

A REVIEW OF THE BEACH FLIES OF THE
CARIBBEAN AND GULF OF MEXICO
(DIPTERA: CANACIDAE)

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Abstract.—The beach flies (Diptera: Canacidae) of the Caribbean and Gulf of Mexico, with focus on the species of Belize (Central America), are reviewed. The faunas from the Caribbean and Gulf of Mexico comprise four genera and seven species as follows: *Canacea* Cresson (*C. macateei* Malloch), *Nocticanace* Malloch (*N. texensis* (Wheeler); *N. wirthi*, new species; *N. panamensis*, new species), *Paracanace* Mathis & Wirth (*P. aicen* Mathis & Wirth; *P. lebam* Mathis & Wirth), and *Procanace* Hendel (*P. dianneae* Mathis). Keys and a diagnosis are provided for each genus and most species, and for *Nocticanace*, *Paracanace*, and *Procanace* a key to the species groups on a world basis is furnished. In addition, the *texensis* group of the genus *Nocticanace* is revised. Several structures of each new species are illustrated to facilitate their identification.

In the published literature on the dipterous family Canacidae, more commonly known as beach flies, no mention is made of collection records from the Caribbean or Gulf of Mexico before 1950. Since then, the record is limited primarily to descriptions of a few new species (Wirth 1975). For individual countries that are a part of this region, the paucity of information is even more acute—usually none exists. Thus for a country like Belize, which is a focus of this paper, there are no records of beach flies, either under that geopolitical name or its predecessor, British Honduras. Although no species or collection records have been published from Belize, the occurrence of a few species was expected because genera such as *Canacea* Cresson and *Nocticanace* Malloch include species with distributions in adjacent countries (Wirth 1975). Like most projects on the systematics of Diptera, however, especially those concerned with the neotropics, many of the observations and discoveries reported here were not anticipated. To give greater meaning and perspective to these findings, the results are reported within the context of a faunal re-

view of the beach flies of the Caribbean and Gulf of Mexico.

The impetus for this project resulted from field work on the insects of mangroves, sometimes called the mangal (Tomlinson 1986), that are associated with Belizean cays, especially those within the Stann Creek District. With funding from the Caribbean Coral Reef Ecosystems Program (CCRE), field work has been conducted on the mangrove habitats of Twin Cays, with reconnaissance work on several of the nearby cays as well. On five field trips to these cays, I have made particular effort to collect specimens of the family Canacidae. This study also includes recently collected specimens from field work that I conducted in Cuba (1984), Dominica and St. Vincent (1989), and Florida (1989). In addition, W. W. Wirth made special effort to collect beach flies on visits to Antigua, Dominica, Jamaica, and Puerto Rico and has graciously made these specimens available. A total of three species was collected and is reported here from Belize. This brings the total number of beach-fly species from the Caribbean and Gulf of Mexico to seven.

Most of the specimens that were studied in conjunction with this paper are in the collections of the Smithsonian Institution (USNM). Others, especially primary types, were borrowed from other institutions. These institutions and their acronyms, as used in the text, and their respective curators are as follows: CAS—California Academy of Sciences, San Francisco, California (Dr. Paul H. Arnaud, Jr.); BDAF—Department of Agriculture and Fisheries, Botanical Garden, Paget, Bermuda (Dr. Daniel J. Hilburn); IZAC—Intituto de Zoologia, Academia de Ciencias, Havana, Cuba (Mr. Jorge L. Fontenla).

For each genus and species treated in this review, a synonymy, diagnosis, the known distribution, and a remarks section are provided. In the synonymies, only the literature that is pertinent to the Caribbean and Gulf regions or the species' nomenclatural history is cited. Specific collection data, except for the *texensis* group of the genus *Nocticanace*, are cited only for Belizean specimens. The *texensis* group is more comprehensively revised to include complete descriptions and a listing of all specimens examined. The descriptive format for the new species follows Mathis & Wirth (1978) and Mathis (1982, 1988). The illustrations of the male terminalia, especially the lateral views of the surstylus, were drawn from flattened, slide-mounted structures to ensure uniform views. In some specimens, the apex of the surstylus has a tendency to curve inward ventrally, partially obscuring the shape of that structure from a lateral view. A more detailed account of the morphology and higher classification of Canacidae can be found in Mathis (1982) and Wirth (1987). Two venational ratios are used commonly in the descriptions. Costal Vein Ratio: The straight line distance between the apices of R_{2+3} and R_{4+5} /distance between the apices of R_1 and R_{2+3} . M Vein Index: The straight line distance along vein M between crossveins (dm-cu and r-m)/distance apicad of dm-cu.

Key to Genera of Canacidae from the Caribbean and Gulf of Mexico

- 1. Laterocline fronto-orbital setae four or more; fore femur bearing row of usually from four to five spinelike setae along apical one-half of anteroventral surface; apical one-third of arista bare; two supra-alar setae *Canace* Cresson
- Laterocline fronto-orbital setae three; fore femur lacking row of spinelike setae; arista evenly haired throughout length; one supra-alar seta 2
- 2. Intrafrontal setae absent, although anterior one-third of frons occasionally with scattered setulae
..... *Procanace* Hendel
- Intrafrontal setae present, one or more pairs in addition to any setulae 3
- 3. One intrafrontal seta present; post-ocellar setae either much reduced or lacking *Nocticanace* Malloch
- Two intrafrontal setae present; post-ocellar setae well developed, proclinate and slightly divergent
..... *Paracanace* Mathis & Wirth

Genus *Canace* Cresson

Canace [lapsus].—Malloch, 1924:52 [unavailable; see Mathis, 1982, for discussion].

Canace Cresson, 1924:164. Type species: *C. macateei* Malloch, by original designation [Cresson validated Malloch's name as an indication].—Mathis, 1982:4–7 [review].

Canace [in part].—Wirth, 1951:259–265 [review]; 1965:733 [nearctic catalog]; 1970:397–403 [revision]; 1975:1 [neotropical catalog].—Wheeler, 1952:90–91 [discussion].

Diagnosis.—Moderately small to moderately large beach flies, length 2.0 to 4.5 mm.

Head: Mesofrons distinct from parafrons, shiny, very thinly microtomentose, bearing from three to five large, proclinate setae along lateral margin, mesofrons bare of setae; parafrons microtomentose, appearing dull; postocellar setae subequal in length to ocellar setae and with similar orientation; four large, latero-clinate, fronto-orbital setae; arista variable, usually with apical one-fourth to one-third bare of setulae, stylelike, some species with minute setulae extended nearly to apex but not appearing plumose; anaclinate genal setae two; antero-clinate genal seta one.

Thorax: Dorsocentral setae 4 (1 + 3), all subequal in size; acrostichal setae conspicuous, arranged in 4 irregular rows anteriorly, becoming more regular posteriorly, middle rows with setulae slightly larger and with large pair of prescutellar setae; lateral scutellar setae 2 pairs and with several setae dorsally; supra-alar setae 2, anterior seta only slightly smaller than posterior seta; 2 notopleural setae; color of pleural setulae variable, usually black, all large setae black; propleuron bare of setulae; 1-2 large, anepisternal setae; katepisternal setae present; fore femur with row of 3-12 stout, spinelike setae anteroventrally; hind tibia lacking apical seta anteroventrally; apical section of vein M straight.

Abdomen: Female epiproct broad basally, roughly triangular to nearly ellipsoidal, cerci as two parallel-sided narrow processes, each with one long, stout, apical seta; male surstylus with anteriorly curved hook.

Discussion.—*Canacea* is a New World genus of four species that are primarily tropical in distribution. Mathis (1982) last reviewed the genus.

Canacea macateei Malloch

Figs. 1-12

Canacea macateei Malloch, 1924:52.—Cresson, 1924:164 [discussion]; 1936:265 [discussion].—Johnson, 1925:276 [list].—Mathis, 1982:7 [review].

Canacea snodgrassii [misidentification, in part].—Johnson, 1910:807 [list].—Wirth, 1951:260 [synonymy]; 1965:733 [nearctic catalog].

Canacea macateei.—Malloch, 1933:5 [note].—Curran, 1934:356 [status].—Wheeler, 1952:90-91 [distribution, key].—Wirth, 1970:399 [resurrection from synonymy, figure of male terminalia].—Teskey and Valiela, 1977:545-547 [description of larva and puparium, natural history].

