

A SYSTEMATIC STUDY OF THE SPHAEROMATIDAE
(CRUSTACEA: ISOPODA)
OF ISLA MARGARITA, VENEZUELA,
WITH DESCRIPTIONS OF THREE NEW SPECIES

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INTRODUCTION

A renewed interest in the systematics of the Sphaeromatidae of the western Atlantic region has been evident over the past decade. Recent studies have indicated clearly that our knowledge of this family is far from complete. Thirty-eight percent of the 13 species treated by LOYOLA e SILVA (1960) in the southern hemisphere were new. Six new sphaeromatids were found in Puerto Rico alone, representing 55% of the total number of sphaeromatid species collected over a period of a few years (MENZIES & GLYNN, 1968). Collections off Georgia, containing 6 species of sphaeromatids, included a single new species, indicating perhaps a somewhat better knowledge of the fauna in this region (MENZIES & FRANKENBERG, 1966). In the present survey of Margarita Island, Venezuela, half of the 6 species collected represent new taxa. These include 2 new species of *Dynamenella* and 1 new species of *Cerceis*, all members of the Eubranchiatae.

Aside from the need of continued taxonomic study, information on the composition of the sphaeromatid fauna of Venezuela is of interest for at least 2 additional reasons. Surface currents moving in a northwesterly direction along the Guianan and Brazilian coasts enter the Caribbean Sea in this region. To what extent this has favored transport and colonization of southern elements into the West Indian Province is a question of fundamental zoogeographic interest. Secondly, the hydrographic character of the area investigated is peculiar, deviating significantly from the stable,

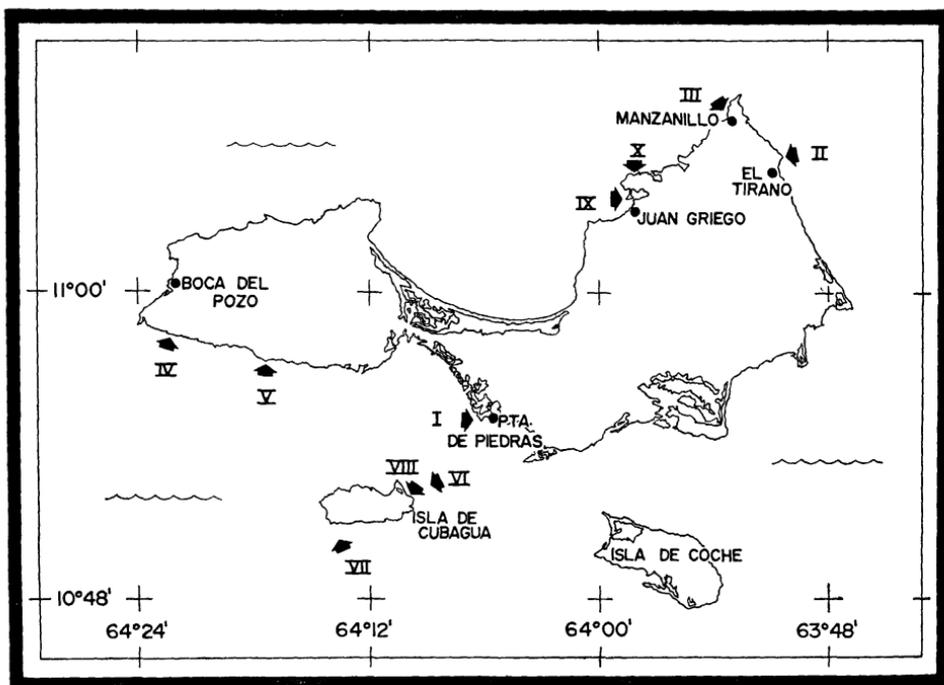


FIGURE 1

Margarita Island and surrounding localities. Arrows indicate the approximate location of collecting stations I-X.

high thermal conditions which normally prevail at this latitude (FUKUOKA & BALLESTER, 1963; LJÖEN & HERRERA, 1965). From January through about June, upwelling causes the surface sea temperatures to decline markedly, from around 27°C to as low as 19°C. Although the littoral biota is predominately Caribbean in its affinities (RODRÍGUEZ, 1959), a local adjustment to the lower thermal regime is apparent in the occurrence of some subtropical and temperate species as well as in the degree of development of certain inshore communities. For example, living corals were not observed to have developed prominent reef structures, and solid intertidal surfaces were found to support a lush growth of algae and dense populations of cirripeds. DÍAZ PIFERRER (1967) described the effect of the marine climate on the composition of the littoral algae; some temperate species occur here and certain typical representatives of the tropical flora are absent.

