THE PACHYGRONTHINAE OF THE WEST INDIES, WITH THE DESCRIPTION OF A NEW SPECIES OF *PACHYGRONTHA* FROM CUBA (HEMIPTERA: LYGAEIDAE)[1]

JAMES A. SLATER

Systematic and Evolutionary Biology Section,
University of Connecticut, Storrs, Connecticut

ABSTRACT

A striking new species of *Pachygrontha* is described from Cuba, *compacta* Distant is returned to *Pachygrontha,* Uhler's (1894) record of *P. oedancalodes* from Grenada is referred to *P. compacta,* and host plant, habitat and West Indian distributional data are given for all species.

The Pachygronthinae fauna of the West Indies is now known to include 7 species contained in 2 genera. While both tribes of Pachygronthinae are represented in both the Nearctic and Neotropical regions, no members of the grass feeding tribe Teracriini have apparently reached the West Indies.

The first pachygronthine to be reported from the West Indies was *Oedancala cubana* described by Stal (1874) from Cuba. Uhler (1893) reported *Pachygrontha longiceps* from St. Vincent and Uhler (1894) listed 3 species of *Pachygrontha* from Grenada (*oedancalodes* Stal, *bimaculata* Distant, *longiceps* Stal). Van Duzee (1907) reported *O. bimaculata* from Jamaica, and Heidemann and Osborn (1917) *O. crassimana* from the Isle of Pines. In 1923 Barber published the first of his numerous contributions on the hemipterous fauna of the Antilles and described, as new, *Pachygrontha parvula* from Mona Island. In 1939 he reported *O. bimaculata* from Puerto Rico, Cuba, Dominica (not the Dominican Republic as indicated by Slater 1955) and Grenada. Barber (1947) reported *O. bimaculata* from Puerto Rico, and *O. crassimana* and *P. longiceps* from Cuba. Slater (1955) revised the subfamily on a world basis. He transferred Uhler's 1893 and 1894 records of *P. longiceps* from St. Vincent and Grenada to a new species, *P. saileri,* reported *P. compacta* from Grenada, and *O. crassimana* from the Leeward Islands and *O. bimaculata* from Hispaniola. Slater (1956) synonymized Barber's *P. parvula* with *P. compacta* Distant. Scudder (1958) reported *O. crassimana* from the Caymans; Barber and Ashlock (1960) listed it from the Bahamas. Alayo (1973) recently reviewed the Cuban fauna and transferred *Pachygrontha compacta* to *Oedancala.*

The present paper describes a striking new species of *Pachygrontha* from Cuba, returns *compacta* Distant to *Pachygrontha,* refers Uhler's (1894) record of *P. oedancalodes* from Grenada to *P. compacta,* and gives host plant, habitat, and West Indian distributional data for all species.

Present zoogeographic information indicates that *Pachygrontha compacta* and *P. longiceps* have reached the West Indies from Central America, *P.*

[1]This work was supported in part by a grant from the National Science Foundation.

saileri and probably *O. bimaculata* from South America. *O. crassimana* may well have reached the Antilles from North America.

All of the above species are widespread in the Neotropics and seem unquestionably to have reached the Antilles by overwater transport. It is thus quite surprising to find an endemic species in each genus on Cuba. The presence of *O. cubana* is perhaps not unusually surprising, as it is related to *crassimana* and may have differentiated relatively recently. However, the presence of *Pachygrontha singularis* n. sp. is quite another matter, as this species is not closely related to any of the other Western Hemisphere species of *Pachygrontha*. Schuchert (1935) believed that there were land connections between the Greater Antilles and Central America several times in the Tertiary and as late as the Upper Miocene. This has been vigorously debated subsequently (see Darlington 1938, 1957). I see no reason to believe that the entire pachygronthine fauna could not have reached the West Indies over water, but it is important to realize that Schuchert's (1935) interpretation leaves the southeastern part of Cuba above water in the Upper Oligocene, Lower-Middle Miocene, and Upper Pliocene-Pleistocene when the rest of the West Indies was submerged. This may well account for the presence on Cuba of the only endemic pachygronthines found anywhere on the islands, and, in the case of *singularis,* raises the possibility that this species reached Cuba very early.

Keys to the West Indian genera and species may be found in Slater (1955), and synonyms and references to the individual species in Slater (1964).

