. Prosternal process triangular; apex tapering, rounded. Mesosternum with a deep depression on midline for the reception of prosternal process. Metasternum with disc concave; with a deep, narrow, longitudinal impression on midline. Epipleuron vertical to posterior margin of sternum 4 then inflexed horizontally.

Abdominal sternum 1 with disc shallowly concave in males and slightly convex in females. Sides of discal area carinate in both sexes. Sterna 1–4 progressively shorter; tapering from posterior margin of sternum 2 to narrow apex.

LARVA (BY ASSOCIATION) (Figures 169, 170).—Length, to 15.5 mm; greatest width, 2.5 mm. Body elongate, subovate; moderately convex dorsally; moderately flattened ventrally; subtriangular in cross section. Margins of mesothoracic, metathoracic, and abdominal segments narrowly expanded laterally. Margins of abdominal segments with acute posterolateral angles. Thoracic and abdominal terga without longitudinal rows of low tubercles bearing setae.

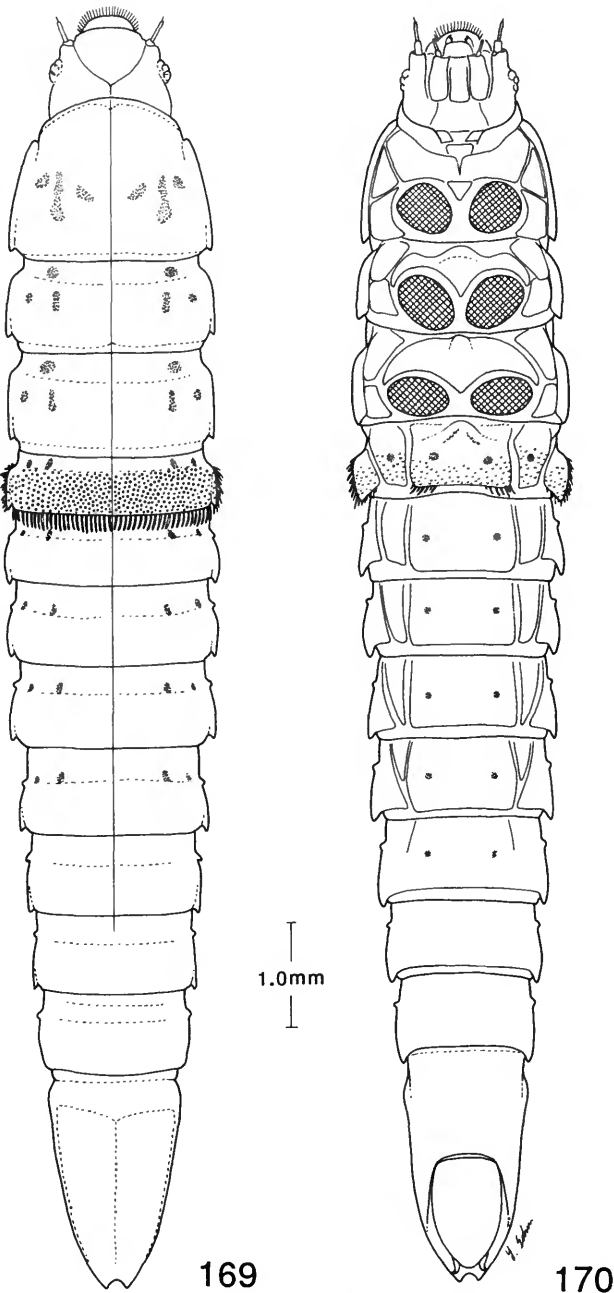
Head with a cluster of 5 stemmata on each side; with tooth on anterior margin between base of antenna and clypeus. Frontoclypeal suture well developed. Antenna, 3 segmented. Mandibles symmetrical; with 3 obtuse apical teeth; prostheca long, slender, and densely hirsute. Maxilla with palpus 4 segmented; stipes without palpifer; galea and lacinia separate and apex of each densely spinose. Labium with palpus 2 segmented; prementum with a palpiger; postmentum undivided. Gula well developed.

Prosternum with small, triangular, medial cervical sclerite;



168

FIGURE 168.—*Pseudodisersus goudotii* (Guérin-Méneville), adult, hind wing.



FIGURES 169, 170.—*Pseudodisersus goudotii* (Guérin-Méneville), larva: 169, dorsal view; 170, ventral view.

episternum long and broad in front of coxal cavities; epimeron divided into 2 sclerites; sternellum triangular; without posteromedial sclerite, thus procoxal cavities open posteriorly. Mesosternum and metasternum each with episternal sclerite, a

single epimeral sclerite, and an undivided sclerite in front of coxae.

Abdomen with sternopleural sclerites on segments 1–5; segment 6 with partial suture. Abdominal terga without longitudinal rows of seta-bearing tubercles; without tergopleural sclerites. Abdomen with sternopleural sclerites on segments 1–5. Segment 6 with a partial suture. Segments 7 and 8 forming completely sclerotized rings. Segment 9 tectiform; with apex deeply emarginate; apicolateral angles with acute, tooth-like projections; midline moderately ridged dorsally. Operculum ovate tapering to an obtuse apex.

Spiracles present laterally on mesothorax and abdominal segments 1–8; opening on small tubercles.

The described larva, presumed to be a last instar, was collected with adults of *Pseudodisersus goudotii* from Panama, Chiriquí Province, Quebrada Honda, 25 May 1985, R.W. Flowers, and is deposited in the National Museum of Natural History, Smithsonian Institution.

The larva of *Pseudodisersus* was misidentified, at first, as the larva of *Disersus* and although it was not described it was included in two keys to elmid larvae by Hinton (1940a, 1940b). Recently, Spangler and Santiago (1987) described and illustrated the larva.

10. *Pseudodisersus goudotii* (Guérin-Méneville)

FIGURES 171–198

Potamophilus goudotii Guérin-Méneville, 1843:18.—Coquerel, 1851:597.

Disersus goudotii.—Sharp, 1882:127.—Blackwelder, 1944:272.

Disersus goudotii.—Zaitzev, 1908:288; 1910:7.

Pseudodisersus coquereli Brown, 1981a:100.

Pseudodisersus goudotii.—Spangler and Santiago, 1987:29.

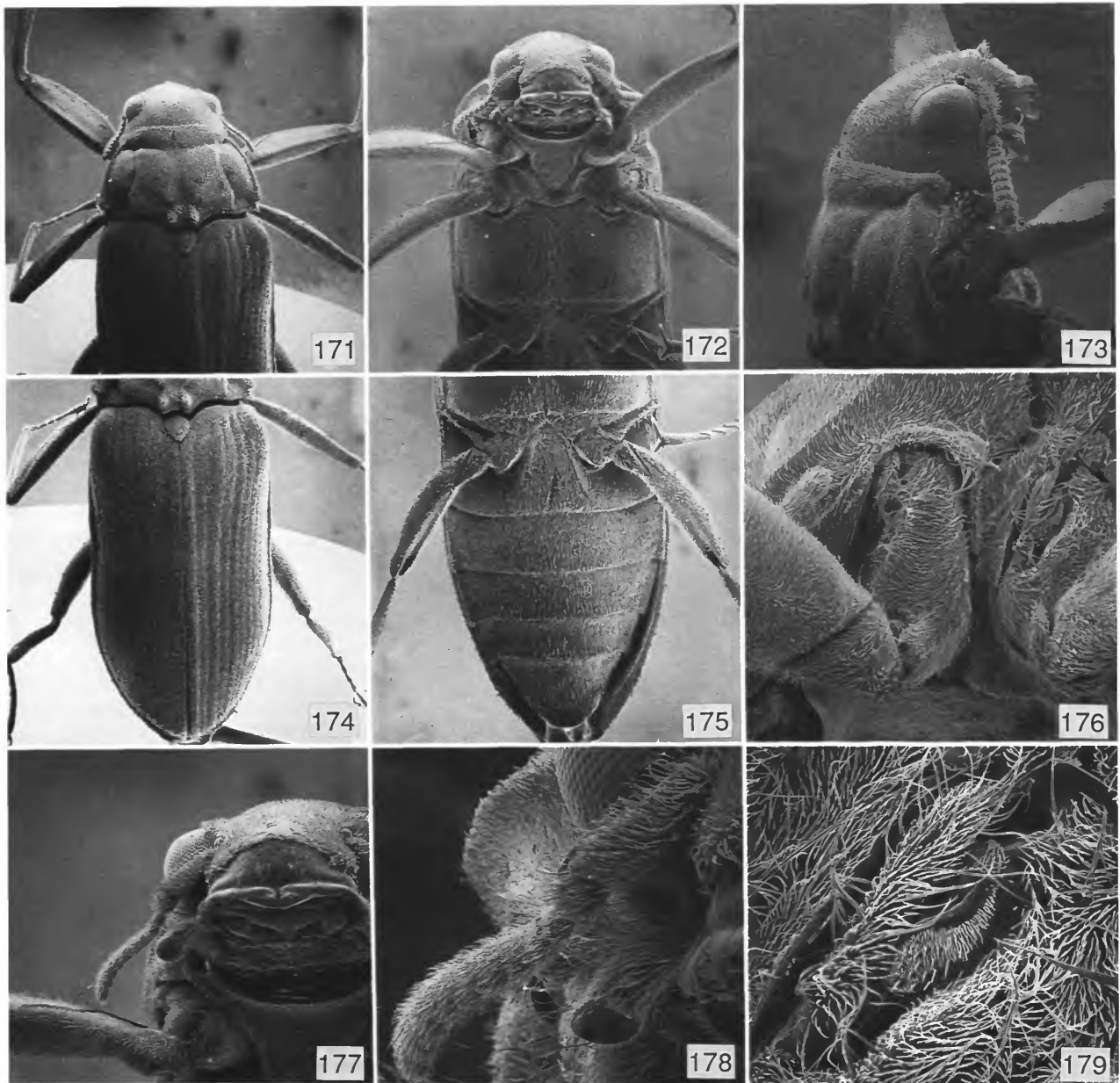
DIAGNOSIS.—The single species known in the genus; may be distinguished by its large size and the distinctive pronotal impressions described under the generic description (Figures 6, 171).

REDESCRIPTION (MALE).—*Body Form and Size:* Elongate, subparallel, moderately convex dorsally. Length, 6.58 mm; greatest width (across elytral humeri), 2.34 mm.

Color: Blackish brown dorsally. Antennal segments 1 and 2 reddish brown; antennal segments 3–11 black. Venter blackish brown except basal segments of all palpi; labium; maxillae; coxae; trochanters; and bases of femora, mesotibiae, metatibiae, and tarsi reddish brown.

Head: Finely, densely punctate; punctures separated by puncture diameter or less. Eyes large, hemispherical. Clypeus broadly emarginate anteriorly. Labrum (Figure 180) densely and moderately coarsely punctate; anterior margin unmodified, almost truncate, and densely fringed with long, fine, golden, hair-like setae; anterolateral angles rounded and only moderately expanded laterally. Maxillary palpus as illustrated (Figures 181, 182). Labial palpus as illustrated (Figures 180, 181, 183).

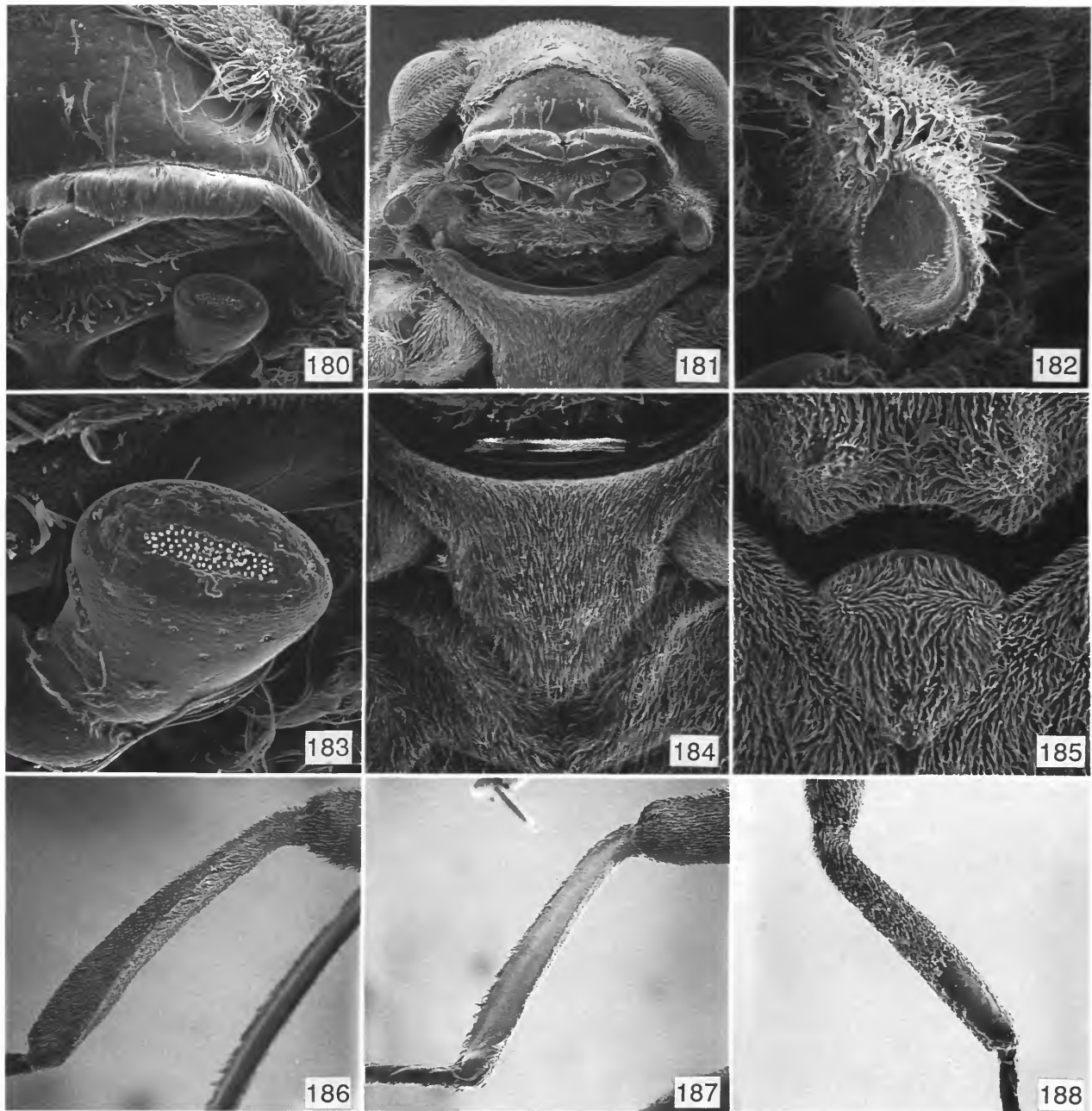
Thorax: Pronotum widest just before base; length, 1.39