The present collecting effort was considerably restricted in time (May 27-31, 1968) and largely confined to the intertidal zone at selected localities around Margarita and Cubagua Islands (Fig. 1). The majority of the 1,163 specimens collected were obtained by the formalin wash technique (MENZIES & GLYNN, 1968). Suspected hosts such as algae, sponges, chitons and barnacles were examined individually. A few samples were obtained subtidally from the shore at Margarita Island and with a dredge at Cubagua Island. Specific information on the various habitats, as well as the species collected, is included in the Station List.

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SYSTEMATICS

The anatomical terminology employed in this paper is described and illustrated by MENZIES and FRANKENBERG (1966) and MENZIES and GLYNN (1968). Anatomical abbreviations used here are as follows:

Cephalon

- Ant¹, first antenna
- Ant², second antenna
- Md, mandible
- Mx¹, first maxilla
- Mx², second maxilla
- Mxp, maxilliped

Pereon

p^1 - p^7 , first through seventh pereopods

Pleon

P, penes

Plp^1 - Plp^5 , first through fifth pleopods

S, stylet (appendix masculinum)

PMS, plumose marginal setae

Family Sphaeromatidae WHITE, 1847

HANSEN'S (1905) classification of the Sphaeromatidae included 3 sub-families, the Limnoriinae, Sphaerominae and Plakarthriinae. Subsequently, the family has been defined in a narrower sense and is now understood to comprise only the Sphaerominae. MENZIES (1957) elevated the rank of the Limnoriinae to Limnoriidae, and RICHARDSON (1913) has recognized the family Plakarthriidae. While the status of the Plakarthriidae is still unresolved —MENZIES (op cit) suggested that this taxon will eventually be shown to belong to the Platybranchiatae of the Sphaeromatidae—the three families will be recognized in this paper.

Members of the Sphaeromatidae are readily distinguished by the following combination of features: pleon and pleotelson combine functionally to form a vault enclosing pleopods; brood commonly develops in incubatory pouches and not out free in marsupium; conglobation pronounced. To these more obvious characters may be added those enumerated by HANSEN (1905) for the Sphaerominae. Md, at least basal half, stout; lacinia mobilis well developed, with plate on left Md; molar process generally well developed; palp 3-jointed. Mx^1 with inner lobe moderately or generally very well developed. Mx^2 with 3 distal lobes moderately long. Mxp with single hook on distal lobe; epipod very small, broader than long, or not discernible. Epimera not marked off from 1st pereonite; 2nd to 7th epimera immovably fused with their somites but generally some marked off by very fine or nearly inconspicuous furrows or lines. Five anterior pleonites completely fused, but furrows or sutures (at most 3 with 2 posterior sutures broadly interrupted at middle) generally seen from above as traces of divisions of somites. Plp^4 and Plp^5 rami usually without PMS; at least endopods with branchial folds (branchiae); exopod of Plp^5 generally with at least 3 protuberances densely clothed with minute scale-like spines. Endopod of uropod fused with sympod or wanting. Mouthparts in ovigerous females often strongly reduced.

Key to the Sphaeromatidae of Margarita Island, Venezuela

The present collections contained 5 species distributed among 3 genera in the Eubranchiatae and a single species in the Hemibranchiatae. This key is based largely on the morphology of the pleotelson which provides several reliable characters.

- 1a. Pleotelson markedly dimorphic in the 2 sexes. Male with medial perforation terminally, female with slight indentation or with smooth terminal border 2
- 1b. Pleotelson rounded, acute or slightly emarginate terminally, but not dimorphic 4
- 2a. Pleonal sutures uniting to form a "Y" before reaching posterior margin of fused somite (Fig. 2B). Male with foramen (Figs. 2A & 5A). Both rami of uropods well developed, slightly exceeding length of pleotelson in mature males 3
- 2b. Pleonal sutures parallel, not uniting to form a "Y". Medial perforation wide in male, with 2 pairs of posteriorly directed teeth. Rami of uropods in male dissimilar in length; exopod long, exceeding length of pleotelson *Paracerceis caudata* (SAY). (Fig. 11B & C).
- 3a. Suture lines united near posterior margin of somite. Terminal area of pleotelson bulbous. Four pairs of conspicuous swellings on pleotelson. Pereonites smooth .. *Dynamenella tumidicauda* n. sp. (Figs. 2, 3 & 4).
- 3b. Suture lines united far anteriorly. Terminal area of pleotelson not noticeably swollen. Pleotelson in male with 3 pairs of minute tubercles. Pereonites 5 - 7 with raised ridges
..... *Dynamenella plicatura* n. sp. (Figs. 5, 6, 7 & 8).
- 4a. Suture lines separated, nearly equal in length, and close to pleonal articulations 5
- 4b. Suture lines separated, both originating laterally; anterior pair short, posterior pair long, nearly reaching to midline. Cephalon with prominent lateral ridges *Cerceis carinata* n. sp. (Figs. 12, 13 & 14).
- 5a. Pleotelson with acute terminal border. Penes short and stout
..... *Dynamenella acutitelson* MENZIES & GLYNN (Fig. 11A).
- 5b. Pleotelson with terminal border evenly convex, not acute. Penes long and filiform
Exosphaeroma diminutum MENZIES & FRANKENBERG (Figs. 15 & 16).