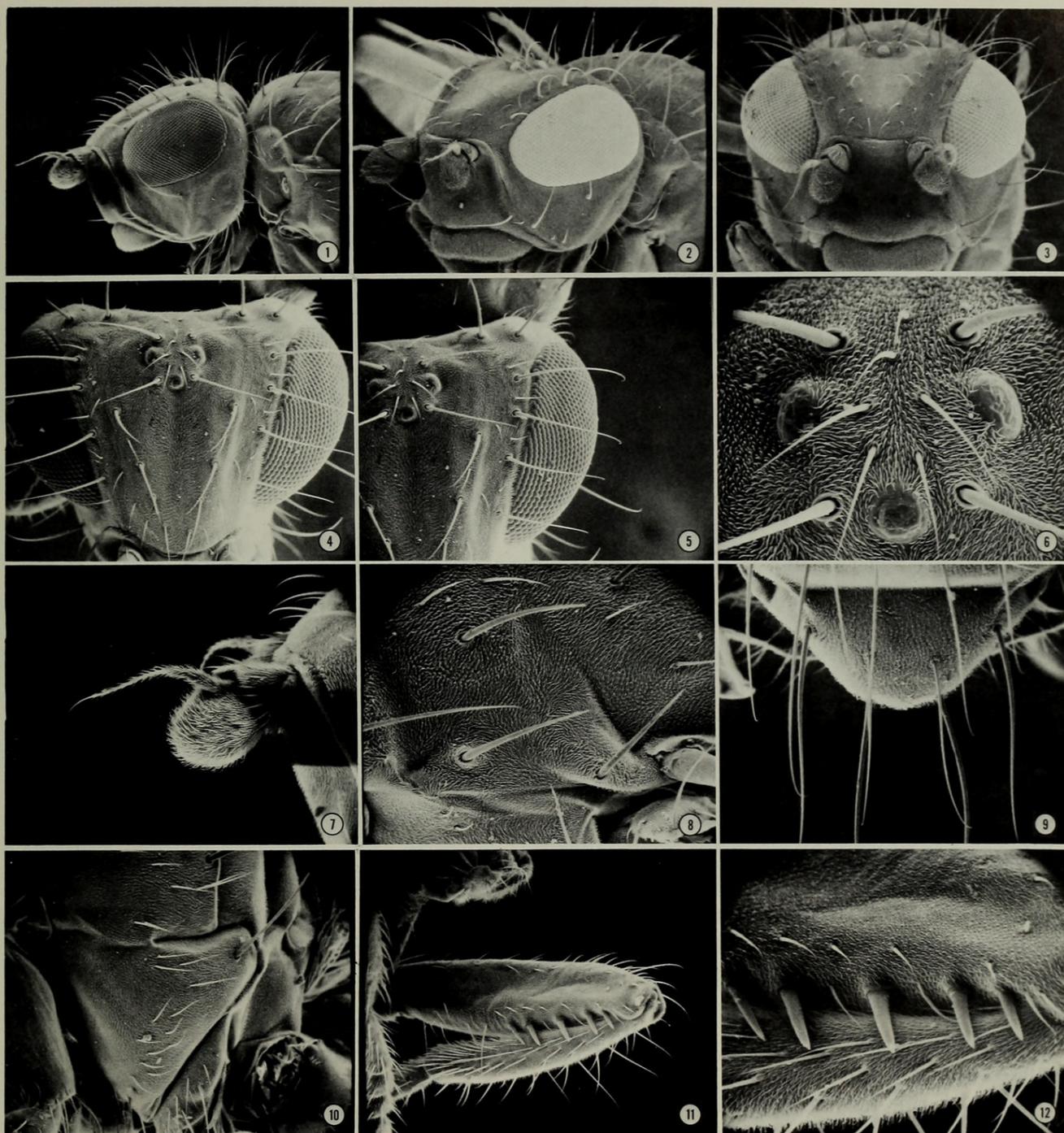
Specimens examined.—Belize. Stann Creek District: Twin Cays (Aanderaa Flats), 7-19 Nov 1987, W. N. & D. Mathis (28 ♂, 14 ♀; USNM); Twin Cays (S end of West Island), 17 Nov 1987, W. N. & D. Mathis (1 ♂; 1 ♀; USNM).

Distribution.—Canada (New Brunswick, Prince Edward Island) and United States (Atlantic and Gulf coasts from Maine to Texas), south to Cuba and Belize.

Natural history.—Teskey & Valiela (1977) successfully reared this species from larvae and puparia that were collected on mats of blue-green algae in Great Sippewissett marsh on Cape Cod, Massachusetts. Larvae of *C. macateei*, along with those of Dolichopodidae, were the principal contributors to the biomass of invertebrates in the algal mats. Pupae were quite common, and the pupal stage is very brief, perhaps no more than two to three days. Adults were observed to aggregate, especially at night, on the tops of grass-covered dunes.

In Belize, we collected adults by sweeping an aerial net just above mats of blue-green algae that occurred along the mud banks of brackish pools. The surface of the mud banks, which is water covered only at higher tides, is broken by deep cracks that have divided the bank into irregularly shaped mud plates that are 15-25 cm in diameter. The algal mats were comparatively thick, and as a protective covering, they helped keep the underlying mud moist.

Remarks.—The species of *Canacea* are



Figs. 1–12. Scanning electron micrographs of *Canacea macateei*: 1, Head, lateral view; 2, Head, fronto-oblique view; 3, Head, anterior view; 4, Frons, dorsal view; 5, Fronto-orbital setae, dorsal view; 6, Ocellar triangle, dorsal view; 7, Antenna, lateral view; 8, Notopleuron and setae, lateral view; 9, Scutellum, dorsal view; 10, Katepisternum and setae, lateral view; 11, Left foreleg, anterior view; 12, Enlargement of left fore femur and tibia showing anteroventral, spinelike setae, anterior view.

quite similar externally but can be distinguished by the structures of the male terminalia and the position, number, and color of certain setae. Specimens of *C. macateei* can be distinguished from congeners by the following combination of characters: fore

femur with a row of from three to five stout, anteroventral setae; the setulae of the pleural sclerites are black; specimens are generally larger, over 2.50 mm in length; and the surstylus of the male terminalia has the stem of the hook wider than long.

Genus *Nocticanace* Malloch

Nocticanace Malloch, 1933:4. Type species: *N. peculiaris* Malloch, by original designation.—Wirth, 1951:269–274 [revision]; 1965:734 [nearctic catalog]; 1975:2–3 [neotropical catalog].

Diagnosis.—Small to medium-sized beach flies, length 1.8 to 3.7 mm; general coloration grayish black.

Head: Intrafrontal setae one pair; post-ocellar setae either absent or much reduced, less than one-fourth length of ocellar setae; ocelli arranged to form an isosceles triangle, distance between posterior ocelli greater than that between either posterior ocellus and the anterior ocellus. Epistomal margin sinuate; clypeus low, width subequal to length of antenna. Two long anaclinate genal setae; anteroclinate genal seta moderately well developed, at least one-half length of larger anaclinate genal setae. Palpus grayish black, bearing one to several long setae, each seta two to three times greatest width of palpus.

Thorax: Anepisternum with scattered setulae; proepisternal seta absent; katepisternal seta present, well developed. Legs entirely dark colored, grayish black; fore femur bearing from four to six long and evenly spaced setae along posteroventral margin, length of setae at least equal to and usually greater than width of femur.

Discussion.—In preparing the following key to species groups, I have examined most species of the genus. The key, however, should still be considered preliminary, and I invite the critique and comment of users, as eventually I plan to review the remaining genera of Canacidae in a paper similar to Mathis (1982). The new species that are described below belong to the *texensis* group, which is also characterized and its species revised.

Annotated Key to Species Groups of the Genus *Nocticanace*

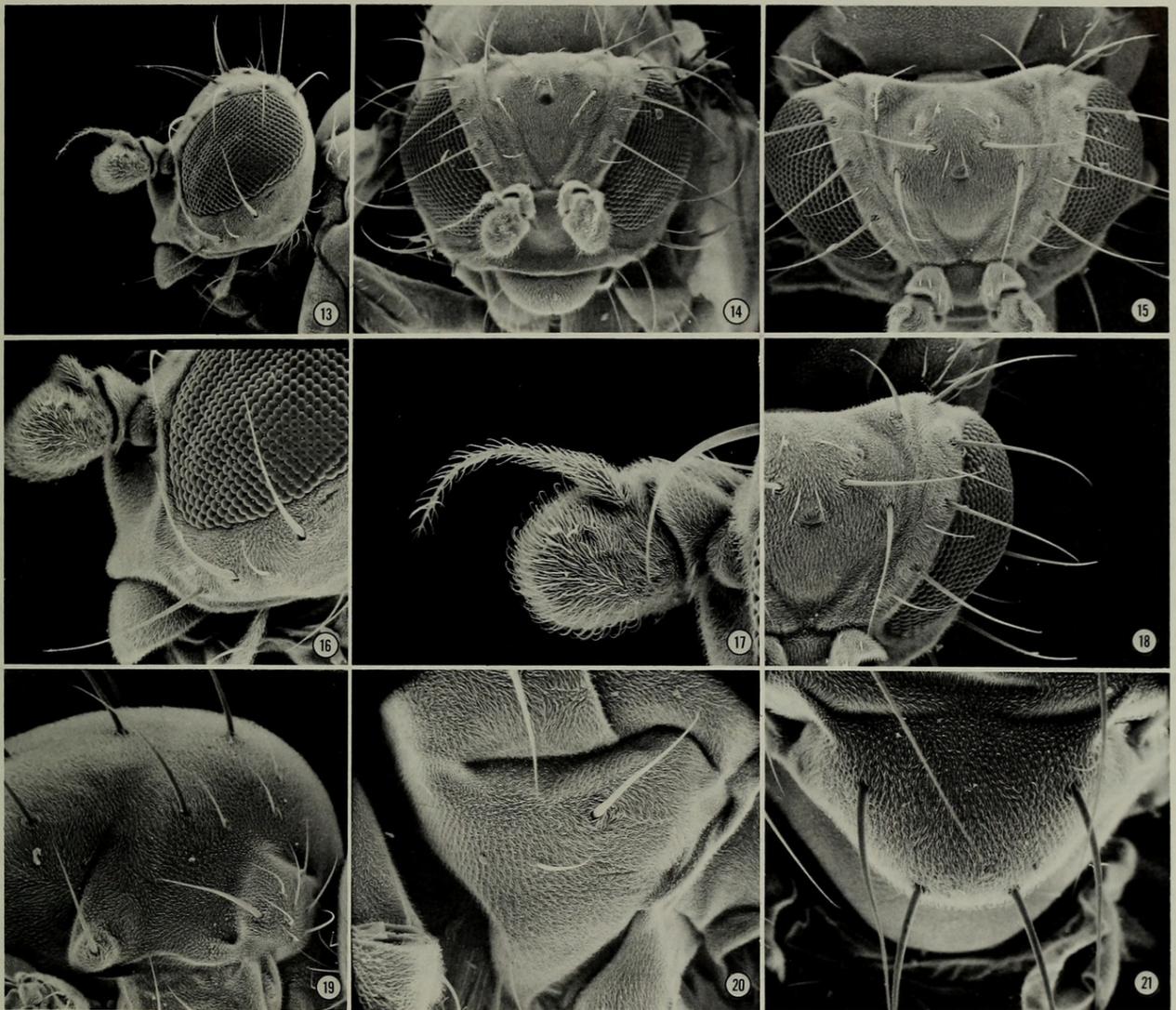
1. Anterior notopleural seta absent 2
– Anterior notopleural seta present 3