FIGURES 171-179.—*Pseudodisersus goudotii* (Guérin-Méneville), adult: 171, head and pronotum, dorsal view, $\times 20$; 172, head and thorax, ventral view, $\times 25$; 173, head and pronotum, lateral view, $\times 40$; 174, elytra, $\times 20$; 175, abdomen, $\times 25$; 176, mesocoxae and trochantin, lateral view, $\times 75$; 177, mouthparts, $\times 50$; 178, antenna, $\times 130$; 179, mesotrochantin, $\times 250$. (Reduced to 64% for publication.)

mm; width, 2.13 mm; sides arcuate; anterolateral angles obtuse; with distinct constriction posterolaterad of each anterior angle; a deep transverse impression across apical fourth of pronotum; apex arcuate; base strongly sinuate; with a

robust tubercle on each side of midline in front of scutellum; each tubercle preceded by a small gibbosity with a slight depression anterolaterally; posterolateral angles acute, a raised dentiform tubercle at lateral margin in front of posterolateral



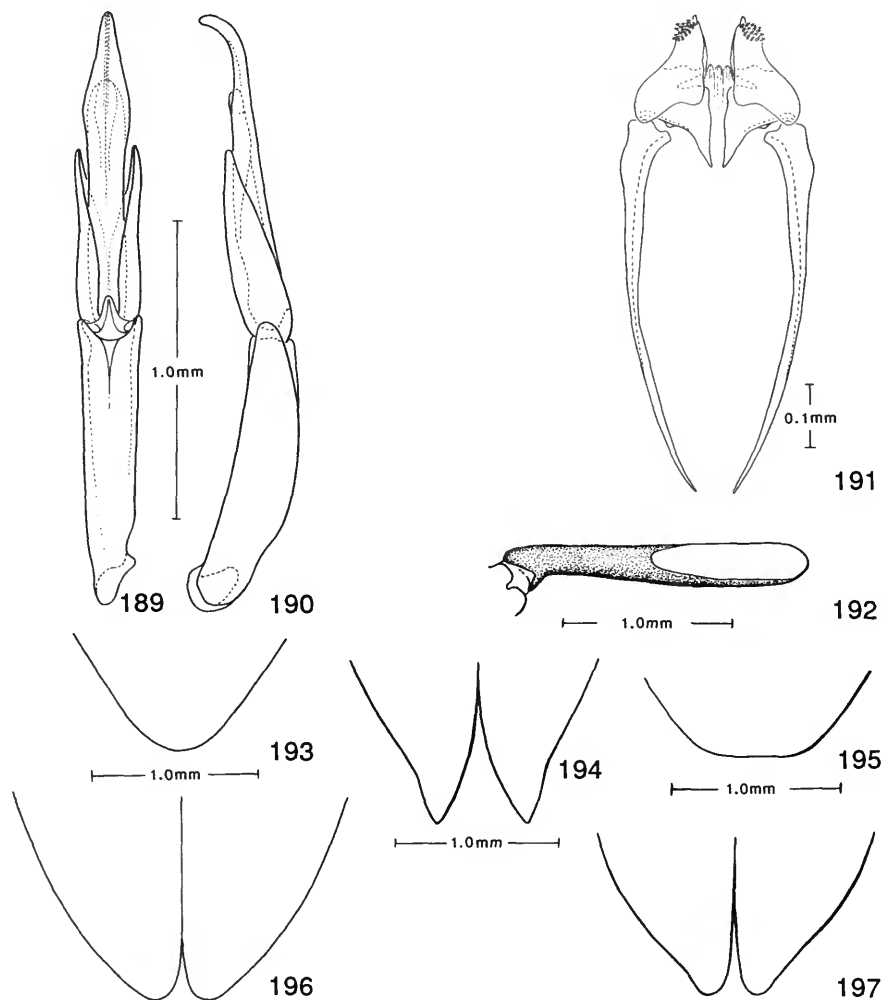
FIGURES 180-188.—*Pseudodisersus goudotii* (Guérin-Méneville), adult: 180, labrum and labial palpus, $\times 200$; 181, mouthparts, $\times 70$; 182, maxillary palpus, $\times 300$; 183, labial palpus, $\times 530$; 184, prosternum and prosternal process, $\times 110$; 185, scutellum, $\times 165$; 186, protibia, lateral view, $\times 58$; 187, mesotibia, lateral view, $\times 58$; 188, metatibia, lateral view, $\times 58$. (Reduced to 64% for publication.)

angle; surface with deep transverse impression across apical fourth; with sublateral, moderately deep impressions separating sublateral lobe from smaller basolateral lobe; midline longitu-

dinally depressed behind transverse depression, more deeply so on basal half; discal area finely densely punctate, punctures separated by $\frac{1}{2}$ puncture diameter. Elytron 5.38 mm long, 1.17

mm wide; with striae coarsely punctate; punctures separated by 1-1½ times puncture diameter; intervals very finely alutaceous and finely, densely punctate; punctures on intervals separated by distance equal to puncture diameter or less and obscured by dense pubescence; humeral area strongly tumid; sides of elytra distinctly rimmed and almost parallel; apex moderately dehiscent, evenly arcuate laterally and terminating in obtusely spinous apex (Figure 196). Prosternum short in front of procoxae; depressed medially. Prosternal process broadly V-shaped; base broadest; converging to narrowed but rounded apex; narrowed apical third flat. Mesosternum deeply and broadly excavated for reception of apex of prosternal process. Metasternum convex on each side of meson; deeply

and broadly depressed posteromedially between metacoxae; surface microreticulate and punctate; punctures moderately coarse and sparse, separated by 1-2 times puncture diameter. Procoxae and metacoxae moderately widely separated; mesocoxae slightly more widely separated. Legs compressed dorsoventrally; profemora and mesofemora distinctly flattened. Mesotibiae with lateral surface finely alutaceous; without dense hydrofuge pubescence except a very small area at base and a narrow strip on medial (lower) and lateral (upper) surface. Metatibiae with lateral surface lightly, finely alutaceous; virtually impunctate; with basal half densely pubescent and sharply delineated from glabrous area (Figure 192). Tarsal claws moderately long and very stout.



FIGURES 189-197.—*Pseudodisersus goudotii* (Guérin-Méneville), adult: 189, male genitalia, ventral view; 190, male genitalia, lateral view; 191, female genitalia, lateral view; 192, metatibia, lateral view, male; 193, abdominal sternum 5, male; 194, clytral apices, variant, female (Ecuador); 195, abdominal sternum 5, female; 196, clytral apices, male; 197, clytral apices, female.

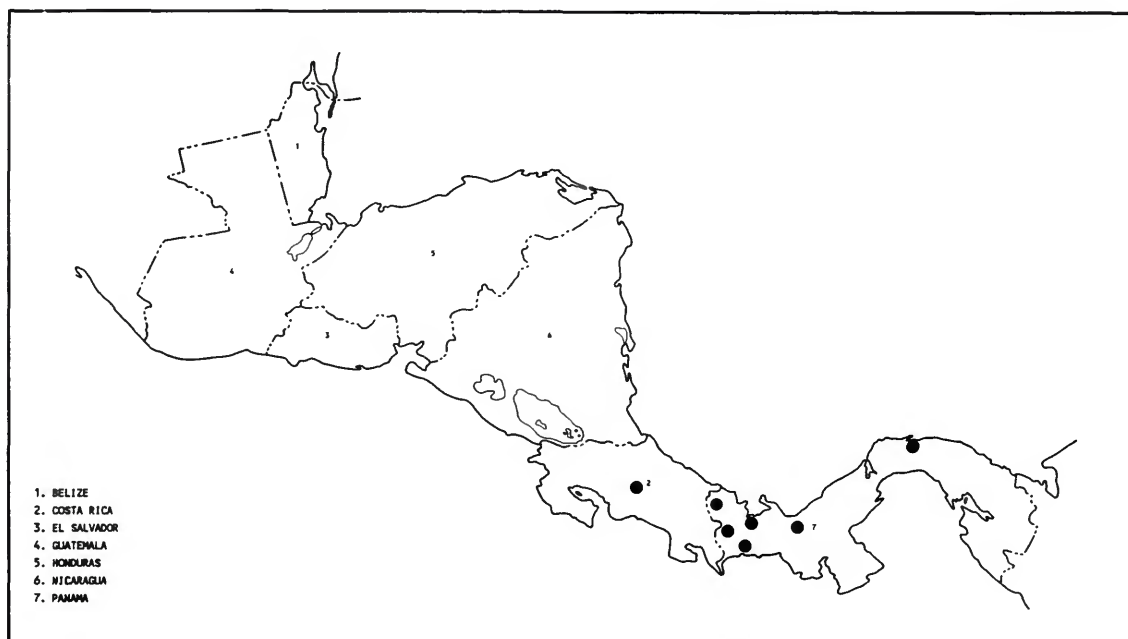


FIGURE 198.—*Pseudodisersus goudotii* (Guérin-Méneville), known distribution in Middle America.

Abdomen: Sterna 1–4 becoming progressively shorter. Sternum 1 with distinct longitudinal carina extending from metacoxa almost to hind margin on each side of meson (Figure 175). Apex of sternum 5 rounded (Figure 193).

Genitalia: As illustrated (Figures 189, 190).

FEMALE.—Similar to male except metasternum less deeply and less broadly depressed on meson. Elytral apices slightly more produced (Figure 197) than those of male. Apex of abdominal sternum 5 subtruncate. Genitalia as illustrated (Figure 191).

VARIATIONS.—We have seen no variations except in size in the specimens we examined from our area of study. Males ($n = 6$) range in length from 5.52 to 6.58 mm ($\bar{x} = 6.21$ mm); females ($n = 6$) range in length from 6.86 to 7.34 mm ($\bar{x} = 7.02$ mm). All of the specimens have the elytral apices moderately dehiscent, evenly arcuate laterally, and terminated in evenly rounded apices. Some variation may be found eventually in Middle American specimens of this species for we have seen some specimens from Ecuador that have the elytral apices more dehiscent and terminating in more elongated apices.

TYPE DATA.—We have examined the female type that is in the Muséum National d'Histoire Naturelle, Paris, and is labeled: [1] "P./Goudoti/Guérin/Columbia"—a blue circular label. [2] "♀"—on a white rectangle. [3] "Museum Paris/Collection/Generale"—a light blue rectangle. [4] "Type"—a red rectangle.

SPECIMENS EXAMINED.—COSTA RICA: *San José*: Río

Union and Pan Am[erican] Hiway, 22 Jun 1972, C.L. Hogue, 1 spm (LACM).

PANAMA: *Bocas del Toro*: Miramar, Laguna de Chiriquí, stream behind sawmill, above falls, 25°C, 2 May 1985, R.W. Flowers, 1 spm (NMNH). *Chiriquí*: Cuenca Fortuna, Quebrada Honda, 17 May 1985, R.W. Flowers, 1 spm (NMNH); Presa Fortuna, It, 8 May 1985, R.W. Flowers, 2 spms (NMNH); Santa Clara, Hartmann's Finca, 15–18 Jun 1985, E. Riley, D. Rider, 2 spms (LSU); Volcán (19 km W), small brook at culvert, 3 Jun 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 53 spms (NMNH). *San Blas*: Campamento Nusagandi (2.5 km S), 1 May 1987, D. Quintero, H. Herrera, R. Cambra, 2 spms (UPan). *Veraguas*: Santa Fe, Quebrada Muela, 9 Aug 1987, R. Cambra, 2 spms (UPan); same data except R. Rodríguez, 1 spm (UPan).

DISTRIBUTION (Figure 198).—*Pseudodisersus goudotii* is presently known in Central America from Costa Rica and Panama and in South America from Colombia and Ecuador (Spangler and Santiago, 1987). In addition, the larva of *Pseudodisersus* keyed to *Disersus* by Hinton (1940a) extends the distribution of *P. goudotii* south to Bolivia.

Hispaniolara Brown, 1981

Hispaniolara Brown, 1981a:85 [type species: *Hispaniolara farri* Brown, 1981a:88; by original designation]; 1987:261.—Spangler and Santiago, 1987:4.

DIAGNOSIS.—Length, to 7.70 mm. Pronotum with transverse

impression at apical third; without arcuate sublateral impressions and basomedial tubercles (Figures 7, 205). Mesofemur longer than greatest body width.

ADULT.—Body slender; widest at elytral humeri and apical fourth of elytra.

Head partly retracted into pronotum but not beyond eyes. Antenna short and compact, 11 segmented. Maxillary palpus, 4 segmented. Labial palpus, 3 segmented. Labrum transversely rectangular; apical margin almost truncate; anterolateral angles rounded; sides arcuate; surface densely pubescent.

Pronotum convex; widest at base; with subapical transverse impression; without longitudinal grooves or carinae; anterolateral and posterolateral angles obtuse; base trisinate, broadly so on each side of and more narrowly so in front of scutellum. Hypomeron vertical. Scutellum flat, broadly triangular. Elytra with punctate striae; without accessory stria. Hind wing (Figure 199) without radial cross vein; with closed anal cell; anal vein 2 with branches 1 and 2 fused; anal vein 1 interrupted between cubito-anal cross vein and wing margin; cubito-anal cross vein joining cubitus to base of incomplete anal vein 1; anal vein 2 joining anal vein 3 before dividing. Prosternum in front of procoxae very short, about $\frac{1}{2}$ width of basal protarsal segment. Prosternal process broad and long; parallel sided between procoxae then converging to obtusely angular apex. Mesosternum transverse; with shallow groove for reception of apex of prosternal process. Metasternum subquadrate; disc moderately broadly concave posteromedially; with a fine, median, longitudinal, impressed line on posterior three-fourths. Epipleuron vertical to posterior margin of sternum 4 then inflexed horizontally.

Abdominal sternum 1 convex in both sexes; without carinae. Sternum 5 with apex obscured by hair-like setae in both sexes; distinctly and narrowly emarginate apicomediaally in males and shallowly broadly emarginate in females.