Group Eubranchiatae

Plp⁴ and Plp⁵ with strongly developed branchiae on both rami, often fleshy, without PMS; Plp⁵ exopod usually 2-jointed. Pleotelson often emarginate terminally, generally with notch or slit terminating in a foramen (slightly modified from HANSEN, 1905).

Genus *Dynamenella* HANSEN, 1905

Type-species. *Dynamene perforata* MOORE, 1901. *Dynamenella perforata* (MOORE, 1901), HANSEN, 1905.

Diagnosis: Both sexes rather similar in aspect, without real processes on pereon; pleotelson with notch which is semicircular or oblong in female, in male narrow in distal part, while proximal part constitutes a transverse foramen; uropods subsimilar in both sexes, with rami lamellar. Mouthparts similar in both sexes; S in male on endopod of Plp²; marsupial lamellae overlap each other somewhat; Plp³ exopod jointed (see MENZIES and GLYNN, 1968, p. 58).

Dynamenella acutitelson MENZIES & GLYNN, 1968
(Fig. 11A)

Reference: *Dynamenella acutitelson* MENZIES & GLYNN, 1968, p. 61, figs. 29 & 30.

Remarks: Two varieties were recognized in the description of this species by MENZIES and GLYNN (1968), namely *Dynamenella acutitelson* var. *typica* and *D. acutitelson* var. *glabrothorax*. The variant "glabrothorax"—lacking transverse ridges dorsally on the pereonites, but provided with minute tuberculations, and differing further from the variant "typica" in the structure of the uropoda—may represent a distinct species. The following diagnosis is based solely on the variant "typica".

Diagnosis: Pleotelson and mouthparts similar in both sexes. Apex of pleotelson acute, ventrally sulcate. Dorsum of pleotelson in male with 2 pairs of elevated, minutely tuberculate swellings centrally; 1st pair globular, posterior pair elongate longitudinally. Pereon in male with transverse ridges on somites 4-6. Penes small and stout, rami about twice as long as wide, apex blunt. Stylus lanceolate and sinuous, extending well beyond margin of Plp² endopod.

Measurements: Maximum length of males 3.7 mm, females 2.8 mm (illustrated).