2. Apical scutellar setae distinctly curved anaclinate . . . the *pacifica* group [19 species; Old World and Oceania]
– Apical scutellar setae straight to very slightly curved the *texensis* group [3 species; Caribbean, Gulf of Mexico, Atlantic coast of southeastern United States]
3. Length of apical section of vein CuA₁ twice or more length of crossvein dm-cu the *galapagos* group [8 species; Galápagos Islands and southwestern North America]
– Length of apical section of vein cuA₁ subequal to length of crossvein dm-cu 4
4. Apical scutellar setae distinctly anaclinate the *ashlocki* group [1 species, *N. ashlocki* Wirth; Galápagos Islands]
– Apical scutellar setae not anaclinate the *chilensis* group [1 species, *N. chilensis* (Cresson); Chile (there are numerous undescribed species in this group)]

The *texensis* Group

Diagnosis.—Acrostichal setae lacking; apical scutellar setae nearly straight in lateral view, slightly convergent in dorsal view, but not distinctly curved upward; anterior notopleural seta lacking, only a posterior seta present; proepisternal seta(e) present; mid femur of male lacking comblike row of setae; hind basitarsomere lacking spinelike basoventral setae. Wing with length of apical section of vein CuA₁ long, about twice length of crossvein dm-cu; M vein index 0.42–0.49.

Discussion.—Until now, the only included species in the *texensis* group was *N. texensis* (Wheeler). The two new species added here are very similar and are very closely related to *N. texensis*. The three species together are the only representatives of the



Figs. 13–21. Scanning electron micrographs of *Nocticanace texensis*: 13, Head, lateral view; 14, Head, anterior view; 15, Head, dorsal view; 16, Gena and setae, lateral view; 17, Antenna, lateral view; 18, Fronto-orbital setae, dorsal view; 19, Right notopleuron and setae, lateral view; 20, Left katepisternum and setae, lateral view; 21, Scutellum, dorsal view.

genus *Nocticanace* that occur on beaches of the Atlantic Ocean (primarily within the Caribbean Sea and Gulf of Mexico). Other species of *Nocticanace* are found along coasts of the Indian and Pacific oceans. The species of the *texensis* group probably arose from a single lineage that originally came from the Pacific Ocean and then penetrated into and radiated within the Caribbean Sea and Gulf of Mexico.

As there are only three known species in the *texensis* group, I have not provided a key to distinguish between them. The diagnoses, descriptions (only *N. texensis* is completely described; the others are compared to it), and figures (Figs. 13–29) ade-

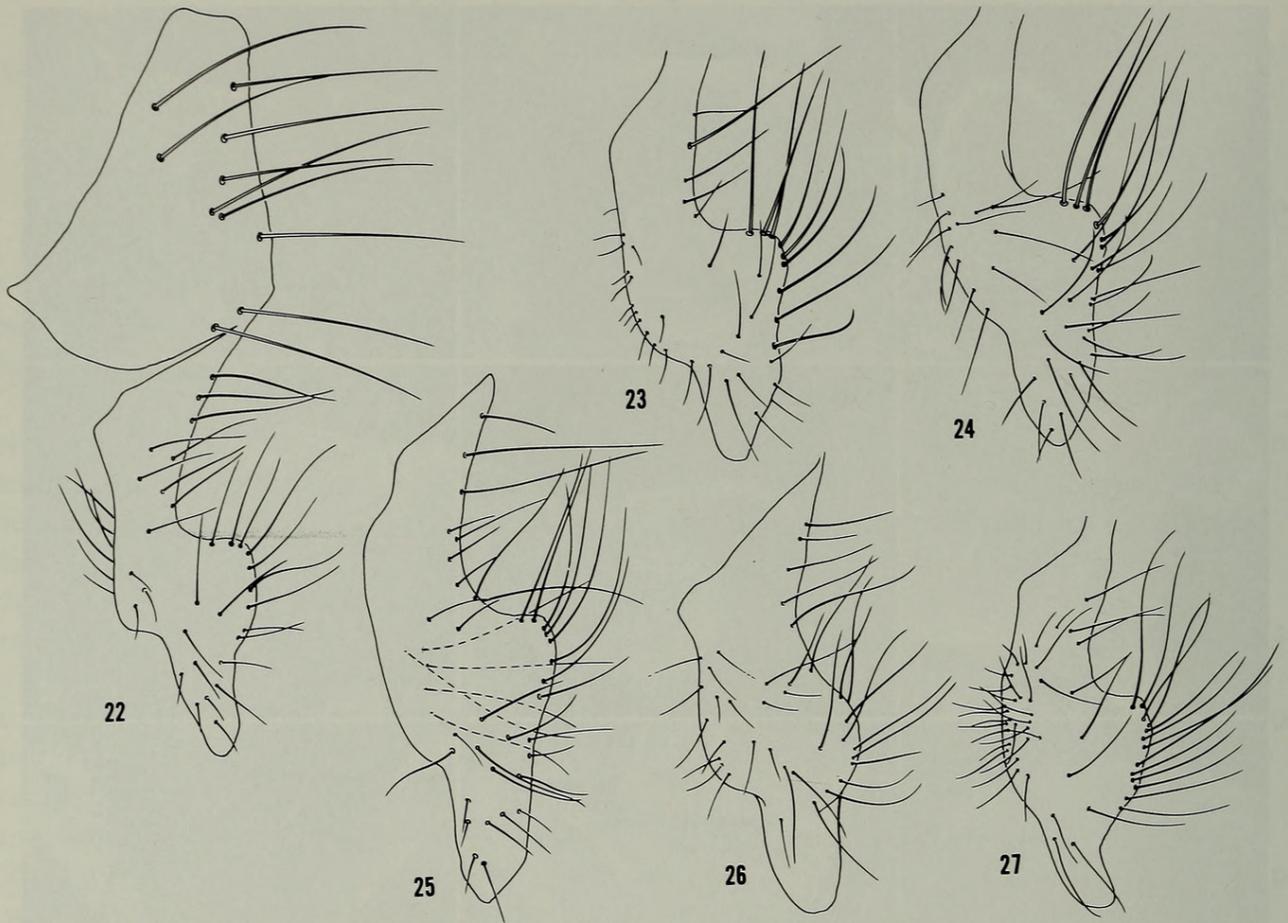
quately outline characters to distinguish between them and other congeners. The only distinguishing characters between the three species of the *texensis* group that I have found are those of the male terminalia.

Nocticanace texensis (Wheeler)

Figs. 13–27

Canaceoides texensis Wheeler, 1952:92.
Nocticanace texensis.—Wirth, 1954:62 [generic combination]; 1965:734 [nearctic catalog]; 1975:3 [neotropical catalog].

Diagnosis.—Small to moderately small beach flies, length 1.60 to 2.95 mm (holo-



Figs. 22–27. External male terminalia of *Nocticanace texensis*: Variation in shape of the surstylus from same and different localities, lateral views: 22, Belize, Stann Creek District, Carrie Bow; 23, USA, North Carolina, Wrightsville; 24, USA, North Carolina, Wrightsville; 25, Mexico, Tabasco, Paraiso (5 km N); 26, Antigua, Dutchman Bay; 27, Dominica, David Bay.

type 2.15 mm). Coloration generally brown dorsally and gray laterally.