LARVA (BY ASSOCIATION) (Figures 200, 201).—Length, 8.4

mm; greatest width, 1.90 mm. Body elongate, subovate; moderately convex dorsally; moderately flattened ventrally; subtriangular in cross section. With 4 longitudinal, sinuous rows of broad, ovate, yellowish setae on each side of meson of pronotum, mesonotum, and metanotum; each seta arising from a tubercle. Margins of all segments neither falcate nor explanate.

Head with cluster of 5 stemmata on each side; without tooth on anterior margin between base of antenna and clypeus. Antennae broken; only basal segment present (presumably 3 segmented). Frontoclypeal suture indistinct. Mandibles rigidly retracted, not dissected from unique specimen. Maxilla with palpus, 4 segmented; stipes without palpifer; galea and lacinia separate and apex of each densely spinose. Labrum with anterior margin broadly, shallowly emarginate; with an apical fringe of dense, short, stout setae. Labium with palpus, 2 segmented; prementum with a palpiger; postmentum undivided. Gula well developed.

Terga of all thoracic segments with 8 longitudinal rows of low tubercles bearing short, ovoid setae. Prosternum with episternum long and broad in front of coxal cavities; with epimeron divided into 2 sclerites; sternellum triangular; without posteromedial sclerite, thus procoxal cavities open posteriorly. Mesosternum and metasternum each with an episternal sclerite, a single epimeral sclerite, and an undivided sclerite in front of mesocoxae and metacoxae.

Abdomen with sternopleural sclerites on segments 1–7. Terga 1–8 each with 5 rows of seta-bearing tubercles on each side of meson similar to those on thorax.

Spiracles present apicolaterally on mesothorax and laterally on abdominal segments 1–8. Mesothoracic spiracles opening at surface. Spiracles on abdominal segments opening on large tubercles.

The larva described above is identified as the presumed larva of *H. farri* Brown because Brown collected it in association

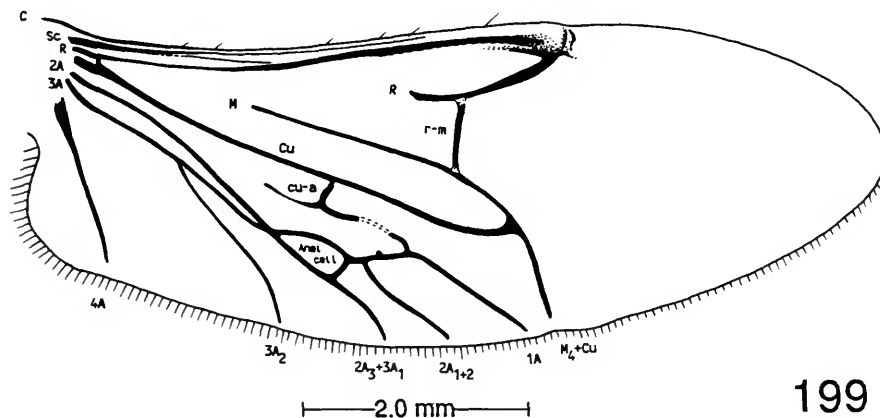
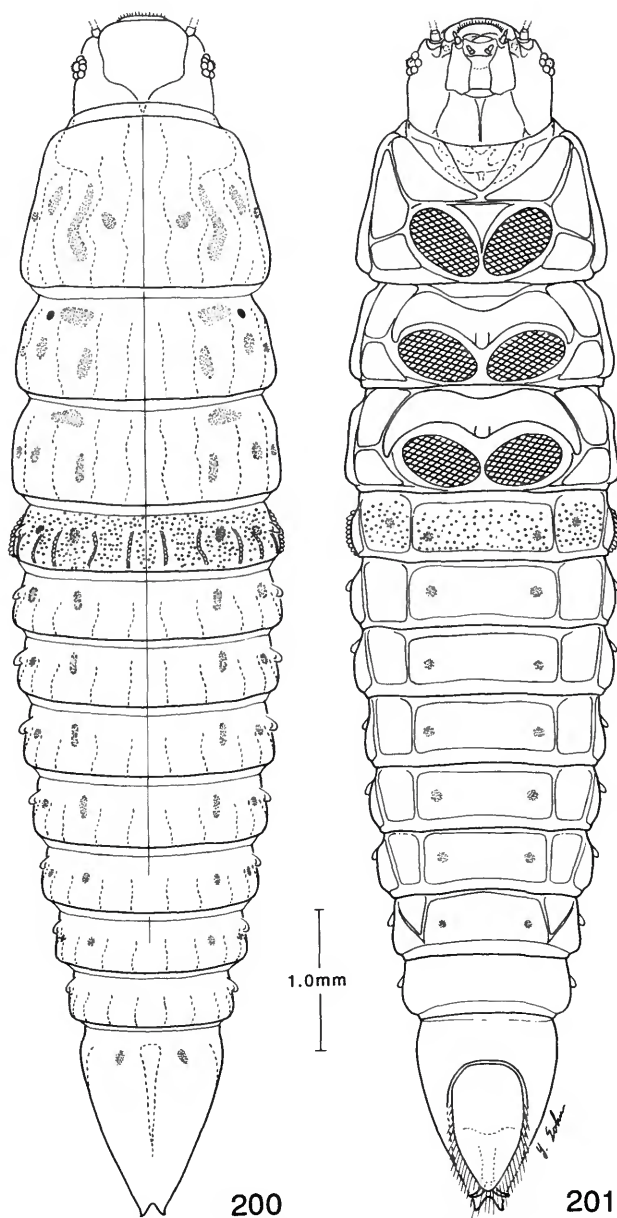


FIGURE 199.—*Hispaniolara farri* Brown, adult, hind wing.



FIGURES 200, 201.—*Hispaniolara farri* Brown, larva: 200, dorsal view; 201, ventral view.

with the adults of that species and its large size eliminates it as the larva of any other elmids known from Hispaniola. The larval characters substantiate the premise that *Hispaniolara* is most closely related to the larvae genus *Disersus*.

The described larva, presumed to be a last instar, was collected with an adult paratype from the Dominican Republic, Río La Candango w. Bonaó, elev. 1025 m, on 10 Oct 1971. We

are indebted to Dr. Brown who kindly donated this larva to the National Museum of Natural History, Smithsonian Institution, and allowed us to include it in our study.

11. *Hispaniolara farri* Brown

FIGURES 202–228

Hispaniolara farri Brown, 1981a:88.

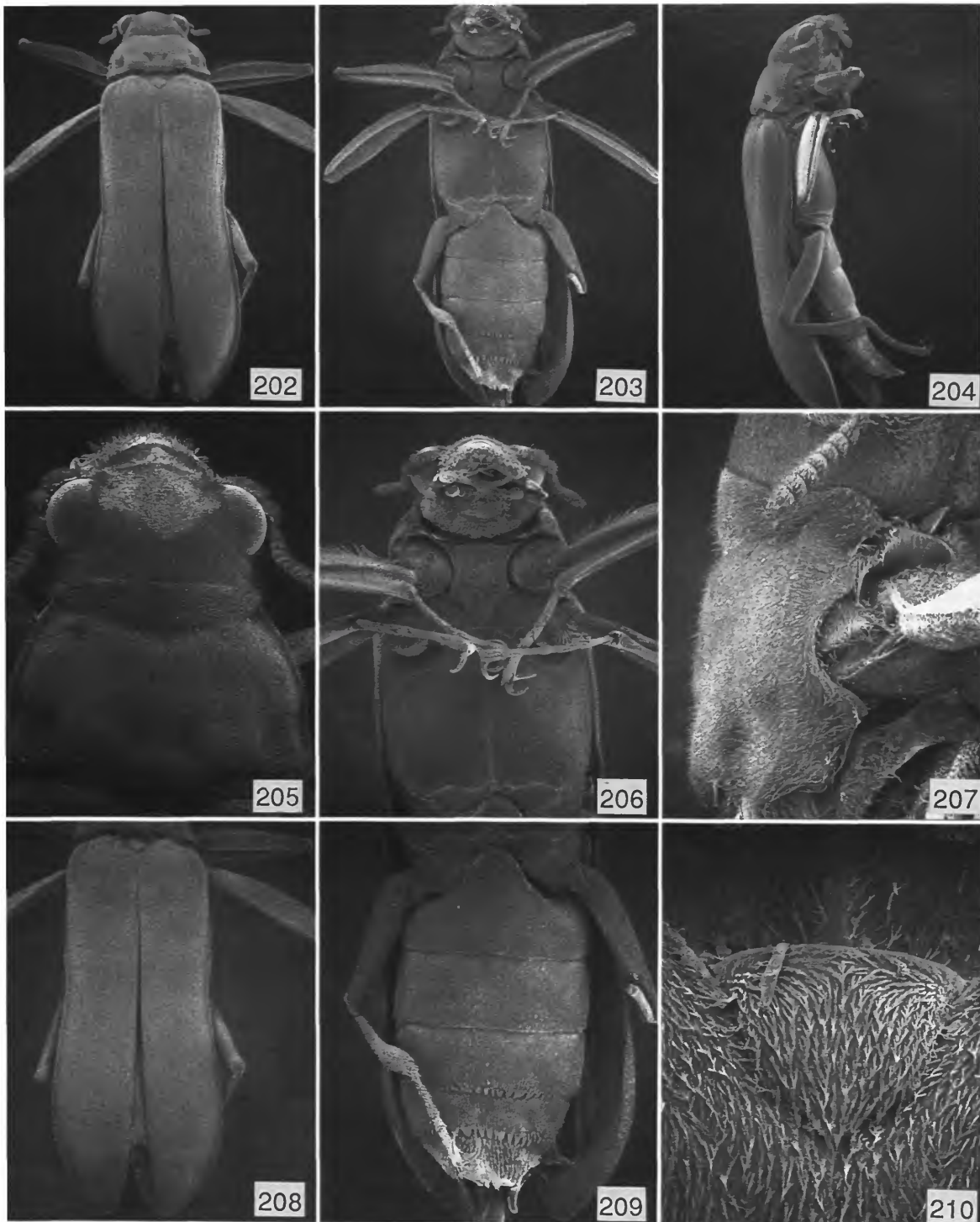
DIAGNOSIS.—The single species known in the genus; recognized by the distinctive pronotum and mesofemur as described under the generic diagnosis.

REDESCRIPTION (MALE).—*Body Form and Size:* Elongate, 3 times as long as wide; narrowed at midlength; moderately convex dorsally. Length, 6.78 mm; greatest width (across elytral humeri), 2.08 mm.

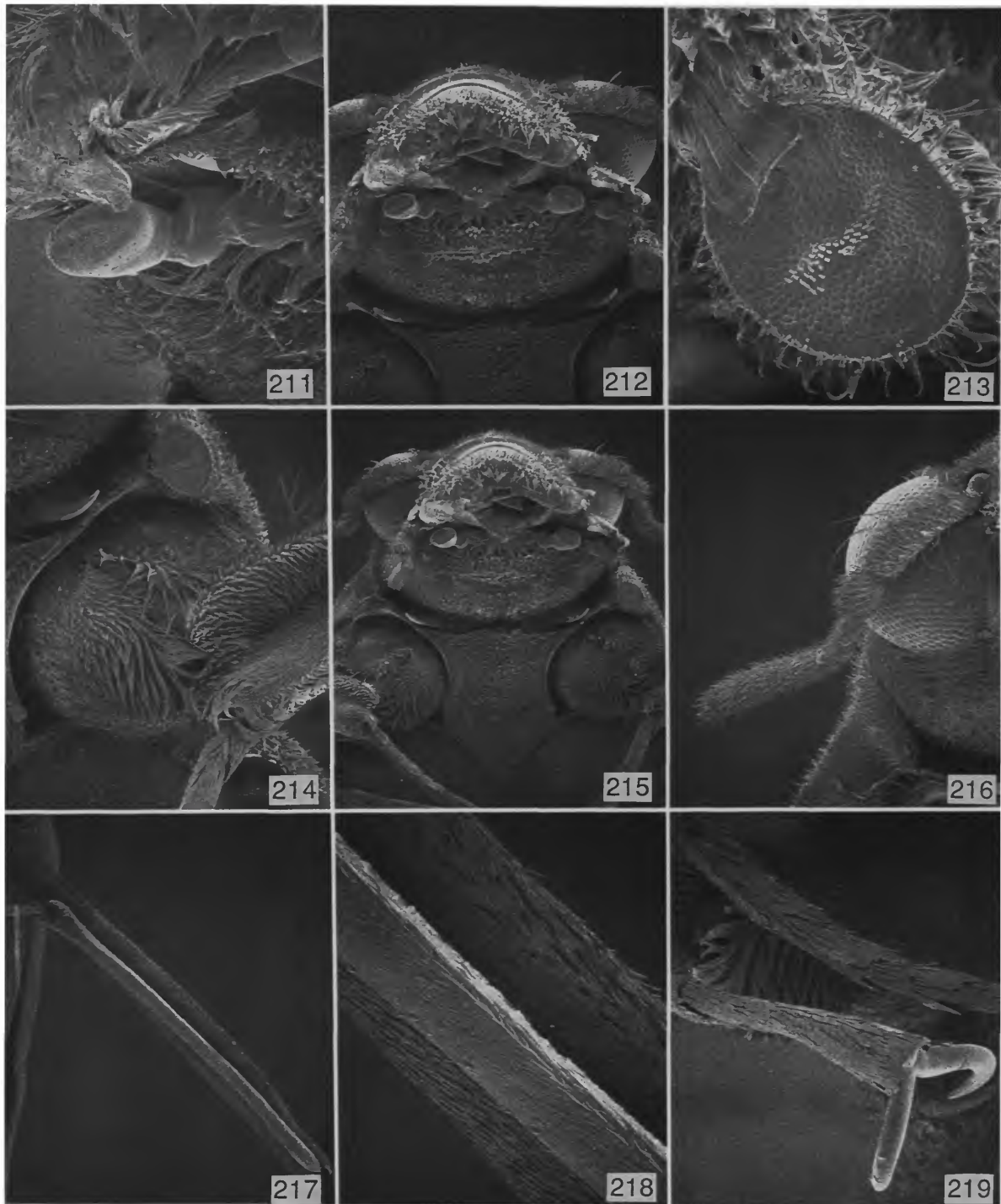
Color: Brown to black dorsally; elytra slightly lighter than head and pronotum. Antennal segments 1 and 2 yellowish brown; antennal segments 3–11 reddish brown. Venter lighter than dorsum; all palpi, labium, maxillae, coxae, trochanters, femora, tibiae, and tarsi reddish brown.