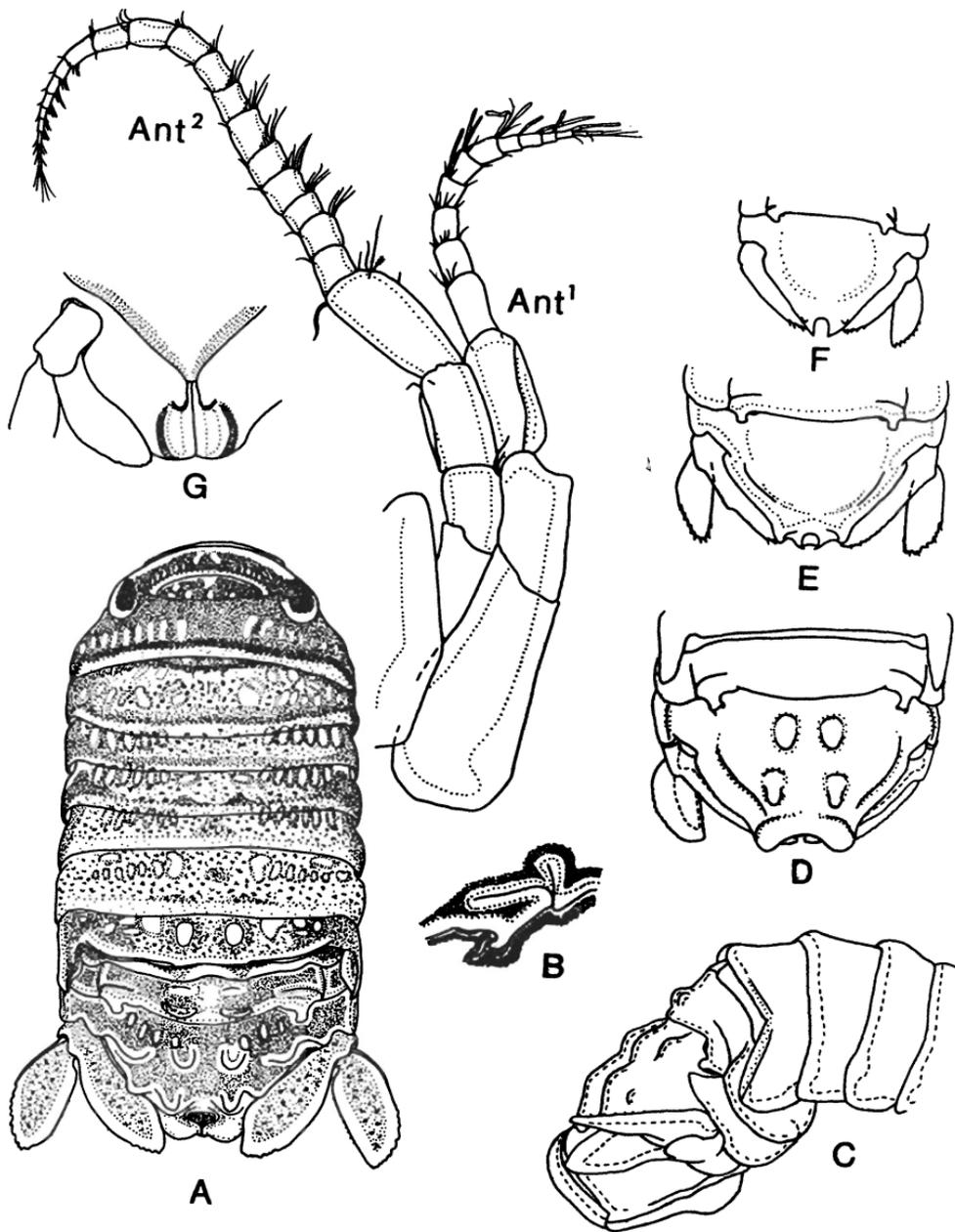


FIGURE 2

Dynamenella tumidicauda, new species. A. male holotype, dorsal view, length 6.7 mm. Length of pereonites appear distorted due to unfoldment of specimen. B. enlarged view of right pleonal suture of holotype. C. lateral view of posterior portion of body of holotype. D. female allotype, dorsal view of pleon, length 6.5 mm. E. immature paratype, dorsal view of pleon, length 3.6 mm. F. immature paratype, dorsal view of pleon, length 2.2 mm. G. ventral view of pleotelson, male paratype, length 6.2 mm.

Type-locality: Wagner's Shipyard, San Juan Bay, Puerto Rico (MENZIES & GLYNN, op cit). Collected along shore from cobbles overgrown with *Ulva*.

Distribution: Puerto Rico and 14 specimens (USNM Cat. N^o 127713) from Manzanillo (Sta. N^o III), 230 specimens (200 in USNM, Cat. N^o 127714; 10 in collections of EIMM, Estación de Investigaciones Marinas de Margarita) from Sta. N^o IV, and 3 specimens (USNM Cat. N^o 127715) from Sta. N^o V.

Supplementary descriptive notes: The Puerto Rican variant "glabrothorax" was not evident in any of the local populations at Margarita Island. Morphological homogeneity was the rule among different individuals of the same sex. Transverse ridges were present on the pereonites in only the larger males. Females also differed from males in the following features: postero-lateral margins of body not elevated; uropods not extending beyond posterior border of pleotelson; median notch in pleotelson not visible dorsally; pleotelson not greatly inflated, swellings usually less prominent; relatively small.

***Dynamenella tumidicauda* n. sp.**

(Figs. 2, 3 and 4)

Diagnosis: Pereonites and anterior margin of pleotelson subequal in width. Anterior 2/3 of 1st pereonite narrows to width of cephalon. Pereonites 2-7 subequal in length; 1st somite longest (in unflexed posture in living animals; holotype in Fig. 2A distorted), nearly twice length of somites 2-7. Seventh somite with a pair of clear circular areas astride mid-line. First pleonal segment short, clearly visible dorsally over breadth of pleon. Pleonal suture bifurcate, 1 incision extending forward, the other, about 1.5 length of former, flexing abruptly toward midline. Pleotelson with 2 pairs of prominent swellings astride midline; anterior margin of pleotelson with 2 additional pairs of swellings laterally; posteriorly a single lateral pair of swellings. Pleotelson inflated terminally with thick, bulbous extensions adjacent to well developed but occluded slit and foramen. Terminal border on either side of slit truncate and thick. Undersurface of pleotelson with shelf-like extensions running from slit forward to insertion of uropods, thus partially enclosing the vault. Frontal lamina just in contact with clypeus. Ant¹ basal article somewhat inflated, twice length of each of basal articles 2 and 3; flagellum with 12 articles. Ant² flagellum with 20 articles. P¹ stouter than P⁷, medial borders of merus, carpus and propodus with dense setal fringe, best developed posteriorly. Penis bifurcate, elongate, tenuiform.