Pachygrontha singularis Slater, new species
(Fig. 1)

General coloration pale testaceous, a prominent black longitudinal vitta present laterally on pronotum just within pale lateral edge; punctures on either side of pronotal midline darkened to form a pair of interrupted stripes, these complete on inner margin of calli; scutellar punctures black with a raised anteriorly bifurcate pale laevigate elevation; hemelytra with punctures brown, a prominent black spot present midway along apical corial margin and a smaller black spot present at corial apex; membrane hyaline; venter testaceous; head dark brown to blackish and a black longitudinal stripe running through middle of thoracic pleura and abdomen; antennae chiefly pale testaceous, 1st segment darkened on swollen distal 0.2, 2nd segment becoming dusky at distal end; 3rd segment chiefly fuscous, indistinctly paler distally, 4th segment uniformly dark brown; femora and fore tibiae with numerous dark brown spots present, femora nearly uniformly dark brown ventrally, fore femoral spines black tipped, distal ends of all tibiae dark brown as are distal 0.2 of 1st tarsal segment, distal end of 2nd and apical half of 3rd; pronotum lacking a distinctly laevigate median elevated line.

Head acuminate, tylus extending anteriorly onto basal 0.25 of 1st antennal segment, jugal carinae slightly bent laterad on posterior 0.5, eyes rounded, set slightly away from antero-lateral pronotal angles; head length 1.28[2], width 1.04; interocular space .70; pronotum elongate, moderately impressed at transverse impression which is present at posterior 0.33 of pronotum, area across calli convex; pronotum length 1.38, width 1.42; scutellum with a rather

[2]All measurements are in millimeters.

deeply excavated basal area, median elevation bifurcate anteriorly, laevigate, scutellum length 1.02, width .68; hemelytra with lateral corial margins nearly straight to level of apex of scutellum then gently convex to apex; membrane extending well onto 7th abdominal tergum, length claval commissure .60; distance apex clavus-apex corium 1.44; distance apex corium-apex abdomen 1.74; abdomen with apex strongly acutely produced into a terminal point; fore femora moderately incrassate, armed below with 4 major spines, 2 small spines distad of distal major spine and 2 between next proximal major spines, then a single major spine, no minor spine between 2 proximal major spines; labium short, extending well between fore coxae, at most slightly attaining anterior