Head: Finely densely microreticulate and finely sparsely punctate; discal punctures separated by 2 times puncture diameter. Clypeus broad and truncate anteriorly. Labrum subtruncate; sparsely and moderately coarsely punctate; punctures separated by distance equal to diameter of puncture and obscured by dense setae; anterior and lateral margins densely fringed with long, fine, golden, hair-like setae; anterolateral angles rounded and moderately expanded laterally. Labium with ligula covered with dense, yellowish brown, stiff setae; setae on lateral lobes recurved. Labial palpus (Figures 211, 212) short and stout; segment 3, except apical sensory area, darkest. Maxillary palpus as illustrated (Figures 212, 213).

Thorax: Pronotum widest at base; length, 1.16 mm; width, 1.73 mm; sides arcuate; distinctly rimmed laterally; anterolateral angles acute, with slight lateral constriction behind each; apex arcuate; base strongly trisinate, very slightly swollen in front of scutellum; with a very shallow prescutellar fovea on each side of swollen area; posterolateral angles acute; surface punctate; disc convex but a distinct posterolateral depression on each side of pronotum; discal punctures separated by 1–2 times diameter of puncture. Scutellum subtriangular; sides arcuate. Elytron 5.39 mm long, 1.04 mm wide; more than 4 times as long as pronotum; broadest across humeri; narrowed medially; humeral area strongly tumid; sides distinctly rimmed and almost parallel sided basally; stria punctures separated by $\frac{1}{2}$ diameter of puncture and becoming shallower apically until effaced on apical sixth; intervals very finely alutaceous, with occasional, fine, widely spaced punctures that are obscured by dense pubescence; apex slightly dehiscent, evenly arcuate laterally and not produced (Figure 208). Prosternum extremely short in front of procoxae. Prosternal process broad, subparallel between procoxae then converging to form a broadly V-shaped, blunt apex; apical third of process essentially flat on meson.



FIGURES 202-210.—*Hispaniolara farri* Brown, adult: 202, habitus, dorsal view, $\times 17$; 203, habitus, ventral view, $\times 15$; 204, habitus, lateral view, $\times 17$; 205, head and pronotum, $\times 50$; 206, head and thoracic sternum, $\times 30$; 207, hypomeron, $\times 80$; 208, elytra, $\times 20$; 209, abdomen, $\times 30$; 210, scutellum, $\times 250$. (Reduced to 68% for publication.)



FIGURES 211-219.—*Hispaniolara farri* Brown, adult: 211, labial palpus, $\times 250$; 212, head and mouthparts, $\times 80$; 213, maxillary palpus, apex, $\times 600$; 214, procoxa, $\times 130$; 215, prosternum, $\times 60$; 216, antenna, $\times 120$; 217, mesofemur and mesotibia, ventral surface, $\times 50$; 218, mesofemoral and mesotibial pubescence, ventral surface, $\times 250$; 219, mesotarsal claws, $\times 150$. (Reduced to 66% for publication.)

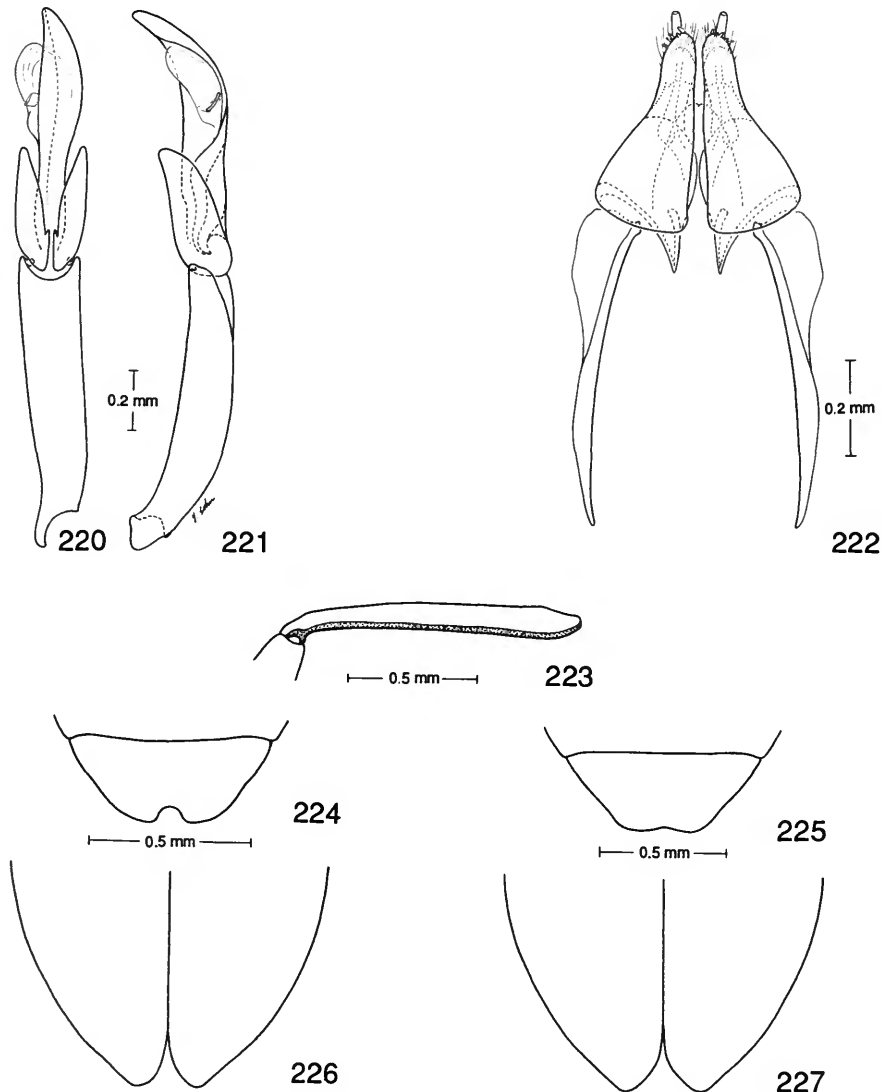
Mesosternum deeply excavated for reception of apex of prosternal process. Metasternum convex on each side of meson, depressed posteromedially between hind coxae; surface microreticulate and punctate; punctures moderately coarse, widely separated laterally, closer medially. Procoxae and metacoxae moderately widely separated; mesocoxae slightly more widely separated. Legs long and slender. Profemora, protibiae, mesofemora, and mesotibiae compressed. Mesofemora longer than greatest body width. Mesotibiae glabrous except for narrow longitudinal band on mesal margin.

Metatibiae with lateral surface lightly microreticulate and densely pubescent. Tarsal claws large and stout.

Abdomen: Sterna 1–5 finely microreticulate and punctate; punctures fine and separated by 1–3 times puncture diameter. Sternum 5 with a patch of golden setae on apical half; setae distinctly longer than the other pubescence covering the sterna; distinctly and narrowly emarginate apicomediaally (Figure 224).

Genitalia: As illustrated (Figures 220, 221).

FEMALE.—Similar to male except pronotum slightly narrower at base. Elytral apices rounded and slightly divergent



FIGURES 220–227.—*Hispaniolara farri* Brown, adult: 220, male genitalia, ventral view; 221, male genitalia, lateral view; 222, female genitalia, ventral view; 223, mesotibia, lateral view; 224, abdominal sternum 5, male; 225, abdominal sternum 5, female; 226, elytral apices, male; 227, elytral apices, female.

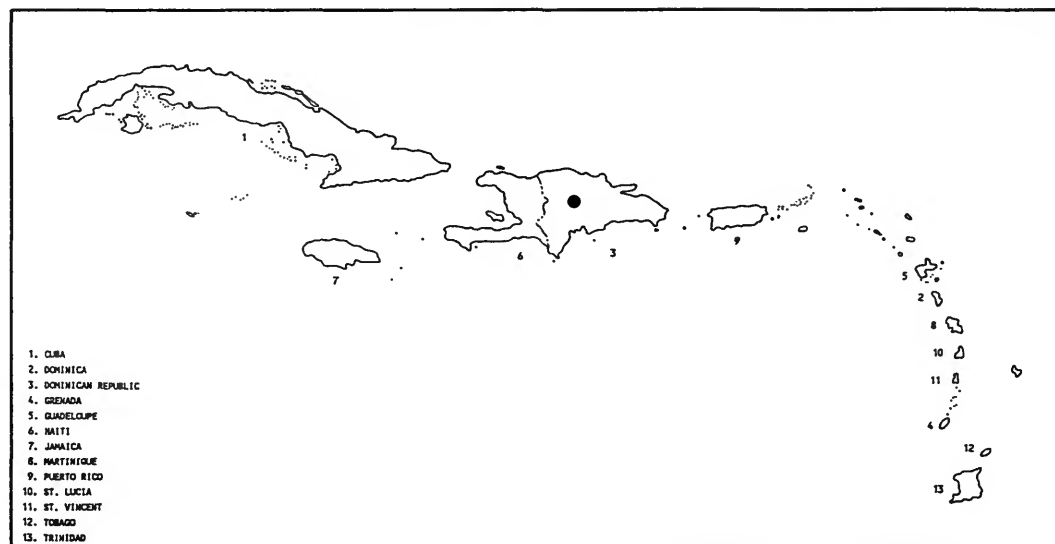


FIGURE 228.—*Hispaniolara farri* Brown, known distribution.

(Figure 227). Abdominal sternum 5 shallowly broadly emarginate apicomediaally (Figure 225). Genitalia as illustrated (Figure 222).

VARIATIONS.—Specimens varied in length. Males ($n = 5$) range in length from 6.60 to 6.82 mm ($\bar{x} = 6.72$ mm); females ($n = 3$) range in length from 7.16 to 7.70 mm ($\bar{x} = 7.14$ mm). Specimens vary in intensity and extent of the reddish brown color of the bases of the appendages and venter. Although the head of some specimens is reddish brown, the head of most specimens is blackish brown.

TYPE DATA.—*Holotype (Male)*: DOMINICAN REPUBLIC: *District La Vega*: mountain stream, w. Jayaco, elev. 1170 m, 10 Oct 1971, Harley Brown; genitalic dissections on slide Hifa-FC1; deposited in the Stovall Museum of Science and History, University of Oklahoma, Norman, Oklahoma.

Allotype: Same data as holotype.

Paratype: DOMINICAN REPUBLIC: *District La Vega*: Río La Candango w. Bonaó, elev. 1025 m, 10 Oct 1971, Harley Brown, 1 spm; dissected parts on slides Hifa-Ag1, Hifa-An1, Hifa-Av1, Hifa-w1; deposited with holotype. All type material examined.

SPECIMENS EXAMINED.—WEST INDIES: DOMINICAN REPUBLIC: fthills Cordillera Central, S. of Santiago, June '38, Darlington, 10 spms (MCZ); Constanza, Aug '38, 914–1219 m, Darlington, 1 spm (MCZ).

DISTRIBUTION (Figure 228).—Presently known only from the Dominican Republic.

HABITAT.—The type specimens were collected from shallow, fast water in montane streams.

Disersus Sharp, 1882

Disersus Sharp, 1882:127 [type species: *Disersus longipennis* Sharp; by monotypy].—Grouvelle, 1896:78.—Zaitzev, 1908:288; 1910:7.—Hinton, 1940a:226.—Blackwelder, 1944:272.—Bertrand, 1972:482.—Brown, 1981a:103.—Spangler and Santiago, 1987:4 [revision].—Roldán and Machado, 1988:121.

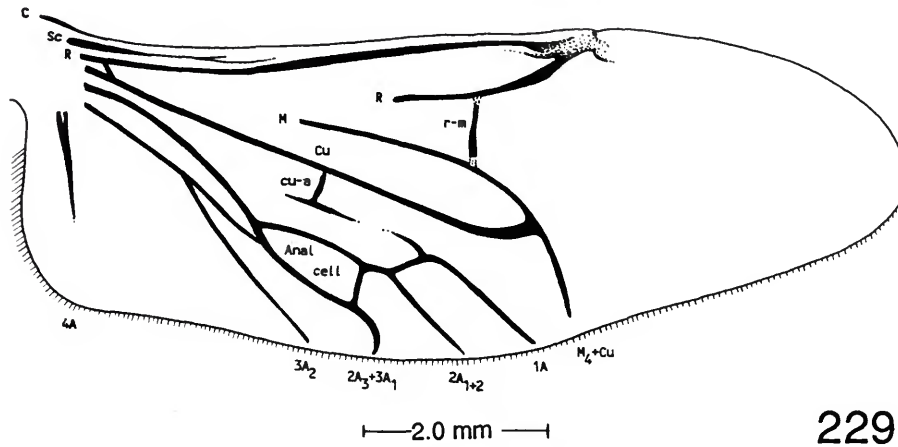
Potamophilus.—Coquerel, 1851:596.

DIAGNOSIS.—Length, to 9.33 mm. Pronotum moderately convex except a small impression in front of each posterolateral angle; without arcuate sublateral impressions, transverse impression, and basomedial tubercles (Figures 8, 232).

ADULT.—Body elongate, subparallel, and moderately convex.

Head partly retracted into pronotum. Maxillary palpus, 4 segmented. Labial palpus, 3 segmented. Antenna, 11 segmented. Labrum transversely rectangular; apical margin truncate; anterolateral angles broadly rounded and expanded laterally.

Pronotum convex, except small impression at each posterolateral angle; widest at base; sides arcuate; anterolateral angles obtuse; base broadly sinuate, emarginate in front of scutellum. Hypomeron vertical. Scutellum flat, subtriangular. Elytra with punctate striae; without accessory striae. Hind wing (Figure 229) without radial cross vein; with a closed anal cell; anal vein 2 with branches 1 and 2 fused; anal vein 1 interrupted and not connected to cubito-anal cross vein; cubito-anal cross vein joining cubitus to base of incomplete anal vein 1; anal vein 2 joining anal vein 3 after dividing. Prosternum in front of procoxae equal to $\frac{1}{6}$ the length of procoxa. Prosternal process



229

FIGURE 229.—*Disersus longipennis* Sharp, adult, hind wing.