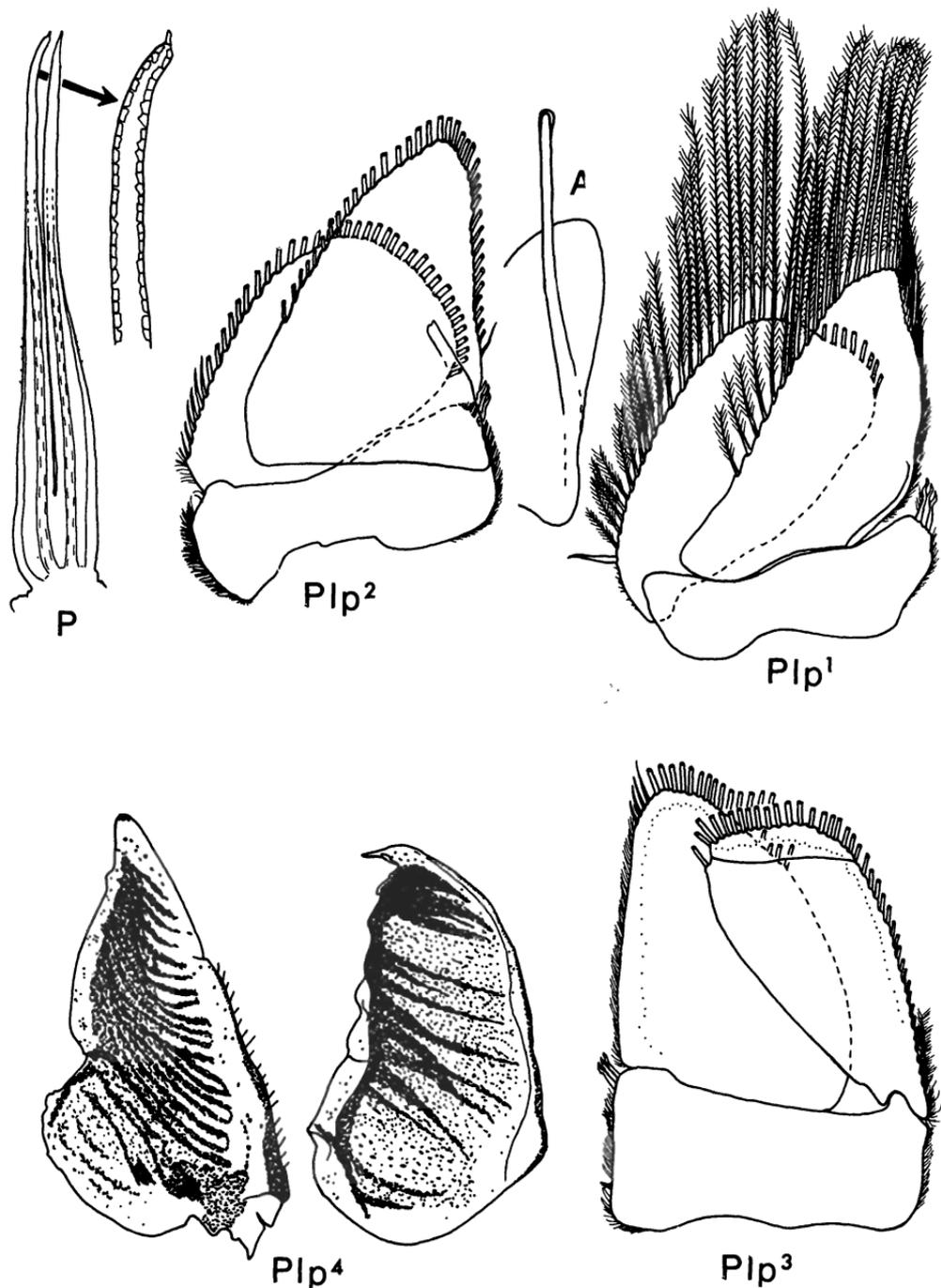


FIGURE 3

Dynamenella tumidicauca, new species. All illustrations from holotype except A which is from a paratype (length 6.3 mm) showing the medial border and stylet of the endopod of Plp². Length of P. 1.3 mm.

Plp³ exopod jointed distally. Plp⁴ and Plp⁵ with prominent branchiae; Plp⁵ exopod jointed. Uropods extend slightly beyond posterior border of pleotelson; both rami weakly crenulate on lateral margins; more crenulations on exopod.

Coloration (based on freshly formalized specimens): General body color brown or green. Free edges of pereonites, mid-pleonal segment, and lateral margin of cephalon bright red. Swellings on pleotelson also outlined by red, particularly posteriorly adjacent to the terminal slit and foramen. Dark pigmentation is most conspicuous as paired circular areas astride midline on 4th pereonite, as short lateral stripes on posterior extensions of 7th pereonite, as short stripes near midline of 2nd pleonal segment, and as long lateral stripes covering length of pleotelson.