Head: Frons generally brown to olivaceous or slightly charcoal brown, coloration of frons uniform or ocellar triangle more grayish, and fronto-orbits charcoal gray. Ocellar setae divergent, latero-clinate; intrafrontal setae antero-clinate, slightly convergent; ocellar area with three or four smaller setulae. Face, clypeus, and gena (to an extent) whitish, with faint tinges of blue or gray, gena becoming darker posteriorly, more charcoal gray. Orientation and size of genal setae as follows (anterior to posterior setae): 1st seta large, antero-clinate; two large anaclinate setae with one, rarely zero or two anaclinate setulae between larger anaclinate setae; anaclinate setula about one-third length of larger setae.

Thorax: Mesonotum from dorsal view mostly brown to olivaceous brown, darker around anterior margins; postpronotum, anterior half of notopleuron, and to a lesser degree the posterior fourth of scutum, and scutellum gray; coloration of thorax in lateral view brown dorsally, becoming gray ventrally around area of notopleuron (in some specimens just above, others at or below notopleuron), remainder of pleural areas mostly unicolorous, gray. Notopleuron bearing only one seta, inserted posteriorly; anepisternum with three large setae and from three to five smaller setulae between larger ones, larger setae with insertions and orientations as follows: posterior seta, usually the largest, with postero-clinate orientation, ventral seta, usually the next largest, with declinate orientation, dorsal seta smallest

(not much larger than setulae) and with anacclinate orientation; one large katepisternal seta and one or two smaller setulae inserted ventrad or anteroventrad. Fore femur with four or five long setae along posteroventral margin and four or five shorter setae posterodorsally; mid tibia bearing apicoventral spinelike seta, length about equal to tibial width; hind basitarsomere lacking basoventral pair of larger setae; legs mostly concolorous, gray to dark gray apically. Wing generally lightly infumate, brownish; costal vein ratio averaging 0.13 (holotype 0.15); M vein index averaging 0.43 (holotype 0.49); apical section of vein CuA_1 slightly more than twice length of crossvein dm-cu.

Abdomen: Dorsum mostly olivaceous brown, gray laterally and ventrally. Male terminalia (Figs. 22–27) as follows: posterior margin of surstylus densely setulose, posterior half of surstylus in lateral view roughly triangular, distinctly angulate to form a large and wide posterior projection and a tapered, more slender process ventrally (sometimes curved inward), anterior margin with a subapical emargination (see remarks section below for discussion of variation).

Type material.—The holotype male is labeled “Galveston[,] Tex[as] 9.13.50 [handwritten]/M. R. Wheeler Collectors/Holotype *Canaceoides texensis* Wheeler 1952 [red; handwritten].” The allotype female (not examined) is reported to bear the same locality label data as the holotype. The holotype is double mounted (glued to a paper point), is in excellent condition (the abdomen has been removed, dissected, and the parts are stored in an attached plastic microvial), and is deposited in the California Academy of Sciences.

Other specimens examined.—Antigua. Dutchman Bay, 7 Jan 1965, W. W. Wirth (4 ♂; USNM). Belize. Stann Creek District: Carrie Bow, 4 Mar 1984, 2 Jun 1985, 15–27 Jan 1987, W. N. Mathis, C. Feller (18 ♂, 9 ♀; USNM). Dominica. Calibishie (sea shore), 27 Feb–22 Mar 1965, 1989, W. N.

Mathis, W. W. Wirth (15 ♂, 3 ♀; USNM); Coulibistri, beach, 21 Mar 1989, W. N. Mathis (23 ♂, 10 ♀; USNM); Layou River (mouth), 9 Jan 1965, W. W. Wirth (1 ♀; USNM); Macoucheri (sea shore), 1 Feb 1965, W. W. Wirth (1 ♀; USNM); Pagua Bay, 18 Feb 1965, W. W. Wirth (6 ♂, 5 ♀; USNM); Rosalie (cobble beach), 23 Mar 1989, W. N. Mathis (7 ♂, 4 ♀; USNM); Soufrière Bay, 24 Mar 1989, W. N. Mathis (9 ♂, 6 ♀; USNM); St. David Bay (sea shore), 23 Jan 1965, W. W. Wirth (15 ♂, 10 ♀; USNM). Mexico. Tabasco Province: Paraiso (5 km E), 6 May 1985, W. N. Mathis, A. Freidberg (26 ♂, 25 ♀; USNM). St. Vincent. Buccament Bay, 25–28 Mar 1989, W. N. Mathis (7 ♂, 4 ♀; USNM); Cumberland Bay, 28 Mar 1989, W. N. Mathis (4 ♂; USNM); Wallilabou (beach), 27 Mar 1989, W. N. Mathis (8 ♂, 4 ♀; USNM). United States. North Carolina: Wrightsville Beach (light trap), 3–7 Sep 1953, R. H. Foote (9 ♂, 23 ♀; USNM).

Distribution.—East (North Carolina south) and Gulf coasts of North America, West Indies (Antigua, Dominica, and St. Vincent), and Caribbean coast of Mexico and Belize.

Natural history.—All of the specimens from Belize were collected on Carrie Bow Cay, formerly Ellen Cay, which is a highly disturbed, vegetated sand cay that is about 18 km off the coast of Hopkins, Stann Creek District. The cay is small, 100 by 40 m, and the former woodland, mostly red mangrove, has been cleared. Twenty-two species of plants have been recorded from Carrie Bow, including a few that have been introduced. Stoddart et al. (1982) and a more recent paper by Rützler and Ferraris (1982) provide more extensive information on Carrie Bow and its habitats.

The specimens of *N. texensis* were collected by sweeping an aerial net with a fine-meshed bag immediately over and between rocks and exposed coral on the surrounding beach, which is mostly sand covered, especially on the north, east, and south sides.

Remarks.—Externally, this species is very similar to *N. wirthi* but can be distinguished from it and other congeners by the following characters: anterior notopleural seta absent; acrostichal setae absent; apical scutellar setae nearly straight in lateral view, not distinctly curved dorsally (anaclinate); and shape of the male terminalia, especially the unique surstylus (see figures).

The shape of the surstylus is quite similar to that found in males of *N. arnaudi* Wirth (the *galapagos* group), but specimens of the latter are usually larger (3–3.5 mm), are much darker brown dorsally with the dark coloration extended ventrally to the dorsal third of the anepisternum, and the notopleuron usually bears an anterior and posterior seta, although the latter seta is usually much better developed.

The shape of the surstylus also differs slightly from locality to locality (see Figs. 22–27 from different localities), and I interpret this to be intraspecific variation, perhaps clinal in nature. The differences found in populations from the Lesser Antilles, however, especially those from Dominica, could represent interspecific variation. The surstylus from a male collected in Antigua (Fig. 26), for example, appears to be somewhat intermediate between that found on Dominica (Fig. 27) and the more typical shape, as found in males from North Carolina, Texas, Mexico, and Belize (Figs. 22–25). Unfortunately no specimens are available from the Greater Antilles that could provide important evidence to help resolve this issue, and for the present, I prefer to recognize a single species.

Nocticanace wirthi, new species

Fig. 28

Nocticanace texensis [of authors, not Wheeler].—Wirth, 1954:61–62 [illustration of male terminalia]; 1965:734 [nearctic catalog].

Diagnosis.—As in the preceding species except as follows: small to moderately small beach flies, length 1.75 to 2.25 mm.

Abdomen: Male terminalia as follows (Fig. 28): surstylus in lateral view with two large, ventral lobes; posteroventral lobe wide, pointed anteroventrally, and densely setulose, especially along outer margin; anterior lobe blunt, thumblike, and setulose.