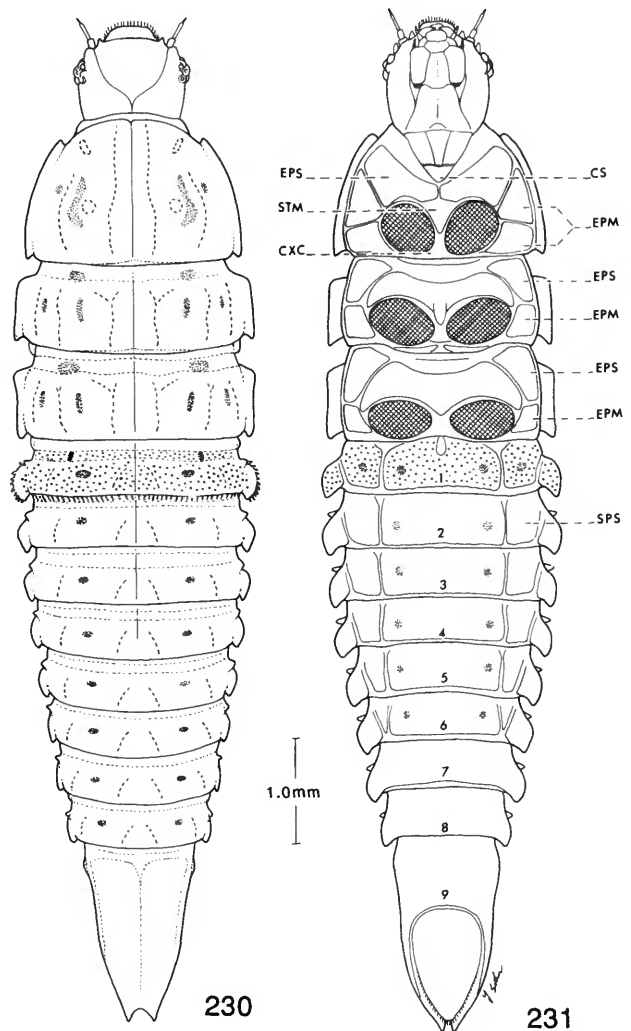
broadly V-shaped; broadest at base then converging to narrowed but rounded apex. Mesosternum with a deep depression on midline for reception of prosternal process. Metasternum with disc broadly and shallowly concave posteriorly; with a longitudinal impressed line on midline. Epipleuron vertical to posterior margin of sternum 4 then inflexed horizontally.

Abdominal sternum 1 concave in both sexes. Sternum 5 indistinctly emarginate apicomediaally and rounded in female.

LARVA (BY ASSOCIATION) (Figures 230, 231).—Length to 16.2 mm; greatest width, 2.7 mm. Body elongate, cylindrical. Moderately convex dorsally; moderately flattened ventrally. Margins of mesothoracic, metathoracic, and abdominal segments broadly expanded laterally; margins of abdominal segments broadly subfalcate laterally and bordered by large setae.

Head with 6 stemmata; with tooth on anterior margin between base of each antenna and clypeus. Antenna, 3 segmented. Frontoclypeal suture well developed. Mandibles symmetrical; with 3 obtuse apical teeth; protheca long, slender, densely hirsute. Maxilla with palpus, 4 segmented; stipes without palpifer; galea and lacinia separate and apex of each densely spinose. Labrum with fringe of dense, long, recurved, apical setae. Labium with palpus, 2 segmented; postmentum undivided. Gula well developed.

Prothoracic tergum with 4 signa and 4 sinuous longitudinal rows of seta-bearing tubercles; 1 row of tubercles on each side of and adjacent to meson and extending full length of prothorax; other 2 rows of tubercles shorter, sublateral, and extending from base for 2/3 length of prothorax. Mesothoracic



FIGURES 230, 231 (opposite).—*Disersus longipennis* Sharp, larva: 230, dorsal view; 231, ventral view. (cs = cervical sclerite, cxc = coxal cavity, epm = epimeron, eps = episternum, pms = posteromedial sclerite, sps = sternopleural sclerite, stm = sternellum.)

230

231

and metathoracic terga each with 6 sinuate longitudinal rows of seta-bearing tubercles; rows of tubercles extending nearly full length of terga. Prosternum with episternum long and broad in front of coxal cavities; epimeron divided into 2 sclerites; without sternellum; without postero-medial sclerite, thus procoxal cavities open posteriorly. Mesosternum and metasternum each with episternal sclerite, a single epimeral sclerite, and an undivided sternum in front of mesocoxae and metacoxae.

Abdomen with sternopleural sclerites on segments 1-6.

Abdominal terga 1-8 each with 4 rows of seta-bearing tubercles similar to those on thorax.

Spiracles present laterally on mesothorax and abdominal segments 1-8; opening on small tubercles.

The described larva, presumed to be a last instar, was collected with adult specimens of *Disersus* from Panama, Cocle Province, El Valle, 25-27 May 1983, P.J. Spangler, R.A. Faitoute, and W.E. Steiner; and is deposited in the National Museum of Natural History, Smithsonian Institution.

Key to the Species of *Disersus* of Mexico and Central America
(Adults)

- Elytral apices distinctly produced, angulate, and strongly emarginate along inner (sutural) margins [Figures 256, 257] 12. *D. longipennis* Sharp
- Elytral apices indistinctly produced and indistinctly angulate [Figures 265, 266] 13. *D. uncus* Spangler and Santiago

Clave para las Especies de *Disersus* de México y Centroamérica
(Adultos)

- Apices elitrales claramente prolongados, angulados agudamente y fuertemente emarginados a lo largo de los márgenes internos (sutural) [Figuras 256, 257] 12. *D. longipennis* Sharp
- Apices elitrales no claramente prolongados y no claramente angulados [Figuras 265, 266] 13. *D. uncus* Spangler and Santiago

12. *Disersus longipennis* Sharp

FIGURES 232-258

Disersus longipennis Sharp, 1882:127.—Grouvelle, 1896:78.—Zaitzev, 1908:288; 1910:7.—Blackwelder, 1944:272.—Bertrand, 1972:494.—Brown, 1981a:78; 1982:113.—Spangler and Santiago, 1982:17; 1987:21.—Roldán and Machado, 1988:130.

DIAGNOSIS.—With dehiscent and acutely spinous elytral apices (Figures 256, 257). The male genitalia are definitive (Figures 250, 251).

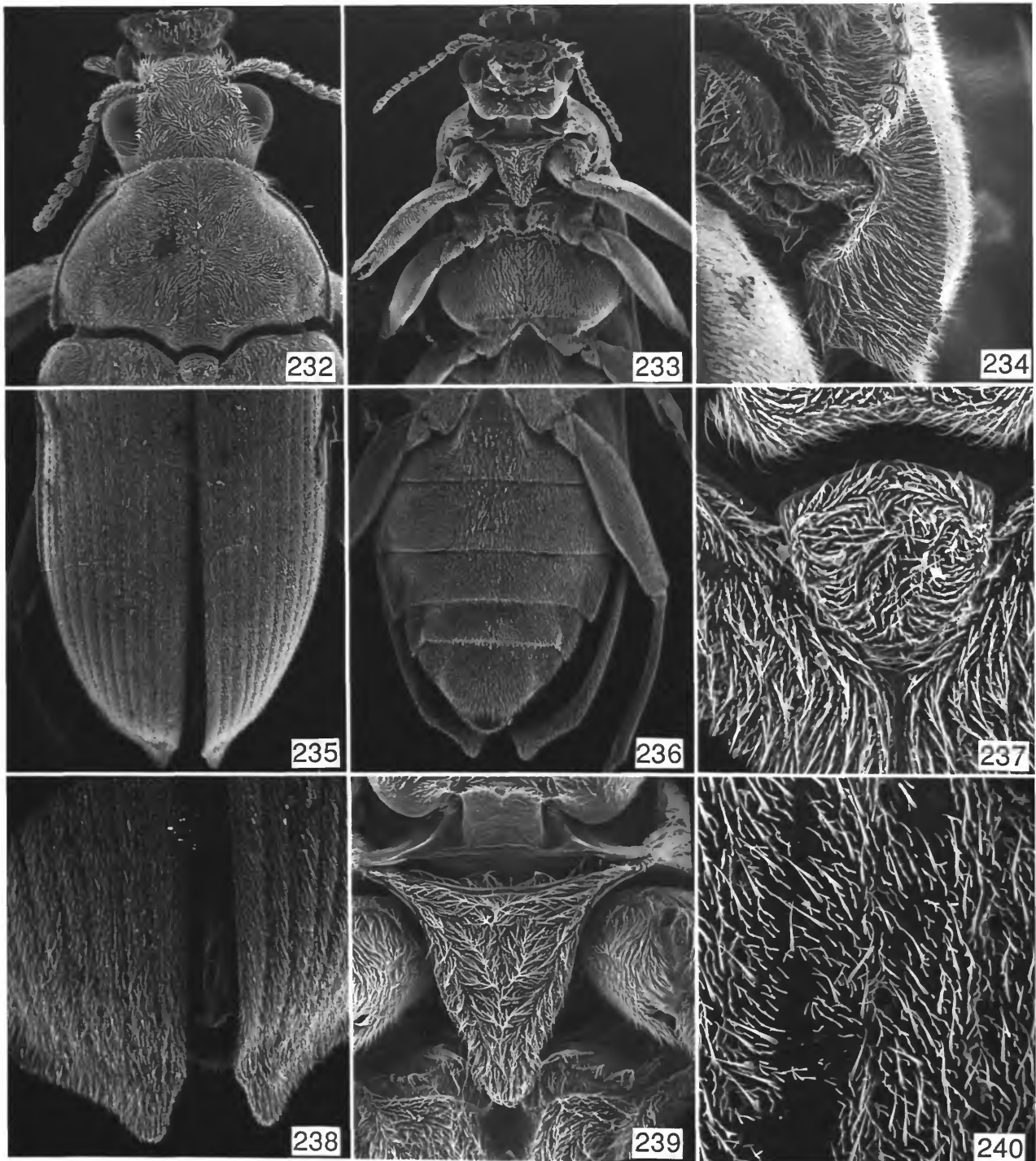
REDESCRIPTION (MALE).—*Body Form and Size*: Elongate, subparallel, and moderately convex dorsally. Length, 9.05 mm; greatest width (across humeri), 3.07 mm.

Color: Black dorsally, with reddish brown tinge; head and pronotum darker than elytra. Antennal segments 1 and 2 yellowish brown; antennal segments 3-11 dark reddish brown. Venter black, with dark reddish brown tinge except all palpi, labium, maxillae, metepisterna, epipleura, coxae, trochanters, bases of femora, apical halves of tibiae, and tarsi lighter reddish brown.

Head: Moderately coarsely, moderately densely punctate; discal punctures separated by about diameter of puncture. Eyes large, hemispherical. Clypeus broadly arcuately emarginate anteriorly. Labrum densely and moderately coarsely punctate;

anterior margin truncate and densely fringed with long, fine, golden, hair-like setae; anterolateral angles broadly rounded and expanded laterally. Maxillary palpus as illustrated (Figures 242, 243). Labial palpus as illustrated (Figures 242, 244).

Thorax: Pronotum widest at base; length, 1.76 mm; width, 2.63 mm; with sides arcuate; distinctly rimmed laterally; anterolateral angles acute, with slight lateral constriction behind each; apex arcuate; base strongly sinuate; slightly swollen in front of scutellum; with shallow fovea on each side of swollen area; posterolateral angles acute, spine-like; surface convex, not impressed; moderately densely, moderately coarsely punctate; discal punctures separated by about 1/2 puncture diameter. Scutellum subtriangular; all three sides arcuate. Elytron 7.61 mm long, 1.53 mm wide; with coarsely punctate striae, punctures separated by a distance 1/2-1 times diameter of puncture; intervals very finely alutaceous, with occasional, fine, widely spaced punctures but punctures obscured by the dense pubescence; humeral areas strongly tumid. Elytral sides distinctly rimmed and almost parallel; apex rounded laterally then produced apically to large, moderately acute, spinous process (Figures 256, 257). Prosternum short in front of procoxae. Prosternal process broadly V-shaped; broadest at base then converging to narrowed but rounded apex; narrowed apical third flat. Mesosternum deeply exca-



FIGURES 232-240.—*Disersus longipennis* Sharp, adult: 232, head and pronotum, dorsal view, $\times 30$; 233, head and thorax, ventral view, $\times 18$; 234, pronotum, lateral view, hypomeron, $\times 70$; 235, elytra, dorsal view, apical half, $\times 24$; 236, abdomen, $\times 18$; 237, scutellum, $\times 165$; 238, elytra, dorsal view, apex, $\times 48$; 239, prosternum and prosternal process, $\times 62$; 240, elytral striae, $\times 220$. (Reduced to 72% for publication.)