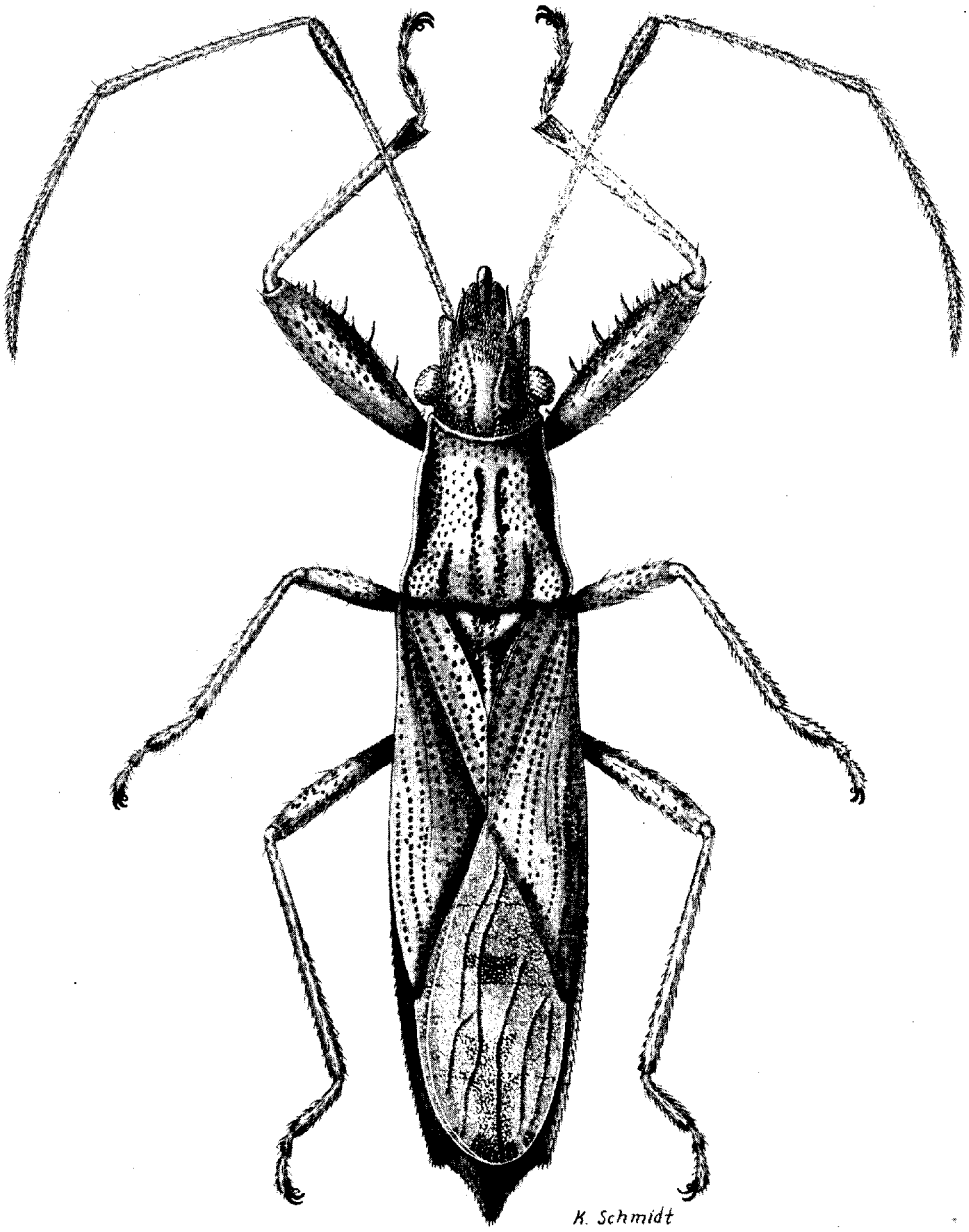


Fig. 1. *Pachygrontha singularis* Slater, new species, holotype, dorsal view.

end of mesosternum, 1st segment not extending caudad of antenniferous tubercles, labial segment length (III & IV from paratype) I .52, II .60, III .50, IV .52; antennal segment length I 2.70, II 1.70, III 1.40, IV .88; total length 7.52.

Holotype: CUBA: Prov. Pinar del Rio, San Diego de los Banos, 200 m, 8-III-1966 (F. Gregor); [Brno Museum, Czechoslovakia].

Paratype: 1 (same data as holotype) [J. A. Slater collection].

This species is not closely related to any other species of *Pachygrontha* in the Western Hemisphere. It will not key well through Slater (1955), as the distance from the apex of the clavus to the apex of the corium is subequal to the length of the pronotum and thus the species does not segregate well at couplet 1 for it is considerably more than 6mm long. This species seems to me to have considerable potential phylogenetic importance in establishing the derivation of the genus *Oedancala* from an ancestral *Pachygrontha* stock similar to *oedancalodes* and *compacta*. These latter species, because of their small short stubby bodies, superficially resemble species of *Oedancala* more closely than they do other species of *Pachygrontha*. This has led some authors to place these small species of *Pachygrontha* in *Oedancala*. Ayalo (1973) recently moved *compacta* to the genus *Oedancala* on the basis of its habitus, without apparently being convinced by my discussion (Slater 1955) where I demonstrated the affinities with *Pachygrontha*. *P. singularis* is intermediate in habitus, and I believe it further substantiates my position in placing *oedancalodes* and *compacta* in *Pachygrontha*.

The isolated nature of this species is further evidenced by the difficulty one encounters in relating it to any of the Eastern Hemisphere groups of *Pachygrontha*. It does have the excavated scutellar base of the *antennata* group but otherwise does not appear to be closely related to it. In habitus it has some resemblance to *P. walkeri*. Slater (1955) hypothesized that *oedancala* was derived from a *Pachygrontha* ancestor similar to *oedancalodes*. I still consider this to be true and this species to further substantiate this. In my former paper I suggested that Western Hemisphere *Pachygrontha* may have reached the area at 2 widely separated periods. At that time continental drift theory had not come into general acceptance, and it is possible that my interpretation of this as being through Beringia is incorrect. However it still seems to me that 2 quite separate introductions of *Pachygrontha* stocks occurred in the Western Hemisphere, and that *P. singularis* is representative of the older of the 2. It shows greater differentiation from Eastern Hemisphere forms and may lead directly or indirectly to the evolution of a derived genus.