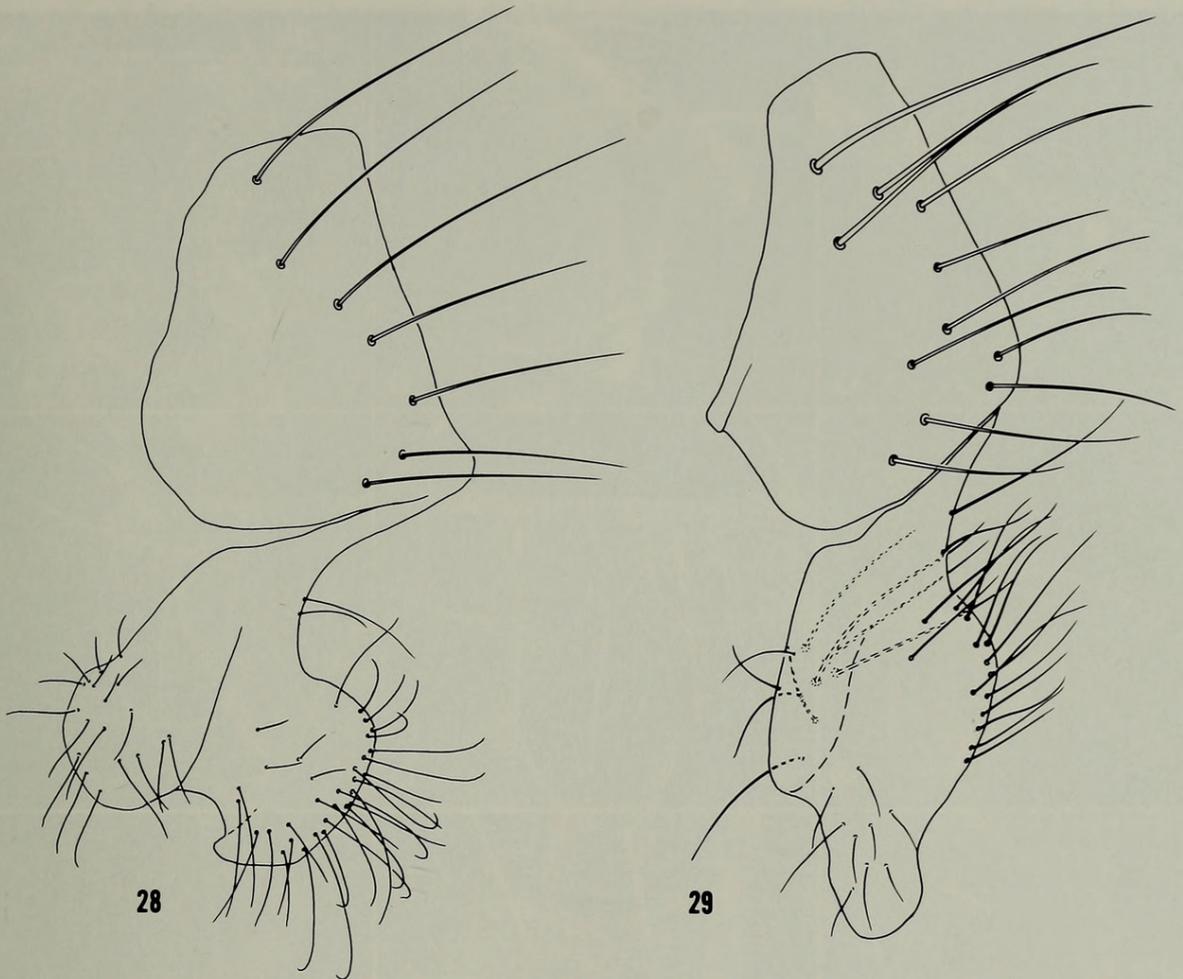
Type material.—The holotype male is labeled “Boyton Beach, Fl[orid]a [Palm Beach Co.]/WWWirth Collector/10 VIII 51 [10 Aug 1951] Intertidal rocks/♂/Nocticanace texensis (Wheeler) det WWirth [species name handwritten; black sub-border]/HOLOTYPE ♂ Nocticanace wirthi Mathis USNM [species name handwritten; red].” The allotype female and 14 paratypes (7 ♂, 7 ♀; CAS, USNM) bear the same locality label data as the holotype. Other paratypes are as follows: Cuba. Matanzas Province: Playa Larga, 1 May 1983, W. N. Mathis (3 ♂, 9 ♀; IZAC, USNM). Bermuda. Smith’s Parish: Spittal Pond (intertidal rocks), 18 Nov 1987, N. E. Woodley (21 ♂, 25 ♀; BDAF, USNM). The holotype is double mounted (minute nadel in a cork block), is in good condition, and is in the Smithsonian Institution (USNM).

Distribution.—Bermuda, Cuba, and southern Florida.

Natural history.—Wirth (1954:62) reported that the type series was “. . . collected from a shelf of limestone rock about a hundred yards long on the Atlantic Ocean beach. The rock projected from the water only at low tide and was covered with a scanty growth of filamentous green algae.” The specimens collected in Cuba were swept from a large limestone outcrop that extended into the sea. The limestone was deeply eroded, and the exposed surface had numerous sharp ridges.

Etymology.—It is a pleasure to name this species after Dr. Willis W. Wirth, who has contributed substantially to our knowledge of beach flies and who first illustrated this species.

Remarks.—This species is very similar to *N. texensis*, and the only distinguishing characters that I have found between these two species are those of the male terminalia,



Figs. 28–29. Lateral view of male terminalia: 28, *Nocticanace wirthi*; 29, *Nocticanace panamensis*.

especially the bilobed shape of the surstylus (see description and figures). Externally the specimens are virtually impossible to separate from those of *N. texensis*.

Nocticanace panamensis, new species

Fig. 29

Diagnosis.—As in *N. texensis* except as follows: moderately small beach flies, length 2.0 mm (based on the single pinned ♀ paratype).

Abdomen: Male terminalia as follows (Fig. 29): surstylus in lateral view more or less rectangular, posterior margin conspicuously setulose; inner lobe not developed as a process, bearing several setulae along median surface; outer lobe a large, thumblike posteroventral process that bears several setulae.

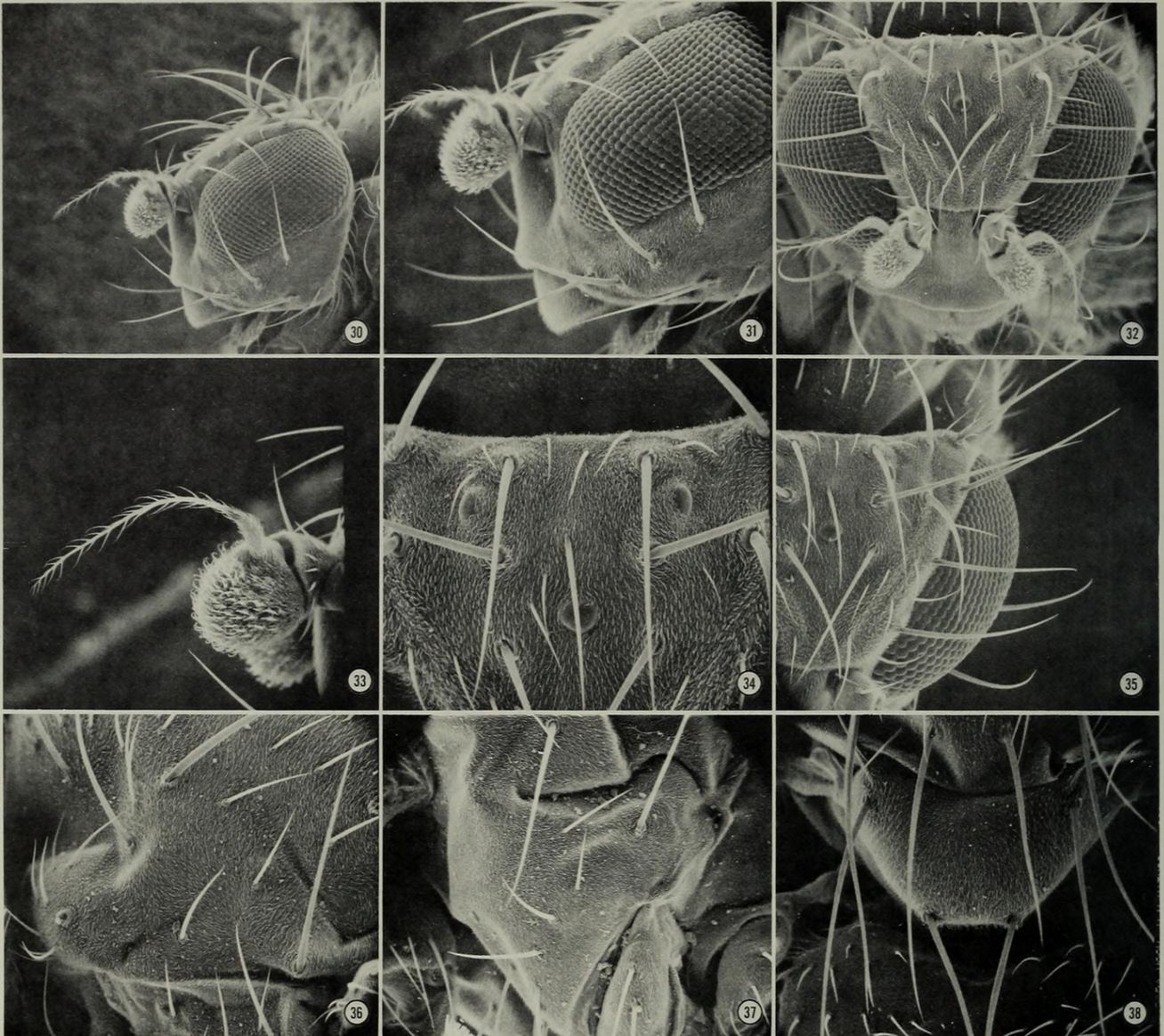
Type material.—The holotype male is la-

beled “[Panama] Mojinga Swamp[,] Ft. Sherman, C. Z. Jan. 1953[,] F. S. Blanton ct. [collector] *Nocticanace texensis* (Wheeler) ♂ 5 [“5” is circled][handwritten].” The allotype female (double mounted) and three paratypes (3 ♀; USNM; slide mounted) bear the same label data as the holotype. The holotype is slide mounted in balsam (most body parts have been dissected and are separated) and is in the Smithsonian Institution (USNM).

Distribution.—Panama. Fort Sherman is located at the Caribbean mouth of the Panama Canal.

Etymology.—The specific epithet, *panamensis*, refers to the country of Panama, where the type series was collected.

Remarks.—Like *N. wirthi*, this species differs from *N. texensis* in characters of the male terminalia, especially the shape of the surstylus (see figures and description above).