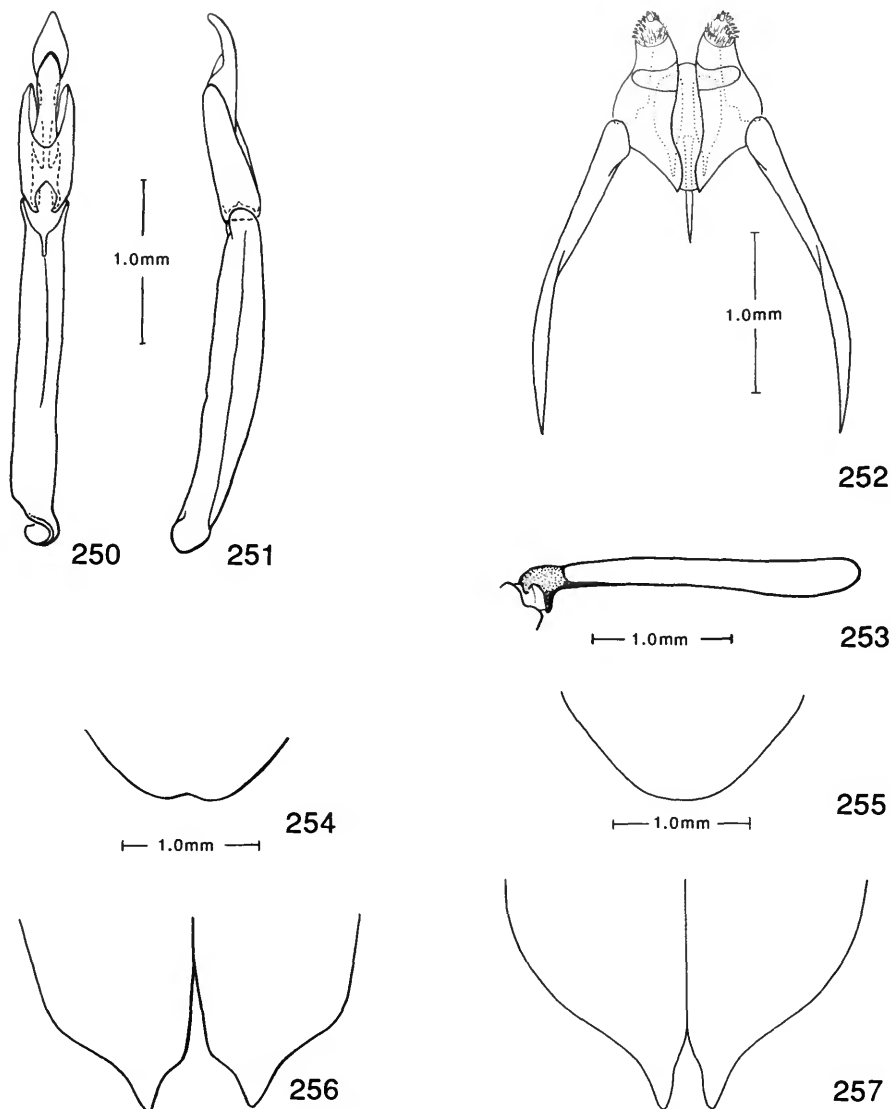


FIGURES 241–249.—*Disersus longipennis* Sharp, adult: 241, antenna, $\times 50$; 242, maxillary and labial palpus, $\times 100$; 243, maxillary palpus, apex, $\times 300$; 244, labial palpus, apex, $\times 525$; 245, head and mouthparts, ventral view, $\times 50$; 246, labial palpus, apex, sensilla, $\times 7500$; 247, protibia, ventrolateral view, $\times 58$; 248, mesotibia, mediolateral view, $\times 44$; 249, metatibia, lateral view, $\times 58$. (Reduced to 61% for publication.)

vated for reception of apex of prosternal process. Metasternum convex on each side of midline; depressed posteromedially between metacoxae; surface microreticulate and punctate; punctures moderately coarse, separated by 1–3 times puncture diameter. Procoxae and metacoxae moderately widely separated; mesocoxae slightly more widely separated. Legs long and slender. Metatibia with lateral surface distinctly microre-

ticulate and sparsely, moderately coarsely punctate; very sparsely pubescent only basally and this not sharply delimited (Figure 249). Tarsal claws large and stout.

Abdomen: Sterna 1–5 finely microreticulate and punctate; punctures fine and separated by 2–3 times puncture diameter. Abdominal sternum 1 deeply concave, with a poorly defined longitudinal carina extending along innermost side of each hind



FIGURES 250-257.—*Disersus longipennis* Sharp, adult: 250, male genitalia, ventral view; 251, male genitalia, lateral view; 252, female genitalia, ventral view; 253, mesotibia, lateral view, male; 254, abdominal sternum 5, male; 255, abdominal sternum 5, female; 256, elytral apices, male; 257, elytral apices, female.

coxal cavity and becoming effaced a short distance behind metacoxal cavity. Sternum 5 with apicomedial margin shallowly emarginate (Figure 254).

Genitalia: As illustrated (Figures 250, 251).

FEMALE.—Similar to male except metasternum and abdominal sternum 1 not concave. Abdominal sternum 1 with a moderate longitudinal carina extending along innermost side of each hind coxal cavity but becoming effaced at hind margin of metacoxal cavity. Sternum 5 rounded instead of shallowly emarginate apicomediaally (Figure 255). Genitalia as illustrated

(Figure 252).

VARIATIONS.—The specimens examined are very similar except in size. Males ($n = 5$) range in length from 8.0 to 9.05 mm ($\bar{x} = 8.56$ mm); females ($n = 4$) range from 8.32 to 9.33 mm ($\bar{x} = 8.66$ mm).

TYPE DATA.—*Lectotype (Female):* PANAMA: Chiriquí: V. de Chiriquí, 610-914 m, Champion, 1 spm (lectotype) (BMNH) [examined].

SPECIMENS EXAMINED.—GUATEMALA: Alta Verapaz: Cobán, Carr. Atlántico, km 170, 28 Aug 1985, H. Velazco, 2

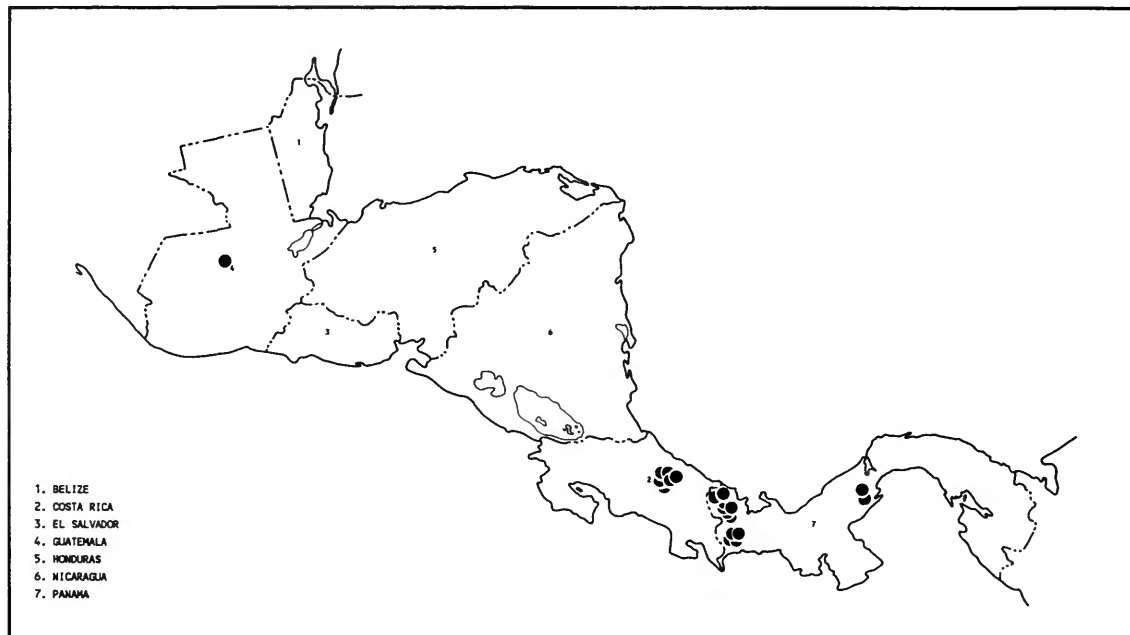


FIGURE 258.—*Disersus longipennis* Sharp, known distribution in Middle America.

spms (UNAM).

COSTA RICA: *Cartago:* Chitaria, 19 Jun 1967, O.S. Flint and Ortiz, 1 spm (NMNH); La Suiza, 17 Jun 1967, O.S. Flint and Ortiz, 4 spms (NMNH); Ruta Turrialba-Siquirras, km 10, 27 Oct 1984, J. Bueno, 6 spms (UNAM); Tapantí, 1189 m, 25 Jun 1967, P.J. Spangler, 2 spms (NMNH); Tuis (2.5 km E), at light by Río Tuis, 21 Jul 1987, H.L. Dozier, 2 spms (NMNH); Turrialba (3 mi W), 18–21 Jun 1967, O.S. Flint and Ortiz, 2 spms (NMNH). *San José:* Sta. María de Dota, 1550 m, 29 Apr 1984, J. Bueno S., 2 spms (UNAM).

PANAMA: *Bocas del Toro:* 1st stream north of continental divide, 975 m, 19°C, 10 May 1985, R.W. Flowers, 12 spms (NMNH); Miramar, 9°N 82°15'W, 24 Dec 1978, H. Wolda, 1 spm (UCalD); pipeline road, It, 10 May 1985, 975 m, R.W. Flowers, 2 spms (NMNH); pipeline road, stream I, trib. of Río Guabo, 14 May 1985, R.W. Flowers, 4 spms (NMNH); pipeline road, trib. of Río Guabo, 549 m, 22.5°C, 25 May 1985, R.W. Flowers, 5 spms (NMNH). *Chiriquí:* Cuenca Fortuna, Quebrada Arena, 1067 m, It, 5 May 1985, R.W. Flowers, 5 spms (NMNH); Cuenca Fortuna, Quebrada Arena, It, 23 May 1985, R.W. Flowers, 1 spm (NMNH); Cuenca Fortuna, Quebrada Honda, 17 May 1985, R.W. Flowers, 1 spm (NMNH); Cuenca Fortuna, Quebrada Mono, 1067 m, 18.5°C, 1 Jun 1985, R.W. Flowers, 1 spm (NMNH); Presa Fortuna, 1st stream west of Aoki camp, 7 May 1985, R.W. Flowers, 1 spm (NMNH); Presa Fortuna, stream below Aoki camp, It, 8 May 1985, R.W. Flowers, 4 spms (NMNH); Presa Fortuna, stream

west of Aoki camp, It, 26 May 1985, R.W. Flowers, 1 spm (NMNH); Santa Clara, 23–25 May 1980, E. Riley and LeDoux, 8 spms (LSU); Santa Clara, Dst. Renacimiento, 1219 m, 3 Jul 1976, E.G. Riley, 1 spm (LSU); V. de Chiriquí, below 1219 m, Champion, 1 spm (BMNH); Volcán (26 km W), small brook, 1380 m, 3 Jun 1983, P.J. Spangler, R.A. Faitoute, W.E. Steiner, 1 spm (NMNH).

DISTRIBUTION (Figure 258).—This species is known from Guatemala, Costa Rica, and Panama.

13. *Disersus uncus* Spangler and Santiago

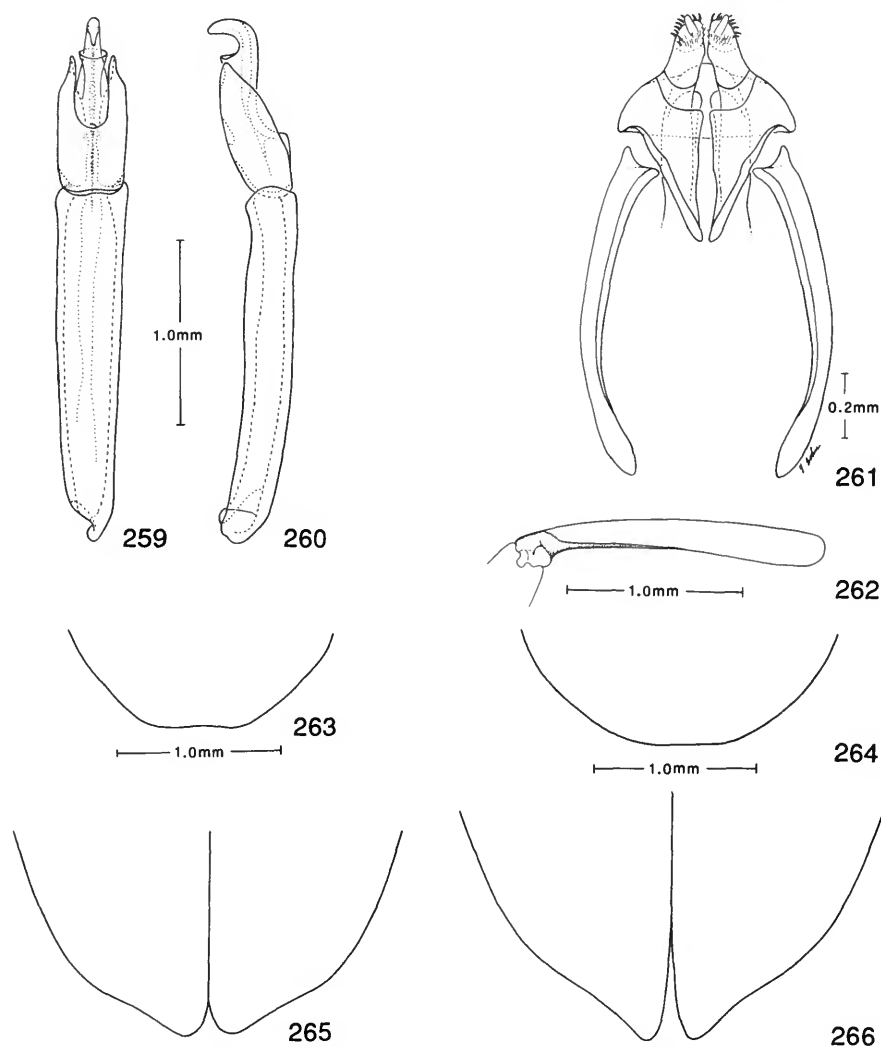
FIGURES 259–267

Disersus uncus Spangler and Santiago, 1982:17; 1987:16.

DIAGNOSIS.—With elytral apices indistinctly produced and indistinctly angulate (Figures 265, 266). Male genitalia with apex of median lobe distinctively hooked (Figure 260).

REDESCRIPTION (MALE).—*Body Form and Size:* Elongate, subparallel, and moderately convex dorsally. Length, 7.21 mm; greatest width (across elytral humeri), 2.80 mm.

Color: Black dorsally, with reddish brown tinge; head and pronotum darker than elytra. Antennal segments 1 and 2 yellowish brown; antennal segments 3–11 dark reddish brown. Venter black, with dark reddish brown tinge except all palpi, labium, maxillae, metepisterna, epipleura, procoxae, meso-coxae, trochanters, bases of femora, apical halves of protibiae



FIGURES 259-266.—*Disersus unicus* Spangler and Santiago, adult: 259, male genitalia, ventral view; 260, male genitalia, lateral view; 261, female genitalia, ventral view; 262, mesotibia, lateral view; 263, abdominal sternum 5, male; 264, abdominal sternum 5, female; 265, elytral apices, male; 266, elytral apices, female.

and mesotibiae, apical three-fourths of metatibiae, and tarsi lighter reddish brown. Integument obscured by dense, golden, hair-like setae; setae shorter on dorsum.

Head: Moderately coarsely, moderately densely punctate; discal punctures separated by about diameter of puncture. Eyes large, hemispherical. Clypeus broadly arcuately emarginate anteriorly. Labrum densely and moderately coarsely punctate; anterior margin truncate and densely fringed with long, fine, golden, hair-like setae; anterolateral angles broadly rounded and expanded laterally.