The species is unusual morphologically in the sharply pointed and produced apex of the abdomen. The paratype is submacropterous in that, while the clavus and the corium are fully developed and separate, the membrane is considerably reduced and reaches only midway over the fifth abdominal tergum. While wing polymorphism is quite common in the related tribe Teracriini it is almost unknown in the tribe Pachygronthini. It will be very valuable to know more of the distribution and habitat relationships of this remarkable insect.

Pachygrontha compacta Distant

This is the smallest and, in the West Indies, most widespread species of *Pachygrontha*. It is readily recognizable, in addition to the small size (4.0 to 4.8), by the uniformly pale third antennal segment.

We found this species commonly along the west coast of Dominica (near Pointe Michel) in June 1971, where adults and nymphs occurred on the seed heads of *Cyperus planifolius* L. C. Rich. The plants were growing on nearly vertical, barren, xeric, rock outcroppings. Specimens were taken on the same host in a quite different mesic habitat on Dominica near the Layou River in the understory of coconut plantations. Slater (1966) reported *compacta* from Costa Rica on *Scirpus* sp. and described the nymphs.

Alayo (1973) placed *compacta* in *Oedancala* apparently because the general habitus appeared to him to more closely resemble Cuban species of *Oedancala* than *Pachygrontha*. Slater (1955:84-85) discussed the generic position of *compacta* and *oedancalodes* in detail and indicated that while *Oedancala* species may well be derived from an ancestor similar to *compacta*, the latter should be placed in *Pachygrontha*. My 1955 conclusion is strengthened after studying the new Cuban species *Pachygrontha singularis*. Alayo (1973) also seems to question the correctness of my (Slater 1956) placement of *Pachygrontha parvula* Barber as a junior synonym of *P. compacta*, stating that only a study of the types can confirm this decision. I have studied both "types" and reaffirm the synonymy. I also discussed the status of *parvula* and *compacta* with the describer of *parvula*, the late H. G. Barber, who agreed with the synonymy.

Uhler (1894) reported 3 specimens of *Pachygrontha oedancalodes* Stal from Granville, Grenada. One female of this series is in the British Museum (Natural History) and is a typical *compacta*. Presumably Uhler's other specimens were also *compacta*, as *oedancalodes* is not otherwise known from the West Indies. Our party was able to take *compacta* but not *oedancalodes* in Grenada in 1973.

West Indian records: GRENADA: Granville (Windward side) (H. H. Smith) (Uhler 1894); Point Saline, St. George Parish, 18-VI-1973 (Slater et al.). DOMINICA: Layou River, Cocoa Center, 24-VI-1971 (Slater, Baranowski, Harrington); Layou River, Clarkehall Estate, 24-VI-1971 (Slater, Baranowski, Harrington); Pointe Michel, 23-VI-1971 (Slater, Baranowski, Harrington). MONA ISLAND: (type of *Pachygrontha parvula*) (Barber 1923). CUBA: Soledad, Cienfuegos (Alayo 1973). HISPANIOLA: 5 mi. W. Sanchez, Samones Prov., Republica Dominicana, 16-VIII-1967 (J. C. Schaffner). JAMAICA: Cockpit, Clarendon Parish, 9-XII-1970 (Slater & Baranowski).

Pachygrontha longiceps Stal

This is a large, elongate, slender species that is readily recognizable by the pair of dark brown spots along each apical corial margin and the pale white distal half of the third antennal segment.

P. longiceps occurs in Central America and northern South America. Barber (1947) and Alayo (1973) previously reported it from Cuba. On 2 July 1971 a series of adults was taken near Linstead, Jamaica on a large sedge (*Scleria* sp.) growing in dense shade in broken second growth forest adjacent to an orange plantation.

The presence of *longiceps* on 2 islands of the Greater Antilles together with the lack of records from the Lesser Antilles is indicative of a Central American derivation. This is in contrast to the derivation of *P. saileri*, the other large, elongate species of *Pachygrontha* that occurs in the West Indies, which appears to have dispersed into the Lesser Antilles from northern South America.

Uhler's (1893 and 1894) records from St. Vincent and Grenada are referable to *saileri* Slater.