Figs. 30–38. Scanning electron micrographs of *Paracanace hoguei*: 30, Head, lateral view; 31, Gena and setae, lateral view; 32, Head, dorsal view; 33, Antenna, lateral view; 34, Ocellar triangle, dorsal view; 35, Fronto-orbital setae, dorsal view; 36, Notopleuron and setae, lateral view; 37, Katepisternum and setae, lateral view; 38, Scutellum, dorsal view.

Genus *Paracanace* Mathis & Wirth

Paracanace Mathis & Wirth, 1978:524.

Type species: *P. hoguei* Mathis & Wirth, by original designation.

Diagnosis.—Small to moderately small beach flies, 1.40 to 2.60 mm; general coloration whitish gray to brownish black.

Head: Intrafrontal setae two pairs; post-ocellar setae well developed, proclinate and very slightly divergent, subequal in length to intrafrontal setae; ocelli arranged to form isosceles triangle, with greater distance between posterior ocelli. Two to three large

anaclinate genal setae; anteroclinate genal seta well developed, subequal in length to larger anaclinate genal setae; epistomal margin sinuate; clypeus low, width more than $4\times$ height; palpus yellowish.

Thorax: Acrostichal setulae present, in about four rows, with a distinctly larger pre-scutellar pair; scutellar disc lacking setae; apical scutellar setae not anaclinate; anterior notopleural seta usually present (very weak or absent in one species); proepisternal seta(e) present; anepisternum with scattered setulae; katepisternal seta present. Femora and tibiae grayish black; tarsomeres yellow-

ish brown to dark brown, becoming darker apically; mid femur of male with comblike row of setae; hind tibia lacking spinelike setae apically. Wing with length of apical section of vein CuA₁ twice or more that of crossvein dm-cu; vein M index 0.38.

Discussion.—Like *Canacea*, all of the described species of *Paracanace* occur in the Western Hemisphere, with primarily tropical or subtropical distributions (Mathis and Wirth 1978).

I have recognized two species groups within *Paracanace*. This arrangement adheres to the cladogram for the species of this genus that Mathis and Wirth (1978:535) published. The two species groups are characterized in the key that follows. All known Caribbean species belong to the *hoguei* group (Figs. 30–38).

Key to Species Groups of *Paracanace*

- 1. Fore femur of male with from three to four long setae along posteroventral surface, setal length subequal to 2× femoral width; mid femur of male bearing a posteroventral, comblike row of setae along entire length, setae at proximate one-fourth pale; costal vein between humeral crossvein and subcostal break usually bearing a row of long spinelike setae, setal length subequal or greater than width of 1st costal cell The *hoguei* Group
- Fore femur of male lacking three or four setae as described above; mid femur of male bearing a posteroventral comblike row of setae along distal one-half only; setae along anterior margin of wing much shorter, not more than one-half width of 1st costal cell The *maritima* Group

Key to Species of the *hoguei* Group

- 1. Three, dorsally curved, genal setae subequal in length; body strongly se-

- tose (Figs. 30–38) (Cocos Island, Costa Rica)
- *P. hoguei* Mathis & Wirth
- Middle, dorsally curved, genal seta about one-half length of setae on either side; body moderately setose 2
- 2. Surstylus broader on distal half, especially evident in lateral view; ventral, surstylar margin broadly truncate in lateral and posterior views; posterior margin of surstylus bearing distinct row of longer setae (Florida, Jamaica)
- *P. lebam* Mathis & Wirth
- Surstylus in lateral view swollen along anterior margin near middle, tapered ventrally to broadly rounded, ventral margin; posterior margin of surstylus lacking distinct row of longer setae; posteroventral angle of surstylus noticeably produced apically (Figs. 39, 40) (Belize, Cuba, Dominica) . . . *P. aicen* Mathis & Wirth

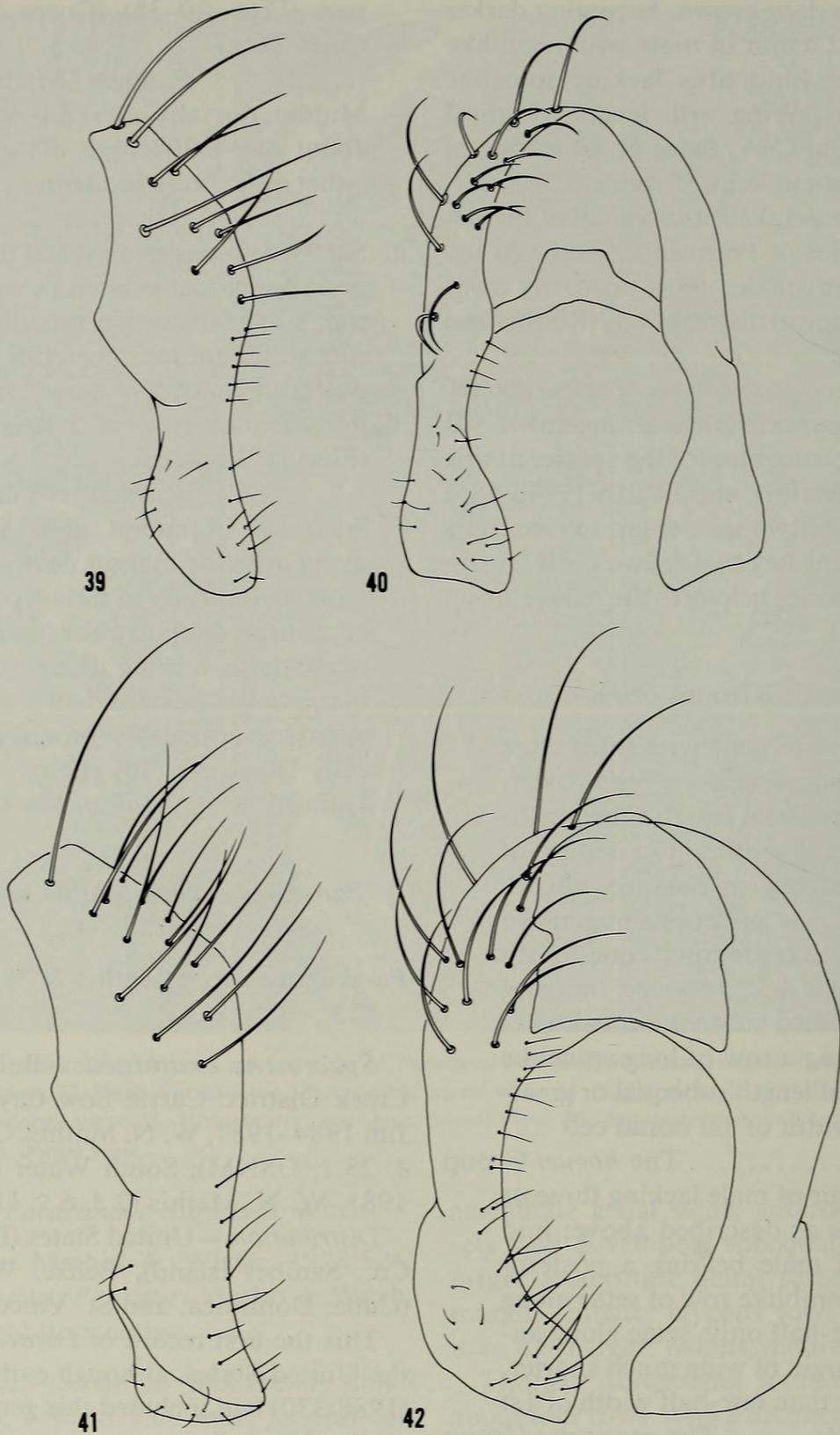
Paracanace aicen Mathis and Wirth
Figs. 39–42

Paracanace aicen Mathis & Wirth, 1978: 533.

Specimens examined.—Belize. Stann Creek District: Carrie Bow Cay, 15 Jan–2 Jun 1984–1987, W. N. Mathis, C. Feller (19 ♂, 25 ♀; USNM); South Water Cay, 1 Jun 1985, W. N. Mathis (2 ♂, 6 ♀; USNM).

Distribution.—United States (Florida: Lee Co., Sanibel Island), Belize, West Indies (Cuba, Dominica, and St. Vincent).

This the first record of *Paracanace* from the United States, although earlier, Mathis (1988:330) had included this genus in a key to the beach-fly genera from the United States with the expectation that the genus was likely to be found there. The new localities from the western Caribbean substantially increase the known distribution of this species, which previously was known only from Dominica in the Lesser Antilles.



Figs. 39-42. External male terminalia of *Paracanace aicen*: 39, Epandrium and surstylus (holotype from Dominica), lateral view; 40, Epandrium and surstyli (holotype from Dominica), posterior view; 41, Epandrium and surstylus (Florida, Lee Co., Sanibel Island), lateral view; 42, Epandrium and surstyli (Florida, Lee Co., Sanibel Island), posterior view.

The species may eventually be found to be circumcaribbean, but the paucity or absence of canacid collections from Colombia, Venezuela, and most countries of Central America precludes assessment of this possibility.