Thorax: Pronotum widest at base; length, 1.52 mm; width, 2.26 mm; with sides arcuate and distinctly rimmed; antero-

lateral angles obtuse; with slight constriction posterolaterally of each angle; apex arcuate; base strongly sinuate; slightly swollen in front of scutellum; with shallow fovea on each side of swollen area; posterolateral angles acute, spine-like; surface convex, not impressed; moderately densely, moderately coarsely punctate; discal punctures separated by about $\frac{1}{2}$ puncture diameter. Scutellum subtriangular; all three sides arcuate. Elytron 5.81 mm long, 1.35 mm wide; with punctate striae, punctures separated by a distance $\frac{1}{2}$ -1 times puncture diameter; intervals very finely alutaceous, with occasional fine, widely spaced punctures but punctures obscured by the dense pubescence; humeral areas strongly tumid; sides of elytra

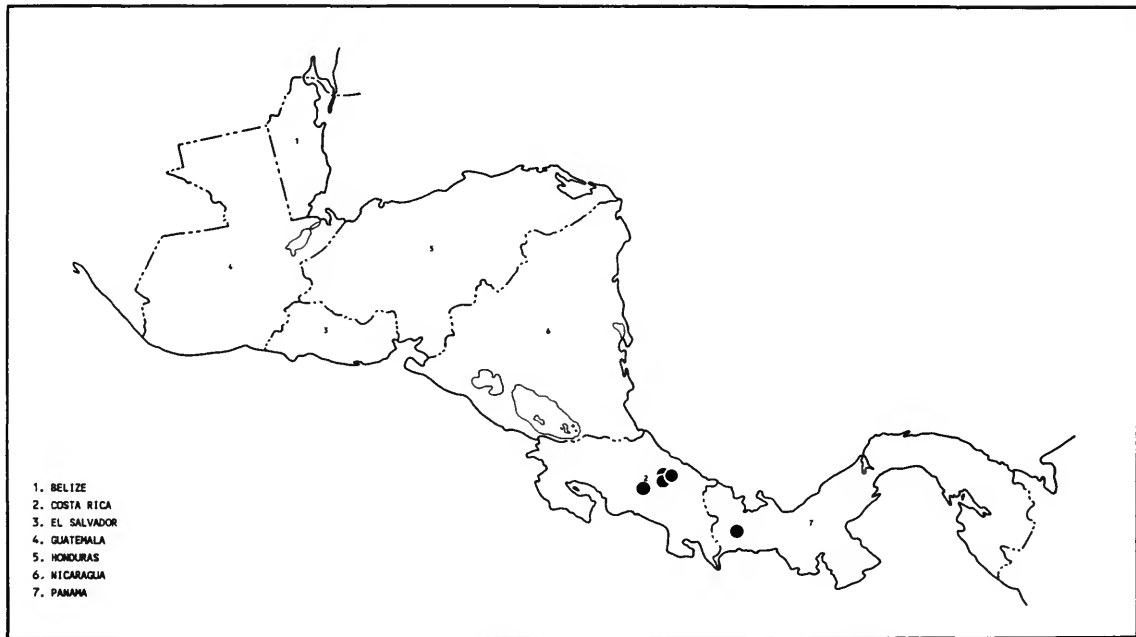


FIGURE 267.—*Disersus unicus* Spangler and Santiago, known distribution in Middle America.

distinctly rimmed and almost parallel; apices dehiscent, scarcely produced, obtusely angulate (Figure 265). Prosternum short in front of procoxae. Prosternal process broadly V-shaped; broadest at base then converging to narrowed but rounded apex; narrowed apical third of process flat. Mesosternum deeply excavated for reception of apex of prosternal process. Metasternum convex on each side of midline; depressed posteromedially between metacoxae; surface microreticulate and punctate; punctures moderately coarse, separated by 1–3 times puncture diameter. Procoxae and metacoxae moderately widely separated; mesocoxae very slightly more widely separated. Legs long and slender. Mesotibia and metatibia with lateral surface distinctly microreticulate and sparsely, moderately coarsely punctate; very sparsely pubescent basally but pubescent area not sharply delimited. Tarsal claws large and stout.

Abdomen: Sterna 1–5 finely microreticulate and punctate; punctures fine and separated by 2–3 times puncture diameter. Sternum 1 concave medially; with a moderate longitudinal carina extending from innermost side of each hind coxal cavity posterolaterally toward but not attaining hind margin of sternum. Last visible sternum with apicomедial margin slightly emarginate; with apicomедial patch of golden setae longer than rest of pubescence.

Genitalia: As illustrated (Figures 259, 260).

FEMALE.—Externally similar to male except abdominal sternum 1 is evenly convex medially and the last sternum is rounded. Elytral apices moderately produced (Figure 266). Genitalia as illustrated (Figure 261).

VARIATIONS.—The specimens of *D. unicus* studied are very similar but vary in size. Males ($n = 2$) range in length from 7.03 to 7.21 mm ($\bar{x} = 7.12$ mm); females ($n = 3$) range from 7.57 to 7.89 mm ($\bar{x} = 7.74$ mm).

TYPE DATA.—Holotype male, allotype, and one paratype, USNM Type 100122; deposited in the National Museum of Natural History, Smithsonian Institution.

SPECIMENS EXAMINED.—GUATEMALA: *Alta Verapaz*: Cobán, Carr. Atlántico, km 170, 28 Aug 1985, H. Velazco, 4 spms (UNAM).

COSTA RICA: *Cartago*: La Suiza, 17 Jun 1967, O.S. Flint and Ortiz, 3 spms (holotype, allotype, 1 female paratype) (NMNH); Tuis (2.5 km E), at light by Río Tuis, 21 Jul 1987, H.L. Dozier, 2 spms (NMNH); Ruta Turrialba–Siquirras, km 10, 27 Oct 1984, J. Bueno S., 1 spm (UNAM).

PANAMA: *Chiriquí*: Cuenca Fortuna, Quebrada Aleman, 1189 m, lt, 11 May 1985, R.W. Flowers, 1 spm (NMNH); Cuenca Fortuna, Quebrada Honda, lt, 16 May 1985, R.W. Flowers, 2 spms (NMNH); Cuenca Fortuna, Quebrada Honda, 1067 m, 18.5°C, 1 Jun 1985, R.W. Flowers, 1 spm (NMNH).

DISTRIBUTION (Figure 267).—This species is known from Guatemala, Costa Rica, and Panama.

RESUMEN

Paul J. Spangler y Silvia Santiago-Fragoso. La Subfamilia de Coleópteros acuáticos Larinae (Coleoptera: Elmidae) en México, Centroamérica y el Caribe. *Smithsonian Contributions to Zoology*, número 528, 74 páginas, 267 figuras, 1992.—La familia de Coleópteros acuáticos Elmidae contiene dos subfamilias, Elminae y Larinae. En la actualidad hay nueve géneros asignados a la subfamilia Larinae en el Hemisferio Oeste; cinco de los géneros de larainos, *Disersus* Sharp (1882), *Hexanchorus* Sharp (1882), *Hispaniolara* Brown (1981a), *Phanocerus* Sharp (1882) y *Pseudodisersus* Brown (1981a), se encuentran en el área de este estudio—México, Centroamérica y el Caribe. Un nuevo género *Pharceonus* basado en una especie no descrita previamente, se describe haciendo que el número de géneros de larainos para el área de estudio sea de seis. Se incluyen las siguientes claves para: los adultos de las dos subfamilias, Elminae y Larinae; los adultos de los 6 géneros de larainos conocidos para México, Centroamérica y el Caribe; las 13 especies incluídas en éstos géneros; y las 5 larvas conocidas de la subfamilia para el área de estudio (larvas de *Disersus*, *Hexanchorus*, *Hispaniolara*, *Phanocerus* y *Pseudodisersus*). Todos los taxa incluídos son descritos o redescritos; se citan las sinonimias; y se presentan mapas mostrando la distribución conocida para cada especie. Los caracteres principales que permiten el reconocimiento de los diferentes taxa se discuten, se ilustran con fotografías, dibujos a línea, o micrografías de microscopio electrónico de barrido. Así como los habitats de adultos y larvas se discuten e ilustran con fotografías.

En la actualidad se conocen los siguientes taxa para el área de estudio: *Disersus longipennis* Sharp (1882) y *Disersus uncus* Spangler y Santiago (1982); *Hexanchorus caraibus* (Coquerel, 1851), *Hexanchorus gracilipes* Sharp (1882), *Hexanchorus crinitus*, especie nueva, *Hexanchorus browni*, especie nueva, *Hexanchorus usitatus*, especie nueva y *Hexanchorus emarginatus*, especie nueva; *Hispaniolara farri* Brown (1981a); *Phanocerus clavicornis* Sharp (1882), *Phanocerus congener* Grouvelle (1898); *Pharceonus volcanus*, género nuevo, especie nueva; y *Pseudodisersus goudotii* (Guérin-Méneville, 1843). Las dos especies *Phanocerus helmoides* Darlington (1936) y *Phanocerus hubbardi* Schaeffer (1911) son sinonimizadas con *Phanocerus clavicornis* Sharp y una subespecie, *Hexanchorus gracilipes orientalis* Zaragoza (1982), es sinonimizada con *Hexanchorus gracilipes* Sharp.

Literature Cited

- Barthe, E.
1927. Tableaux analytiques des Coléoptères de la Faune Franco-Rhénane; Famille XLV Dryopidae. *Miscellanea Entomologica*, 30(5):1-16.
- Bertrand, H.P.I.
1940 ("1939"). Les larves et nymphes des Dryopoides paléarctiques. *Annales Sciences Naturelles (Zoologie)*, 2nd series, 2(2):299-412. [Date on title page is 1939; actually published 1940.]
1972. *Larves et nymphes des Coleopteres aquatiques du globe*. 804 pages, 561 figures. Abbeville, France: F. Paillart.
- Blackwelder, R.E.
1944. Elmidae. In Checklist of the Coleopterous Insects of México, Central America, the West Indies, and South America. *United States National Museum Bulletin*, 185(2):189-341.
- Bollow, H.
1938. Monographie der palaearktischen Dryopidae, mit Berücksichtigung der eventuell transgredierenden Arten. (Col.). *Mitteilungen der Münchener Entomologischen Gesellschaft*, 28(1):147-187.
- Böving, A.G.
1929. On the Classification of Beetles According to Larval Characters. *Bulletin of the Brooklyn Entomological Society*, 24(2):55-80.
- Böving, A.G., and F.C. Craighead
1931. An Illustrated Synopsis of the Principal Larval Forms of the Order Coleoptera. *Entomologica Americana*, new series, 11(1-4):1-351.
- Brown, H.P.
1965. Microhabitats of Some Neotropical Riffle Beetles (Coleoptera: Dryopoidea). *American Zoologist*, 5(2):151.
1972. Aquatic Dryopoid Beetles (Coleoptera) of the United States. *U.S. Environmental Protection Agency Water Pollution Control Research Series*, 18050 ELD04/72:i-ix + 1-82.
1975. A Distributional Checklist of North American Genera of Aquatic Dryopoid and Dascilloid Beetles (Elmidae, Dryopidae, Linnichidae, Chelonariidae, Heteroceridae, Psephenidae, Ptilodactylidae, Cyphonidae, Georyssidae). *The Coleopterists Bulletin*, 29(3):149-160.
1981a. Key to the World Genera of Larinae (Coleoptera, Dryopoidea, Elmidae), with Descriptions of New Genera from Hispaniola, Colombia, Australia, and New Guinea. *Pan-Pacific Entomologist*, 57(1):76-104.
1981b. A Distributional Survey of the World Genera of Aquatic Dryopoid Beetles (Coleoptera: Dryopidae, Elmidae, and Psephenidae sens. lat.). *Pan-Pacific Entomologist*, 57(1):133-148.
1982. On the Cascade Beetles of the World (Dryopoidea: Elmidae: Larinae). *Transactions of the American Microscopical Society*, 101(1):113.
1983. A Catalog of the Coleoptera of America North of México; Family: Elmidae. *Agriculture Handbook*, 529(50):i-x + 1-82.
1987. Biology of Riffle Beetles. *Annual Review of Entomology*, 32:253-273.
- Chandler, H.P.
1956. Aquatic Coleoptera, Elmidae. In R.L. Usinger, editor, *Aquatic Insects of California*, pages 356-363. Berkeley and Los Angeles: University of California Press.
- Coquerel, J.C.
1851. Monographie du genre *Potamophilus*. *Revue et Magasin de Zoologie*, series 2, 3:591-603.
- Crowson, R.A.
1955. *The Natural Classification of the Families of Coleoptera*. 187 pages. London: Nathaniel Lloyd and Company, Ltd.
- Curtis, J.
1830. *British Entomology*. Volume 7, plates 290-338. London.
- Darlington, P.J.
1936. A List of the West Indian Dryopidae (Coleoptera), with a New Genus and Eight New Species, Including One from Colombia. *Psyche*, 43(2-3):65-83.
- Delève, J.
1968. IV: Coleoptera Elminthidae. In *Mission zoologique belge aux îles Galapagos et en Ecuador (N. et J. Leleup, 1964-1965)*, 1:211-272. Bruxelles: L'Imprimerie Des Sciences.
- Ganglbauer, L.
1904. *Die Käfer von Mitteleuropa*. Volume 4, number 1, 286 pages. Wien.
- Grouvelle, A.H.
1896. Note sur les subdivisions générique des Potamophiliens (Col.). *Bulletin de la Societé Entomologique de France*, 1896:77-79.
1898. Clavicornes de Grenada et de St. Vincent (Antilles) récoltés par M.H.H. Smith, et appartenant au Musée de Cambridge. *Notes from the Leyden Museum*, 20:35-48.
- Guérin-Méneville, F.E.
1843. Insectes nouveaux, observes sur les plateaux des Cordillieres et dans les vallées chaudes de la Nouvelle-Grenade. *Revue Zoologique*, 1:12-22.
- Hinton, H.E.
1935. Notes on the Dryopoidea (Col.). *Stylops*, 4:169-179.
1936a. Results of the Oxford University Expedition to Borneo, 1932. Dryopidae (Coleoptera), Part 1. *Annals and Magazine of Natural History*, series 10, 18:89-109.
1936b. Results of the Oxford University Expedition to Borneo, 1932. Dryopidae (Coleoptera), Part II. *Annals and Magazine of Natural History*, series 10, 18:204-224.
1936c. New Dryopidae from the Japan Empire (Coleoptera). *The Entomologist*, 69:1-5.
1937a. Notes on Some Brazilian Potamophilinae and Elmidae (Coleoptera, Dryopidae). *Entomologist's Monthly Magazine*, 73:95-100.
1937b. New African Larinae (Coleoptera, Dryopidae). *Annals and Magazine of Natural History*, series 10, 19:289-304.
1939. An Inquiry into the Natural Classification of the Dryopoidea, Based Partly on a Study of Their Internal Anatomy (Col.). *The Transactions of the Royal Entomological Society of London*, 89(7):133-184.
1940a. A Monographic Revision of the Mexican Water Beetles of the Family Elmidae. *Novitates Zoologicae*, 42:217-396.
1940b. The Percy Sladen Trust Expedition to Lake Titicaca in 1937 under the Leadership of Mr. H. Cary Gilson, VII: The Peruvian and Bolivian Species of *Macrelmis* Motsch. (Coleoptera, Elmidae). *The Transactions of the Linnean Society of London*, third series, 1(2):117-147.
1971. The Elmidae (Coleoptera) of Trinidad and Tobago. *Bulletin of the British Museum of Natural History (Entomology)*, 26:245-265.
- Horn, G.
1870. Synopsis of the Parnidae of the United States. *Transactions of the American Entomological Society*, 3:29-42.
- International Commission on Zoological Nomenclature
1988. Opinion 1515, Laridae Rafinesque Schmalz, 1815 (Aves) and Larini LeConte, 1861 (Insecta, Coleoptera): Homonymy Removed. *Bulletin of Zoological Nomenclature*, 45(3):245.
- Kolbe, H.J.
1901. Vergleichend-morphologische Untersuchungen an Coleopteren, nebst Grund-lagen zu einem System und zur Systematik derselben. *Archiv für Naturgeschichte Beiheft*, 67:89-150.
- LeConte, J.L.
1854. Synopsis of the Parnidae of the United States. *Proceedings of the*