West Indian records: CUBA: Guaro, Ote. (Barber 1947); Gran Piedra, Ote. (Alayo 1973). JAMAICA: Linstead, St. Catherine Parish, 2-VII-1971 (Slater, Baranowski, Harrington); Faiths Pen, St. Ann Parish, 3-VII-1971 (Slater, Harrington, Baranowski).

Pachygrontha saileri Slater

Prior to the present description of *singularis,* this species and *longiceps* Stal were the only large elongate species of *Pachygrontha* known from the West Indies. *P. saileri* is readily recognizable by the lack of a conspicuous dark color spot at the apex of the corium, the unicolorous pale yellowish antennae, and the strongly, laterally bent, jugal carinae; it is also a more robust, heavy bodied species than is *longiceps.*

This species is closely related to the South American *minarum* (L. & S.) and indeed may well prove eventually to represent a subspecies. In any event *saileri* certainly is a South American element in the West Indian fauna. It extends northward in the Lesser Antilles at least to Dominica.

P. saileri was described by Slater (1955) from Grenada and subsequently reported by Slater (1966) from Trinidad, Surinam, and Guyana. Uhler's (1893, 1894) records of *longiceps* from Grenada and St. Vincent are all referable to *saileri* and in part constitute its type series.

On 24 June 1971 the author took a series of adults and nymphs breeding on a large sedge *Scleria melaleuca* Schl. & Champ. in Dominica. The plants were growing on a steep hillside south of the mouth of the Layou River. The habitat was an overgrown clearing surrounded by broken second growth forest. *Scleria* is a tall, rank sedge that does not seem to be present along roadsides, in plantation understories, or adjacent to beaches.

Uhler (1894) noted that on Grenada *saileri* (as *longiceps*) was swept from weedy places near a stream and on herbage in open and marshy places, so it apparently is not restricted to woodland habitats.

West Indian records: GRENADA: Uhler's (1894) records of *longiceps* from Grenada belong here. The Balthazar material constitutes the type material of *saileri;* Balthazar (windward side), Mount Gay Estate (leeward side); Vendome Estate (leeward side); ST. VINCENT: Uhler (1893) (as *longiceps* without definite locality); ST. LUCIA: Union, Castries 17-IX-19 (J. C. Bradley); DOMINICA: 1 mi. S. Layou River Mouth 24-VI-1971 (Slater, Baranowski, Harrington).

Oedancala cubana Stal

This is one of the largest and is the most elongate species of *Oedancala.* It is readily recognizable by the very elongate first antennal segment and the non-spotted apical corial margin. As noted by Slater (1955) the sexes are strongly dimorphic in antennal length, males having much longer antennae than females. In contrast to most pachygronthines, males generally are larger and more robust. Slater (1966) described the fifth instar nymph.

O. cubana is essentially endemic to Cuba and the Isle of Pines and apparently is relatively common. I have recently examined authentic specimens from Big Pine Key, Florida. Uhler (1876) reported *cubana* from the southern United States. Subsequent authors (including myself) have referred this

record to *O. crassimana*. Such action is probably correct, but the discovery of true *cubana* in the Florida Keys makes it possible that Uhler actually did examine specimens from the U. S.

West Indian records: CUBA: reported by Barber (1947) from Santiago de las Vegas, Hav.; Benavides; Sta. Tomas Las V.; Palmira Las V.; Guaimaro, Cam.; Ct. Jaronu, Cam.; C. Baragua, Cam.; Seboruco, Ote.; Rio Toa, Baracoa, Ote.; Jarahueca, Ote.; Guaro, Ote.; Nagua, Ote.; Central, E. Palma, Ote.; Santiago de Cuba, Ote.; Hoyo Colorado, Hav.; Soledad, Las V. By Slater (1955) from Upper Yara Valley; San Blas; Cienga de Zapota; Buenos Aires (Trinidad Mts.); Guantanamo. Alayo (1973) stated that it occurs throughout Cuba and reported it from Guana (P. Rio) and Soledad, Cienfuegos L.V. Additional records: St. Antonio de las Vegas, 100-150 m. 22-XI-1965, Prov. Habana (Jar Prokop) (Brno Museum); Cabanas P. d R, 5-18-IX-13; Baños de Ciego.; Montero, S. Clara, 30 km. W. Cienfuegas 14-X-1917; Sta. Clara Las Villas, 18-V-1971 (L. Gruner) (JAS).

ISLE OF PINES: reported by Barber (1947) without definite locality, by Slater (1955) from Columbia and McKinley and by Slater (1966) from Santa Barbara.