Measurements: Male holotype, length 6.7 mm (measured from posterior border of uropods), width 3.2 mm. Female allotype (illustrated), length 6.5 mm, width 3.2 mm. Mature male paratype (illustrated), length 6.2 mm, width 2.8 mm. Immature paratypes (illustrated), length 3.6 mm, width 1.4 mm; length 2.2 mm, width 1.0 mm.

Type-locality: Sta. N^o III, Manzanillo, Margarita Island, Venezuela. Collected from the spaces within dense clusters of the cirripeds *Tetraclita squamosa stalactifera* and *Balanus (Megabalanus) tintinnabulum antillensis*. Male holotype, USNM Cat. N^o 127705; 31 paratypes, USNM Cat. N^o 127706.

Material examined: Paratypes of *Dynamenella bakeri* (MENZIES, 1962), Lund Univ. Chile Exped., Sta. No's. M56 (4 specimens), M124 (1), M127 (8), M131 (2), M135 (11), M158 (3), and M159 (6). A collection of *D. bakeri* from Salaverry, Perú (USNM Cat. N^o 113815, 58 specimens) was also examined. *Dynamenella dumerili* (AUDOUIN, 1826) was requested, but found to be absent from the British Museum of Natural History, Museum National d'Histoire Naturelle and the United States National Museum.

Distribution: Type locality and 17 specimens (7 in USNM, Cat. N^o 127712) from Juan Griego (Sta. N^o IX), and 28 specimens (18 in USNM Cat. N^o 127711); 10 in collections of EIMM from Playa Caribe (Sta. N^o X). All collected in association with barnacles.

Supplementary descriptive notes: Large males with a pair of circular areas on 7th pereonite; absent in females. In mature females the only conspicuous swellings on pleotelson are adjacent to midline; in some individuals a pair of small tubercles is present laterally, adjacent to the posterior swellings. Swellings and tubercles on pleotelson about equally developed in all but