Natural history.—The specimens from Florida were collected on the causeway between the Gulf Coast of Florida and Sanibel Island (Lee Co.). The sides of the causeway, particularly the south side, were partially lined with broken pieces of concrete and large rocks to moderate the erosive action of waves. Much of the surface of the concrete and rocks was covered with algae. In addition to this species, beach flies of the following two species were also found in this habitat: *Procanace dianneae* (very abundant; see treatment below) and *Canacea macateei* (uncommon; see treatment above).

Although this species and *Nocticanace texensis* both occur on Carrie Bow Cay and are found in essentially the same habitats, I did not collect the two species together during a particular season. In the Lesser Antilles (Dominica and St. Vincent), I found the two species in the same sweep of the net, although in very unequal numbers. Where one species was common, the other was not. Whether this is an artifact of sampling or is indicative of temporal partitioning needs further investigation. Indeed, to what degree these two species may compete for the same or similar resources merits closer scrutiny.

See comments under the treatment of *N. texensis* for further information concerning Carrie Bow Cay and the specific habitat where this species occurs.

Remarks.—This species is closely related and similar to congeners of the *hoguei* group but can be distinguished from the latter by the following combination of characters: middle anaclinate genal seta about one-half length of seta on either side; spinelike setae along costal margin variable, short, not as long as width of 1st costal cell, or long (the holotype), length equal or slightly greater than width of 1st costal cell; general ap-

pearance setose but less so than in *P. hoguei*; surstylus of male terminalia as illustrated (Figs. 39–42). After study of several males from the new material collected in Belize, Cuba, Dominica, and Florida, I have noted some variation, although slight, in the shape of the surstylus. The range in variation is as illustrated (Figs. 39–42); the illustrations also facilitate identification of this species. Based on the sampling available, the shape of the ventral surstyler margin in the male from Florida, both lateral and posterior views (Figs. 41, 42), is more characteristic of the species than that of the holotype, which is from Dominica (Figs. 39, 40).

Paracanace lebam Mathis & Wirth
Figs. 43–44

Paracanace lebam Mathis & Wirth, 1978: 530.

Distribution.—Jamaica. Point Henderson.

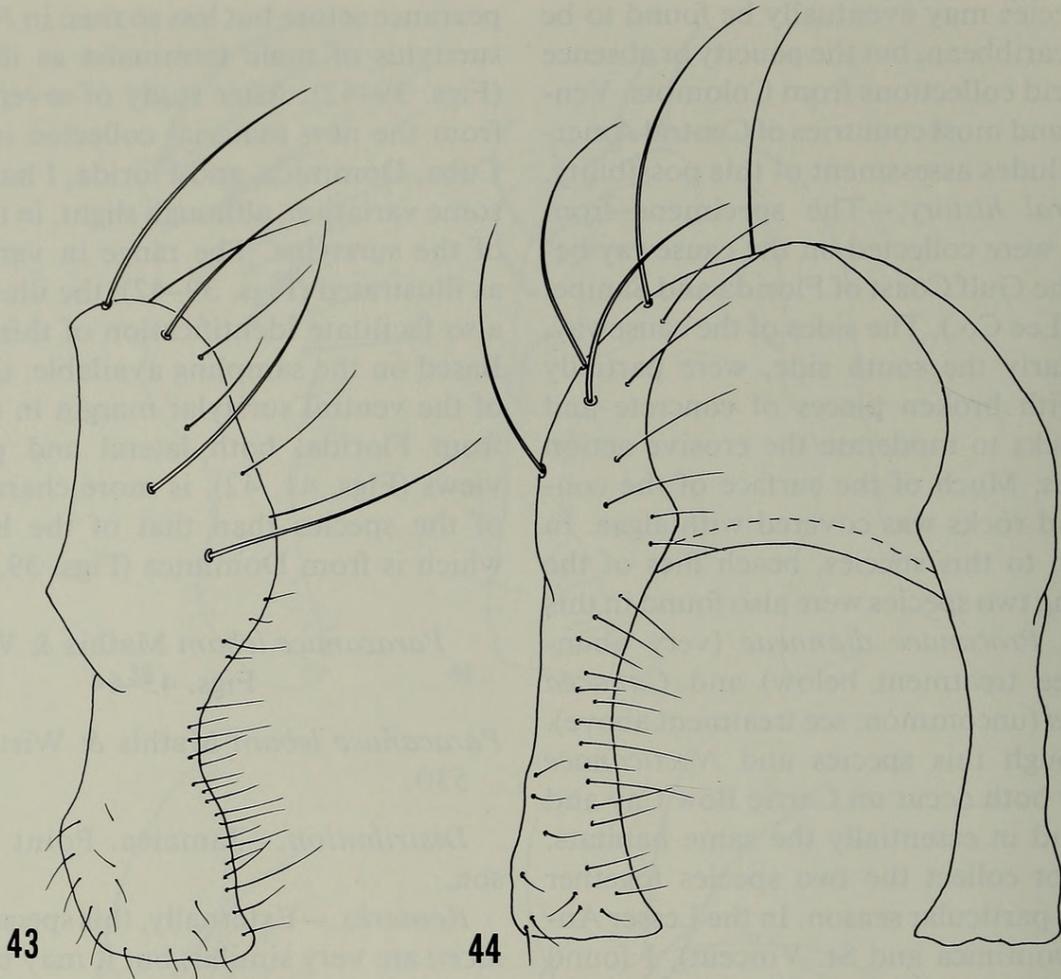
Remarks.—Externally, this species and *P. aicen* are very similar, but it may be distinguished from the latter by the following characters from the male terminalia: surstylus (Figs. 41, 42) broader on distal half, especially evident in lateral view; ventral margin of surstylus broadly truncate in lateral and posterior views; posterior margin of surstylus bearing distinct row of longer setae.

Genus *Procanace* Hendel

Procanace Hendel, 1913:93. Type species: *Procanace grisescens* Hendel, by original designation.—Mathis, 1988:329–333 [first record of genus from Western Hemisphere].

Diagnosis.—General coloration whitish gray, olivaceous, to blackish brown.

Head: Intrafrontal setae absent, but with a few setulae inserted anteriorly; fronto-orbital setae three; ocelli arranged to form equilateral or isosceles triangle, if isosceles,



Figs. 43–44. External male terminalia of *Paracanace lebam*: 43, Epiandrium and surstylus, lateral view; 44, Epiandrium and surstyli, posterior view.

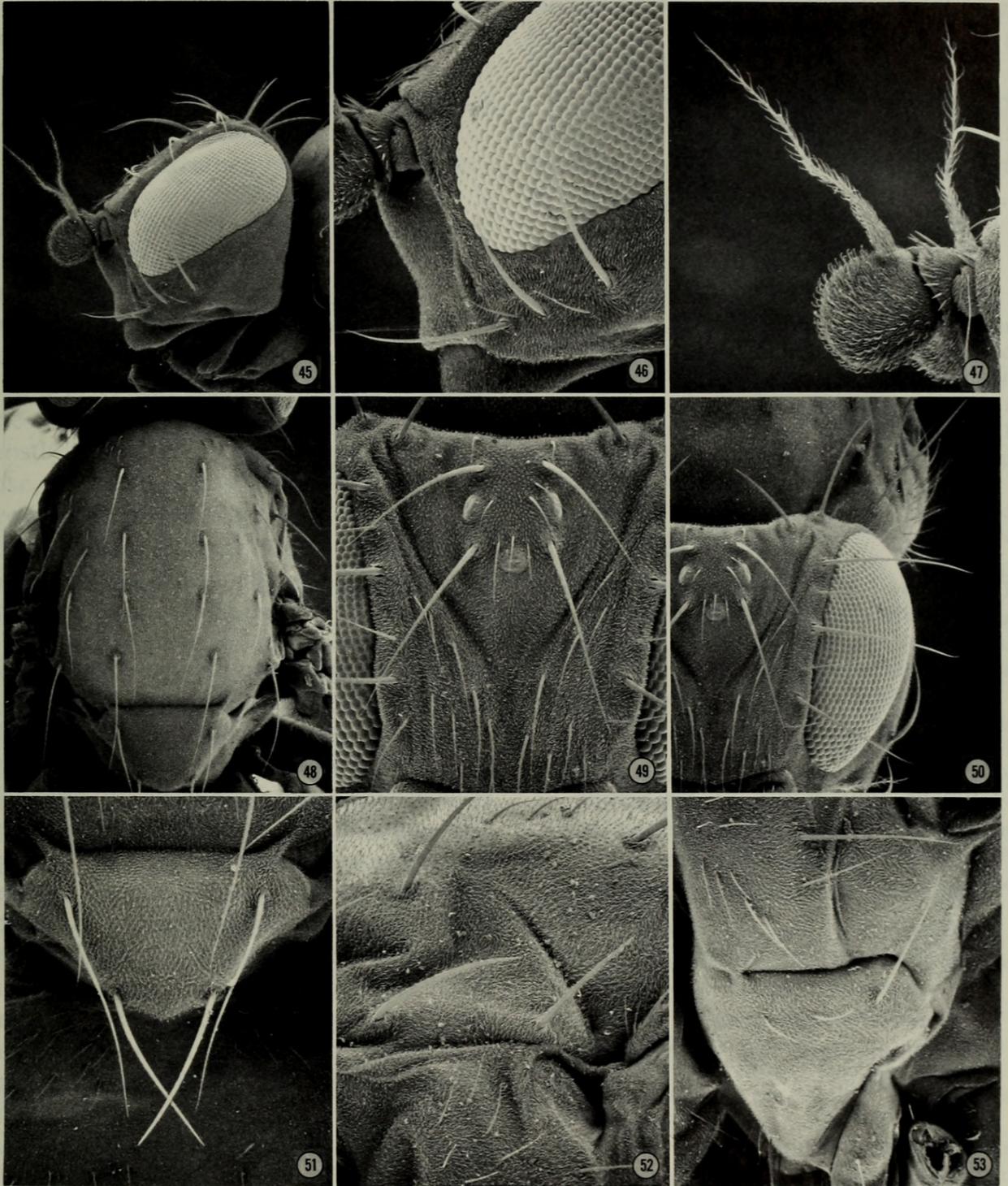
the greater distance is between posterior ocelli. Arista pubescent over entire length. Two large anaclinate genal setae; antero-clinate genal seta moderately well developed. Palpus not bearing long setae. Epistomal margin, in lateral view, more or less horizontal.