Oedancala crassimana (Fabricius)

This species and *bimaculata* Distant closely resemble each other in habitus, although they are unquestionably distinct species. Other than the male genitalia (see Slater 1955), the most reliable character that distinguishes *crassimana* from *bimaculata* is the distinct pubescence mesally as well as laterally on the vertex, whereas *crassimana* is glabrous on the vertex mesad of the ocelli except for a small seta arising from each puncture. Once this character is understood, discrimination is no problem. *O. crassimana* has much thicker, heavier antennae than *bimaculata* and usually possesses a complete white or yellow median longitudinal vitta on the anterior pronotal lobe. The interocular/width pronotum ratio that I used previously (Slater 1955) to separate the 2 species has also proven reliable for West Indian material seen since then, although (as might be expected from ratios that approach one another so closely) an occasional specimen will be difficult to place on this criterion alone. The following Table shows a series of ratios of these characters for West Indian and Floridian material.

TABLE 1. RATIO OF WIDTH PRONOTUM/INTEROCULAR SPACE IN *Oedancala* SPP.

Species	N	Mean	Ratios	Locality
crassimana	5	2.9	2.7-3.1	Florida
crassimana	7	3.0	2.8-3.2	Cuba
crassimana	2	2.9	2.8-3.0	Jamaica
crassimana	1	2.8	—	Puerto Rico
bimaculata	8	2.5	2.3-2.66	Hispaniola
bimaculata	1	2.5	—	Grenada

While there are a number of characters that are coordinate in West Indian and continental *crassimana* populations the dark spot along the apical corial margin is almost invariably present (99%) in Floridian and Gulf Coast populations and is absent in the majority of specimens from the Greater Antilles (both specimens from Jamaica, 5 of 7 from Cuba and very faint in the other 2). This difference will probably prove to be of subspecific importance.

The female from Mayaguez, Puerto Rico, reported by Barber (1939) and Slater (1955) as *bimaculata,* is perplexing and may be a hybrid. It has the pronotal/interocular ratio and glabrous mesal vertex area and acuminate head of *crassimana* but the spotted apical corial margin and the thin antennae characteristic of *bimaculata.* I believe that until an adequate Puerto Rican sample, including males, can be examined this specimen should be tentatively referred to *crassimana.*

At Runaway Beach, Jamaica adults and nymphs were taken on *Cladium jamaicense* Crantz, a large sedge, growing in a damp sandy area near the beach.

West Indian records: CUBA; Viñales; Pen. de Guanahacabibes; Buenos Aires, (Trinidad Mts.); Jaronu; Camaguey; C. Baragua; Central E. Palma; Moa (Barber 1947); Baragua (Slater 1955); San Carlos Estate, Guantanamo; Guane N. of Viñales; S. Pinar del Rio (Slater 1956); Guanimar; larguna de Blanquizal (Alayo 1973). ISLE OF PINES: Heideman & Osborn (1917); Barber (1947); Alayo (1973) JAMAICA: Runaway Bay, St. Ann Parish 3-VII-1971 (Slater, Baranowski, Harrington) GRAND CAYMAN ISLAND: Scudder (1958); Slater (1966). LEEWARD ISLANDS: B.W.I. (Slater 1955).

Oedancala bimaculata Distant

The relationship of this species to *crassimana* is discussed above. *O. bimaculata* is actually much more difficult to separate, on external features, from *O. notata* Stal, a species which has not yet been taken in the West Indies. In addition to genitalia differences (see Slater 1955) the presence of distinct pubescence mesally on the vertex in *bimaculata* is diagnostic. The glabrous mesal area of the head in *notata* contrasts strikingly with the dense lateral pubescence. The pronotal width/interocular ratio will usually also separate the 2, but the differences are not great and cannot be relied on alone for a given individual.

West Indian records: GRENADA: Mount Gay Estate (Leeward side) (Uhler 1894); HISPANIOLA: San Christobal, Dominican Republic (Slater 1955); Mirebalais, Haiti, 8-VIII-1931 (J. G. Myers); JAMAICA: Richmond Hill, 12-IV-1906 (Van Duzee 1907); CUBA: Barber (1939) without definite locality; Camaguey; Nagua, Ote. (Barber 1947); Guanimar, Hab. (Alayo 1973); DOMINICA: Barber (1939). ISLE OF PINES: Barber (1947).