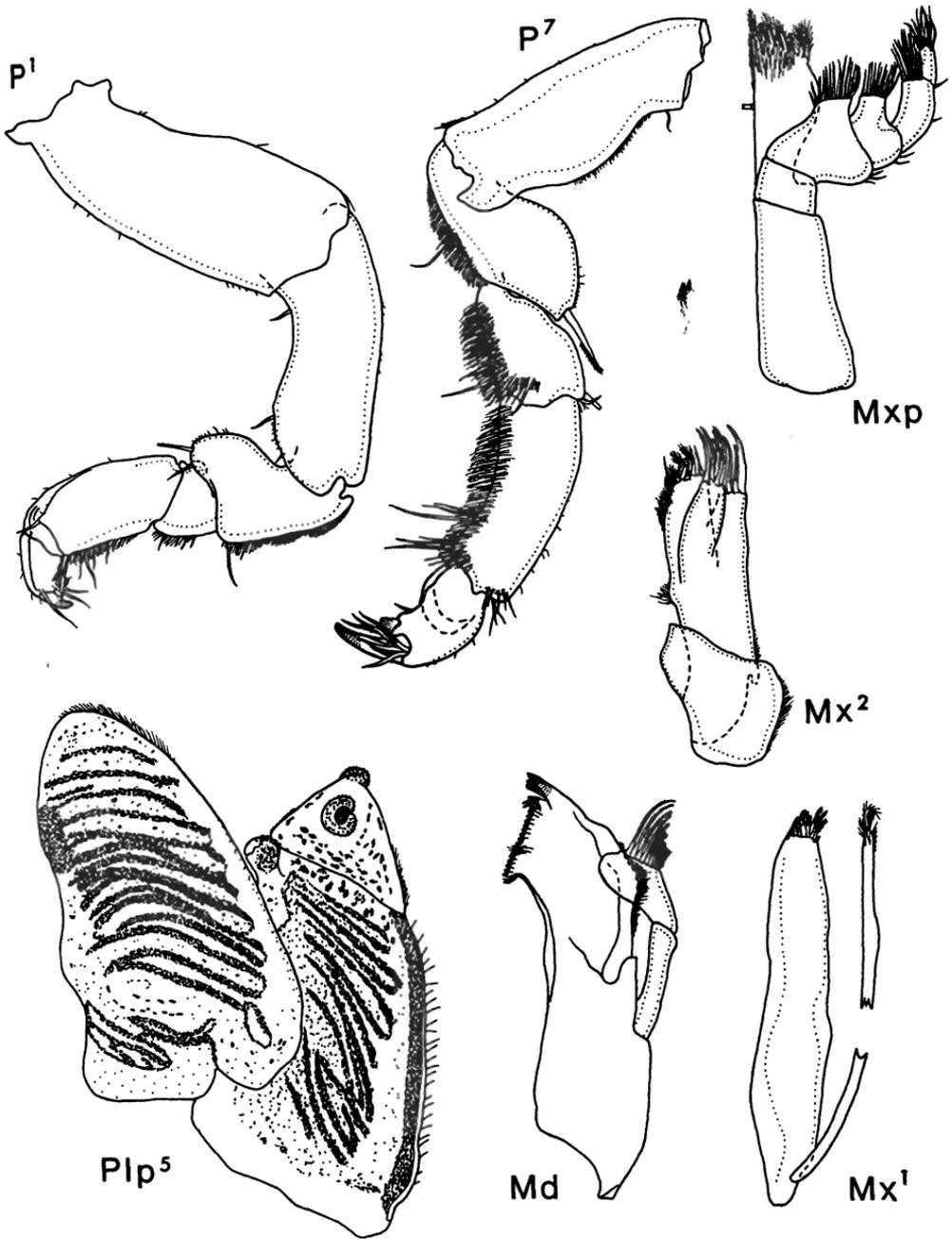


FIGURE 4

Dynamenella tumidicauda, new species. All illustrations from holotype.

the largest males. Only the largest males with a foramen and closed slit on apex of pleotelson. Smaller males (and females) have an indentation with a wide ventral groove which presumably narrows and lengthens as this area of pleotelson becomes inflated with age. Vault shelf less strongly developed in females. A faintly ragged border is present adjacent and medial to the pleonal articulations, representing a portion of pleotelson which overrides the anterior segment. Setal fringe on medial border of pereopods best developed in males. Females carry a large brood; a 5.9 mm individual contained 47 embryos.

The following pertains to the male holotype. Mouth parts normal and similar in mature individuals of both sexes. Md with triarticulate palp bearing 10 plumose setae apically; incisor of 3 teeth; setal row of 5 setae; molar teeth well developed; setal border present laterally below incisor. Mx¹ endite narrow with plumose setae apically; exite thick with 4 plumose setae and 6 sclerotized teeth. Mx² inner lobe heavily setose. Mxp palp articles 2, 3 and 4 slightly produced into lobes with numerous setae (2nd art.-16 setae, 3rd art.-18 setae, 4th art.-14 setae, 5th art.-13 setae); exite with 3 large teeth apically. Plp¹ endopod with 35 PMS, exopod with 38 PMS plus a single, stout seta. Plp² endopod with 38 PMS; S smooth, longer than endopod, and free of medial border. Plp² exopod with 40 PMS. Plp³ endopod with 22 PMS, medial border setose; exopod with 40 PMS. Plp⁴ endopod with apical spine; exopod with 19 setae along lateral border and small cleft present distally where these end; about 9 pairs of branchiae. Lateral border of Plp⁵ exopod with 28 setae, numerous surface setae also present adjacent to border; about 7 pairs of branchiae; squamiferous protuberances prominent; endopod with apical setae and about 8 pairs of branchiae.

Affinities: Although MENZIES and GLYNN (1968) recently found the exopod of Plp³ to be 2-jointed in the type species (holotype specimen) of *Dynamenella*, this feature alone does not seem to warrant synonymy of BAKER'S (1908) *Dynamenopsis* with *Dynamenella*. BAKER'S diagnosis of *Dynamenopsis*, partly summarized below, indicates that this form represents a separate genus of distinctive character: First and 7th pereonites longer than others and subequal in length. Seventh somite almost completely covers anterior part of pleon, posterior border with 4 short lobes, 2 median ones projecting somewhat behind. Epimeral plates of 6th pereonite wedge-shaped and produced behind, more than overlapping that of 7th somite and lateral portion of anterior part of pleon. To this may be added the disposition of the epistome (clypeus), which is not separated from the frontal lamina but rather fits into a notch of the latter.