Thorax: Acrostichal setae, especially a prescutellar pair of large setae, usually lacking (setulae present in species of the *williamsi* group); scutellar disc lacking setae (one or two pairs of scutellar disc setulae occur in *P. nakazatoi* Miyagi of the *williamsi* group); two pairs of marginal scutellar setae, apical pair not anaclinate; anterior and posterior notopleural setae present, length of both subequal, anepisternum with scattered setulae. Katepisternal setae usually present (lacking in species of the *griseocens*

group). Hind tibia lacking spine-like setae apically.

Abdomen: Male genitalia as follows: Epiandrium in posterior view wider than high; cerci reduced, poorly sclerotized; surstylus with an anterior and posterior lobe, the latter larger, sometimes markedly so and shape unique to species.

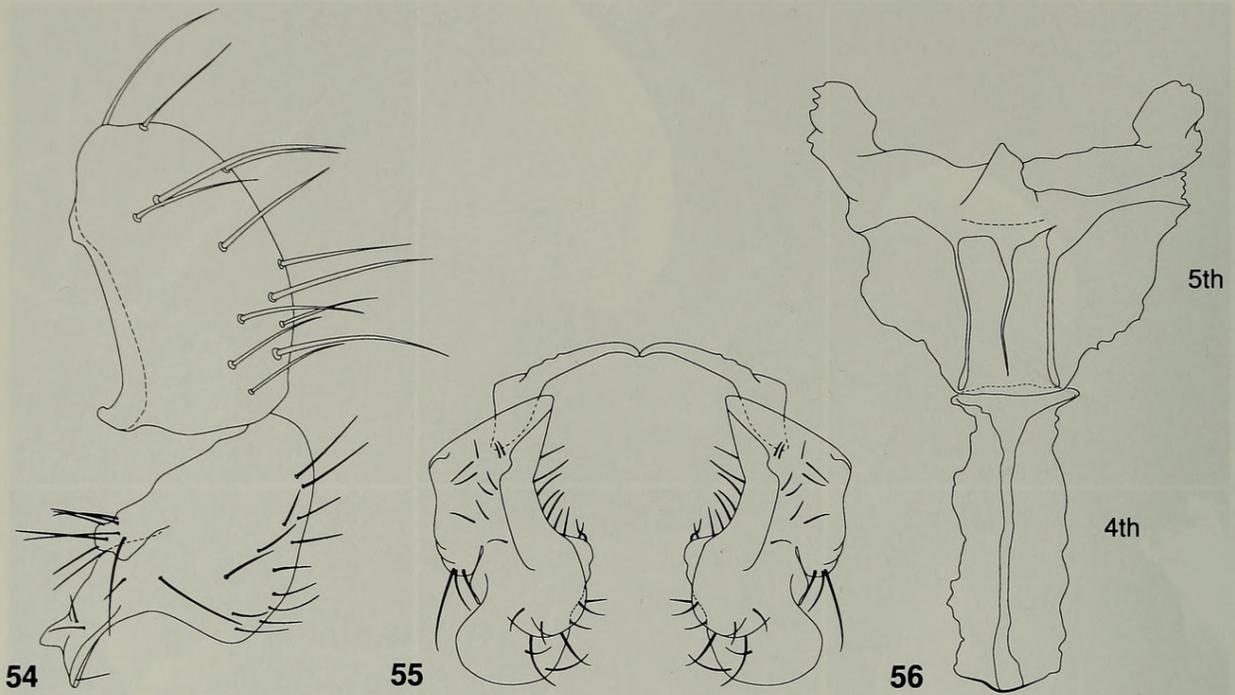
Discussion.—Mathis (1988) first reported the occurrence of *Procanace* in the Western Hemisphere from specimens collected in Virginia along the tidal shores of the Potomac River. The species, *P. dianneae*, was then only known from Virginia, but recent collecting in North and South Carolina, as well as the Gulf Coast of Florida has resulted in discovery of this species along much of the eastern coast of the United States.



Figs. 45–53. Scanning electron micrographs of *Procanace dianneae*: 45, Head, lateral view; 46, Gena and setae, lateral view; 47, Antenna, lateral view; 48, Mesonotum, dorsal view; 49, Frons and ocellar triangle, dorsal view; 50, Fronto-orbital and vertical setae, dorsal view; 51, Scutellum, dorsal view; 52, Notopleuron and setae, lateral view; 53, Katepisternum and setae, lateral view.

Annotated Key to Species Groups of
Procanace Hendel

- | | |
|---|---|
| <p>1. Katepisternal seta absent
 the <i>griseascens</i> group
 [four species; Oriental, eastern</p> | <p>Palaeartic, Oceanian, Malagasy, Seychelles]</p> <p>– Katepisternal seta present 2</p> <p>2. Clypeus high, width about twice the height; palpus blackish brown;</p> |
|---|---|



Figs. 54–56. External male terminalia of *Procanace dianneae*: 54, Epandrium and surstylus, lateral view; 55, Surstyli, posterior view; 56, Fourth and fifth sterna, ventral view.

- proepisternal seta absent the *nigroviridis* group
 [seven species; Hawaiian Islands]
- Clypeus low, width at least four times the height; palpus yellowish; proepisternal seta(e) present 3
- 3. Acrostichal setulae present, in two irregular rows the *williamsi* group
 [four species; Hawaiian and Ryukyu Islands]
- Acrostichal setulae absent 4
- 4. Postocellar setae either absent or much reduced the *fulva* group
 [nine species; Oriental and eastern Palaearctic]
- Postocellar setae present, subequal to length of ocellar seta the *cressoni* group
 [three species; Oriental, Nearctic]

Procanace dianneae Mathis
 Figs. 45, 46

Procanace dianneae Mathis, 1988:330–333.

Distribution.—Eastern coast of the United States from Virginia south through North

and South Carolina to Florida, including the Gulf Coast.

Natural history.—The type series was taken along the tidal shore of the Potomac River where the water is only slightly brackish. The additional distribution sites reported here are oceanic (Atlantic and Gulf of Mexico), with distinctly saline water. On Kure Beach (North Carolina, Brunswick Co.), the specimens were extremely abundant on the sandy shore within a protected area where boats could be launched. The exposed sand was largely covered with algae that had washed ashore. At Cherry Grove (South Carolina, Horry Co.), the specimens were found exclusively on the concrete foundations of a fishing pier. The foundations nearest the shore are exposed at low tide and most high tides and were partially covered with algae. A species of *Tethina* (probably *albula* (Loew); Tethinidae) and *Fucellia* (Anthomyiidae) also occurred on the foundations. The causeway leading to Sanibel Island (Gulf Coast side of Florida, Lee Co.) had portions of the shore that were lined with large chunks of concrete and rock to brake the erosive action of waves, and the specimens *P. dianneae* mostly occurred

where the wave action was dampened by the rocks and concrete that were also extensively covered by algae. Two other beach flies, *Canacea macateei* and *Paracanacea aicen*, also occurred on the causeway.

Remarks.—Externally this species is very similar to those of the *cressoni* group. It differs from the two species of that group, *P. cressoni* Wirth and *P. taiwanensis* Del-finado, as well as other congeners by the following combination of characters: Post-ocellar setae well developed, subequal in length to ocellar setae; clypeus low, height one-fourth width; palpus yellowish. Scutum mostly bluish black, sparsely microtomentose, scutum densely microtomentose, brown; proepisternal seta present, pale; kat-episternal seta present; acrostichal setae absent. Shape of the male genitalia unique (see figs. and description above).

As noted previously, this species was only recently discovered in Virginia, and it has now been found to occur along the East Coast of the United States from Virginia to Florida, including the Gulf Coast. Apparently the species either dispersed rapidly along the East Coast after its introduction, perhaps similar to *Brachydeutera longipes* Hendel (Mathis and Steiner 1986; Ephydridae), or it has resided here for some time without being detected.

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