ACKNOWLEDGEMENTS

My appreciation is extended to the following: Dr. G. G. E. Scudder (University of British Columbia) for forwarding the specimens of *Pachygrontha singularis* to me for study; to Dr. R. M. Baranowski (University of Florida, Homestead), my colleague on several trips to the West Indies, for aid in field work, processing of material, and financial arrangements; to Mrs. Jane Harrington (University of Connecticut) for aid in field work on Dominica and Jamaica; and to Mrs. Veronica Picchi and Mrs. Flavia

O'Rourke for field assistance on Grenada and St. Vincent. Records from these last 2 islands cited as "Slater et al." pertains to material collected by the party of Baranowski, O'Rourke, Picchi, and Slater.

Appreciation is also extended to the Drake Fund of the National Museum of Natural History and to the Research Foundations of the University of Florida and the University of Connecticut for financial assistance to aid field work in the West Indies; to Mrs. Kathleen Schmidt (University of Connecticut) for execution of the Figure and to Mrs. Darleen Wilcox and Mrs. Elizabeth Slater (University of Connecticut) for assistance in the preparation of the manuscript.

Literature Cited

ALAYO, P. 1973. Los Hemipteros de Cuba Parte XI. Familia Lygaeidae. Torreia (N.S.) 25:1-67.

BARBER, H. G. 1923. A preliminary report on the Hemiptera-Heteroptera of Porto Rico collected by the American Museum of Natural History. Amer. Mus. Novitates 75:1-13.

BARBER, H. G. 1939. Insects of Porto Rico and the Virgin Islands. Hemiptera-Heteroptera (excepting the Miridae and Corixidae). New York Acad. Sci.; Sci. Surv. Puerto Rico and Virgin Islands 14(3):263-441.

BARBER, H. G. 1947. The family Lygaeidae (Hemiptera-Heteroptera) of the island of Cuba and the Isle of Pines. Mem. Soc. Cubana Hist. Nat. 19:1:55-75.

BARBER, H. G., and P. D. ASHLOCK. 1960. The Lygaeidae of the Van Voast-American Museum of Natural History expedition to the Bahama Islands 1953. Proc. Ent. Soc. Washington 62:117-124.

DARLINGTON, P. J., JR. 1938. The origin of the fauna of the Greater Antilles, with discussion of dispersal of animals over water and through the air. Quart. Rev. Biol. 23:1-26.

DARLINGTON, P. J., JR. 1957. Zoogeography: The geographical distribution of animals. J. Wiley & Sons, New York.

HEIDEMANN, O., and H. OSBORN. 1917. Rhynchota of the Isle of Pines. Ann. Carneg. Mus. 11:346-355.

SCHUCHERT, C. 1935. Historical geology of the Antillean-Caribbean region of lands bordering the Gulf of Mexico and the Caribbean Sea. John Wiley & Sons, New York.

SCUDDER, G. G. E. 1958. Results of the Oxford University Cayman Islands biological expedition of 1938: Lygaeidae (Hemiptera-Heteroptera). Ent. Mon. Mag. 94:145-150.

SLATER, J. A. 1955. A revision of the subfamily Pachygronthinae of the World (Hemiptera: Lygaeidae). Philippine J. Sci. 84(1):1-160; 4 pl.