- Academy of Natural Sciences of Philadelphia*, 6(1852, 1853):41–45.
1861. Classification of the Coleoptera of North America, Part I. *Smithsonian Miscellaneous Collections*, 136: xxiv + 208 pages.
- LeConte, J.L., and G. Horn
1883. Classification of the Coleoptera of North America. *Smithsonian Miscellaneous Collections*, 507: xxxviii + 567 pages.
- Leech, H.B., and H.P. Chandler
1956. Aquatic Coleoptera. In R.L. Usinger, editor, *Aquatic Insects of California*, pages 293–371. Berkeley and Los Angeles: University of California Press.
- Leech, H.B., and M.W. Sanderson
1959. Coleoptera. In W.T. Edmondson, editor, *Fresh-Water Biology*, pages 981–1023. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited.
- Legros, E.C.
1947. Dryopoidea. In E. Fleutiaux, C. Legros, P. Lepesme, and R. Paulian, *Faune de L'Empire Français VII, Coléoptères des Antilles*, 1:85–89. Paris: Office de la Recherche Scientifique Coloniale.
- Leng, C.W.
1920. *Catalogue of the Coleoptera of America, North of Mexico*. x + 470 pages. Mount Vernon, New York: John D. Sherman, Jr.
- Leng, C.W., and A.J. Mutchler
1914. Article XXX.—A Preliminary List of the Coleoptera of the West Indies as Recorded to Jan. 1, 1914. *Bulletin of the American Museum of Natural History*, 33:391–424.
- Mulsant, E., and C. Rey
1872. *Histoire naturelle des coléoptères de France, Diversicornes*. 39 pages. Paris: Deyrolle.
- Olmi, M.
1976. Coleoptera Dryopidae, Elminthidae. In *Fauna d'Italia*, 12: x + 280 pages. Bologna: Edizioni Calderini.
- Porta, A.
1929. *Fauna Coleopterorum Italica, III, Diversicornia*. 466 pages. Piacenza: Stabilimento Tipografico Piacentino.
- Reitter, E.
1909. Coleoptera. In A. Brauer, editor, *Die Süßwasserfauna Deutschlands*, 3–4:1–235.
1911. *Fauna Germanica*. Volume 3, 436 pages. Stuttgart.
- Roldán P., G., and T. Machado C.
1988. Orden Coleoptera. In G. Roldán Pérez, *Guía para el estudio de los macroinvertebrados acuáticos del Departamento de Antioquia*, pages 116–144. Bogotá, Colombia: Editorial Presencia Ltda.
- Sanderson, M.W.
1938. A Monographic Revision of the North American Species of *Stenelmis* (Dryopidae: Coleoptera). *University of Kansas Science Bulletin*, 25:635–717.
1953. A Revision of the Nearctic Genera of Elmidae (Coleoptera). *Journal of the Kansas Entomological Society*, 26(4):148–163.
1954. A Revision of the Nearctic Genera of Elmidae (Coleoptera). *Journal of Kansas Entomological Society*, 27(1):1–13.
- Schaeffer, C.
1911. New Coleoptera and Miscellaneous Notes. *Journal of the New York Entomological Society*, 19:113–120.
- Sharp, D.
1882. Parnidae. In F.D. Godman and O. Salvin, editors, *Biologia Centrali-Americana, Insecta, Coleoptera*, 1(2):119–144. London.
1887. Supplement. In F.D. Godman and O. Salvin, editors, *Biologia Centrali-Americana, Insecta, Coleoptera*, 1(2):775. London.
- Spangler, P.J.
1966. Results of Catherwood Foundation Peruvian-Amazon Expedition, Insects, Part XIII, The Aquatic Coleoptera (Dytiscidae; Noteridae; Gyrinidae; Hydrophilidae; Dascillidae; Helodidae; Psephenidae; Elmidae). *Academy of Natural Sciences of Philadelphia Monograph*, 14:377–443, 129 figures.
1973. Aquatic Coleoptera Collected by the Biospeleological Expeditions to Cuba by the Academies of Science of Cuba and Romania. In Orghidian et al., *Résultats des Expéditions Biospéologiques Cubano-Roumaines à Cuba*, 1:353–358. Bucaresti, România: Editura Academiei Republicii Socialiste România.
1981. Supplement to the Aquatic and Semiaquatic Coleoptera of Cuba Collected by the Biospeleological Expeditions to Cuba by the Academies of Science of Cuba and Romania. In Orghidian et al., *Résultats des Expéditions Biospéologiques Cubano-Roumaines à Cuba*, 3:145–171. Bucaresti, România: Editura Academiei Republicii Socialiste România.
1985. A New Genus and Species of Riffle Beetle, *Neblinagena prima*, from the Venezuelan Tepui, Cerro de la Neblina (Coleoptera, Elmidae, Larinae). *Proceedings of the Entomological Society of Washington*, 87(3):538–544.
1986. The Status of the Riffle Beetle Genus *Lara* and Homonymy of the Subfamily Group Name Larinae (Coleoptera: Elmidae). *Entomological News*, 97(2):77–79.
1987. Case 2581, Laridae Vigors, 1825 (Aves) and Larini LeConte, 1861 (Insecta, Coleoptera): Proposal to Remove the Homonymy. *Bulletin of Zoological Nomenclature*, 44(1):25–26.
- Spangler, P.J., and S. Santiago
1982. A New Species of Aquatic Beetle, *Disersus unicus*, from Costa Rica (Coleoptera: Elmidae: Larinae). In *Special Issue to the Memory of Retirement of Emeritus Professor Michio Chûjô*, pages 17–20. Nagoya, Japan: The Association of the Memorial Issue of Emeritus Professor M. Chûjô.
1987. A Revision of the Genera *Disersus*, *Pseudodisersus*, and *Potamophilops* of the Western Hemisphere (Coleoptera: Elmidae). *Smithsonian Contributions to Zoology*, 446: iii + 40 pages.
- Steedman, R.J., and N.H. Anderson
1985. Life History and Ecological Role of the Xylophagous Aquatic Beetle, *Lara avara* LeConte (Dryopoidea: Elmidae). *Freshwater Biology*, 15:535–546.
- Steffan, A.W.
1961. Vergleichend-mikromorphologische Genitaluntersuchungen zur Klärung der phylogenetischen Verwandtschaftsverhältnisse der mitteleuropäischen Dryopoidea (Coleoptera). *Zoologische Jahrbücher*, 88(3):255–354.
- White, D.S., W.U. Brigham, and J.T. Doyen
1984. Aquatic Coleoptera. In R.W. Merritt and K.W. Cummins, editors, *An Introduction to the Aquatic Insects of North America*, second edition, pages 361–437. Dubuque: Kendall/Hunt Publishing Company.
- Wielzak, W.W.
1986. Parnidae, Limniidae, Psephenidae. In *Klucze do Oznaczenia Owadów Polski, Czesze XIX, Coleoptera. Polskie Towarzystwo Entomologiczne*, 136:1–65.
1987. Contribution to the Knowledge of African Larinae (Coleoptera, Limniidae). *Bulletin Entomologique de la Pologne*, 57:441–451.
- Zaitzev, P.
1908. Catalogue des Coléoptères aquatiques des familles des Dryopidae, Georyssidae, Cyathoceridae, Heteroceridae et Hydrophilidae. *Horae Societatis Entomologicae Rossicae*, 38(4):18–420.
1910. Family Dryopidae. In W. Junk and S. Schenkling, editors, *Coleopterorum Catalogus*, 14(17):1–47. Berlin: Junk.
- Zaragoza, S.
1982 (“1981”). Una Nueva Subespecie de *Hexanchorus gracilipes* Sharp, 1882 (Coleoptera: Elmidae; Larini) de Sotepa, Veracruz, México. *Anales del Instituto de Biología Universidad Nacional Autónoma de México, Series Zoología*, 52(1):353–360. [Date on title page is 1981; actually published 1982.]

REQUIREMENTS FOR SMITHSONIAN SERIES PUBLICATION

Manuscripts intended for series publication receive substantive review (conducted by their originating Smithsonian museums or offices) and are submitted to the Smithsonian Institution Press with Form SI-36, which must show the approval of the appropriate authority designated by the sponsoring organizational unit. Requests for special treatment—use of color, foldouts, case-bound covers, etc.—require, on the same form, the added approval of the sponsoring authority.

Review of manuscripts and art by the Press for requirements of series format and style, completeness and clarity of copy, and arrangement of all material, as outlined below, will govern, within the judgment of the Press, acceptance or rejection of manuscripts and art.

Copy must be prepared on typewriter or word processor, double-spaced, on one side of standard white bond paper (not erasable), with 1¼" margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

Front matter (preceding the text) should include: **title page** with only title and author and no other information, **abstract page** with author, title, series, etc., following the established format; table of **contents** with indents reflecting the hierarchy of heads in the paper; also, **foreword** and/or **preface**, if appropriate.

First page of text should carry the title and author at the top of the page; **second page** should have only the author's name and professional mailing address, to be used as an unnumbered footnote on the first page of printed text.

Center heads of whatever level should be typed with initial caps of major words, with extra space above and below the head, but no other preparation (such as all caps or underline, except for the underline necessary for generic and specific epithets). Run-in paragraph heads should use period/dashes or colons as necessary.

Tabulations within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or numbered table captions.

Formal tables (numbered, with captions, boxheads, stubs, rules) should be submitted as carefully typed, double-spaced copy separate from the text; they will be typeset unless otherwise requested. If camera-copy use is anticipated, do not draw rules on manuscript copy.

Taxonomic keys in natural history papers should use the aligned-couplet form for zoology and may use the multi-level indent form for botany. If cross referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa, using the same numbers with their corresponding heads in the text.

Synonymy in zoology must use the short form (taxon, author, year:page), with full reference at the end of the paper under "Literature Cited." For botany, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in "Literature Cited") is optional.

Text-reference system (author, year:page used within the text, with full citation in "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all Contributions Series and is strongly recommended in the Studies Series: "(Jones. 1910:122)" or "... Jones (1910:122)." If bibliographic

footnotes are required, use the short form (author, brief title, page) with the full citation in the bibliography.

Footnotes, when few in number, whether annotative or bibliographic, should be typed on separate sheets and inserted immediately after the text pages on which the references occur. Extensive notes must be gathered together and placed at the end of the text in a notes section.

Bibliography, depending upon use, is termed "Literature Cited," "References," or "Bibliography." Spell out titles of books, articles, journals, and monographic series. For book and article titles use sentence-style capitalization according to the rules of the language employed (exception: capitalize all major words in English). For journal and series titles, capitalize the initial word and all subsequent words except articles, conjunctions, and prepositions. Transliterate languages that use a non-Roman alphabet according to the Library of Congress system. Underline (for italics) titles of journals and series and titles of books that are not part of a series. Use the parentheses/colon system for volume (number): pagination: "10(2):5-9." For alignment and arrangement of elements, follow the format of recent publications in the series for which the manuscript is intended. Guidelines for preparing bibliography may be secured from Series Section, SI Press.

Legends for illustrations must be submitted at the end of the manuscript, with as many legends typed, double-spaced, to a page as convenient.

Illustrations must be submitted as original art (not copies) accompanying, but separate from, the manuscript. Guidelines for preparing art may be secured from Series Section, SI Press. All types of illustrations (photographs, line drawings, maps, etc.) may be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively as they will appear in the monograph. If several illustrations are treated as components of a single composite figure, they should be designated by lowercase italic letters on the illustration; also, in the legend and in text references the italic letters (underlined in copy) should be used: "Figure 9b." Illustrations that are intended to follow the printed text may be termed **Plates**, and any components should be similarly lettered and referenced: "Plate 9b." Keys to any symbols within an illustration should appear on the art rather than in the legend.

Some points of style: Do not use periods after such abbreviations as "mm, ft, USNM, NNE." Spell out numbers "one" through "nine" in expository text, but use digits in all other cases if possible. Use of the metric system of measurement is preferable; where use of the English system is unavoidable, supply metric equivalents in parentheses. Use the decimal system for precise measurements and relationships, common fractions for approximations. Use day/month/year sequence for dates: "9 April 1976." For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun." etc. Omit space between initials of a personal name: "J.B. Jones."

Arrange and paginate sequentially every sheet of manuscript in the following order: (1) title page, (2) abstract, (3) contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes section, (8) glossary, (9) bibliography, (10) legends, (11) tables. Index copy may be submitted at page proof stage, but plans for an index should be indicated when manuscript is submitted.