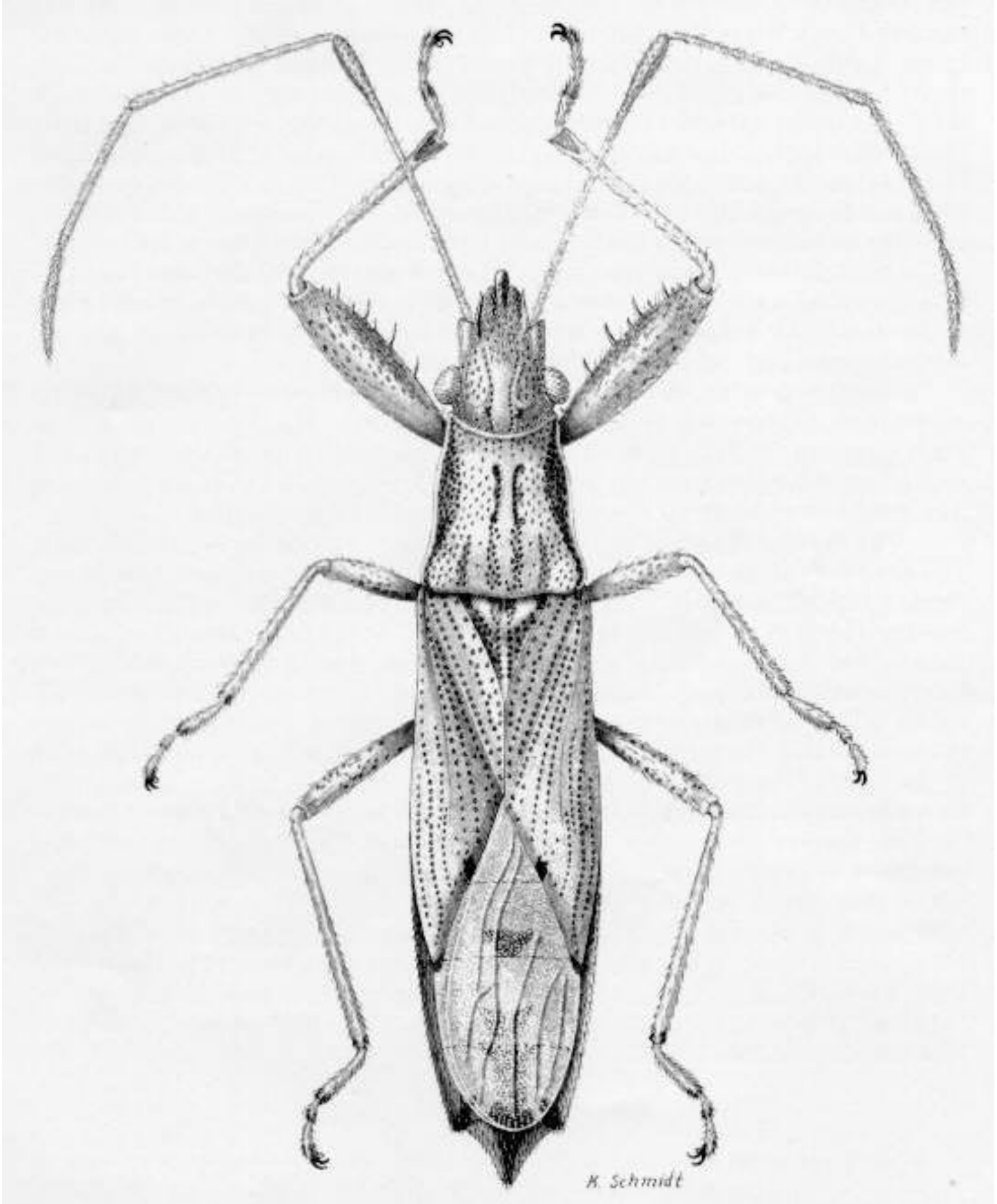
SLATER, J. A. 1956. Neotropical Pachygronthinae in the American Museum of Natural History (Hemiptera: Lygaeidae). Amer. Mus. Novitates 1769:1-5.

SLATER, J. A. 1964. A Catalogue of the Lygaeidae of the World. 2 vol. University of Connecticut, Storrs, Connecticut. 1668 p.

SLATER, J. A. 1966. A further contribution to our knowledge of the Pachygronthinae (Hemiptera: Lygaeidae). Jour. Ent. Soc. Queensland 5:51-65.

STÅL, C. 1874. Enumeratio Hemipterorum pt. 4. K. Svenska VetenskAkad. Handl. 12(1):1-186.

UHLER, P. R. 1876. List of Hemiptera of the region west of the Mississippi River, including those collected during the Hayden explorations of 1873. Bull. U. S. Geol. Geog. Surv. Terr. 1:269-361.
UHLER, P. R. 1893. A list of the Hemiptera-Heteroptera collected in the island of St. Vincent by Mr. Herbert H. Smith; with descriptions of new genera and species. Proc. Zool. Soc. Lond. 1893:705-719.
UHLER, P. R. 1894. On the Hemiptera-Heteroptera of the island of Grenada, West Indies. Proc. Zool. Soc. Lond. 1894:167-224.
VAN DUZEE, E. P. 1907. Notes on Jamaican Hemiptera. Bull. Buffalo Soc. Natur. Sci. 8:5:1-79.


K. Schmidt