Dynamenopsis dumerili (AUDOUIN, 1826), illustrated in detail by

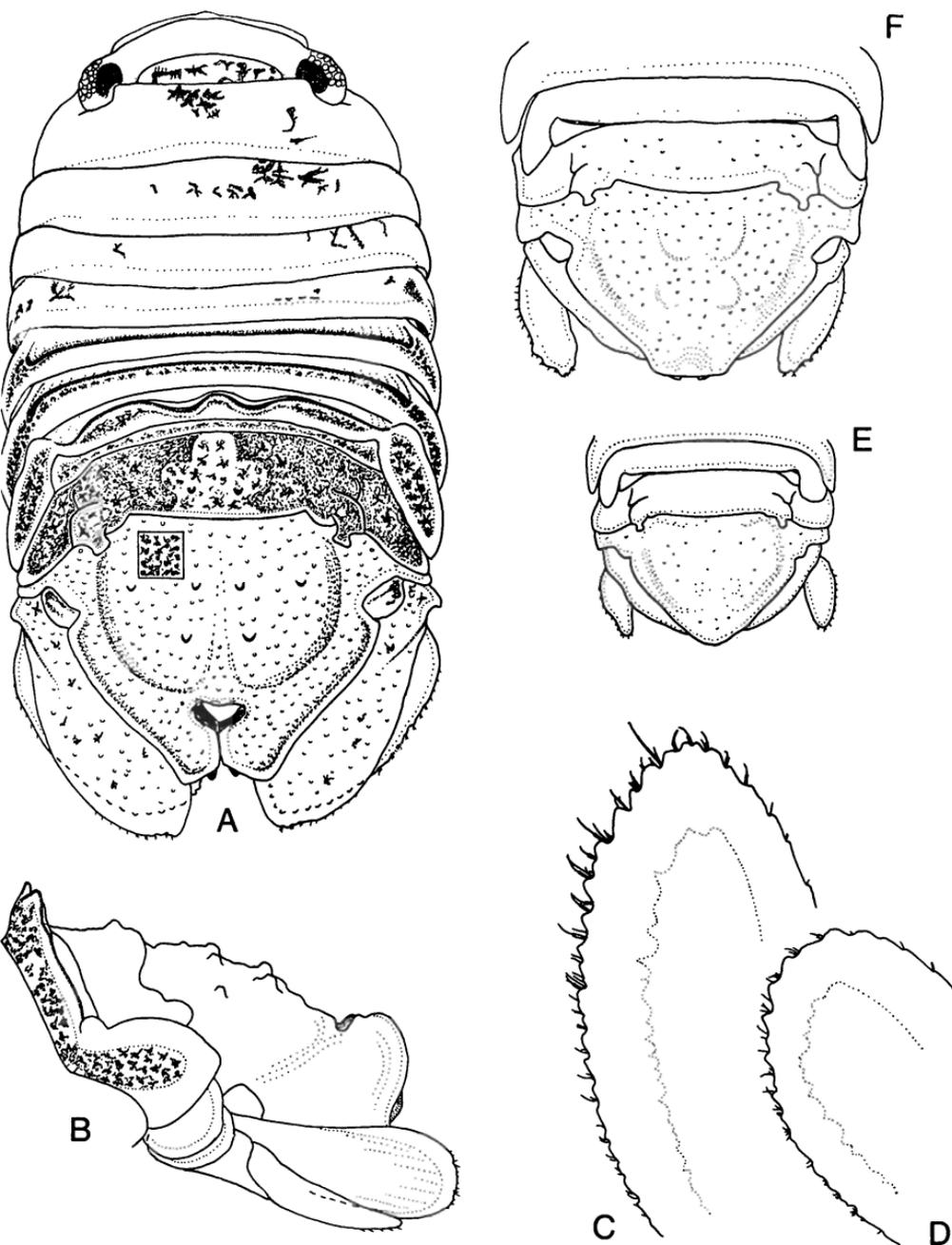


FIGURE 5

***Dynamenella plicatura*, n. sp.** A. male holotype, dorsal view, length 3.8 mm. Small area of pleotelson shown with full pigmentation. B. lateral view of pleon of holotype. C. Exopod of uropod, dorsal view, male paratype of *Dynamenella dianae* (MENZIES, 1962, San Quintín, Mexico. D. Exopod of uropod, dorsal view, male of *D. dianae*, Mayagüez, Puerto Rico. E. immature paratype, *D. plicatura*, dorsal view of pleon, length 2.2 mm. F. female paratype, *D. plicatura*, dorsal view of pleon, length 3.4 mm.

MONOD (1933), *Dynamenopsis bakeri* MENZIES, 1962, in MENZIES (1962a), *Dynamenella diana* (MENZIES, 1962), in MENZIES (1962b) and probably other closely related species such as *Dynamenopsis globicauda* (DANA, 1853), as well as the present new species, differ substantially in several characters of the pereon from BAKER'S original description. Accordingly, it is recommended that all of the above species be transferred to *Dynamenella*, but that *Dynamenopsis* remain a valid generic taxon as originally proposed by BAKER.

Dynamenella tumidicauda shares a number of features in common with *D. dumerili*, *D. bakeri* and possibly *D. globicauda* (not examined). On the pleotelson these include the broad, shelf-like extension along its lower edge, the inflated bulbous appearance posteriorly, and the numerous swellings and protuberances dorsally. In addition, the pleonal sutures and articulations are essentially identical. The penes are long and tenuiform in at least *D. tumidicauda* and *D. bakeri*, and the stylet is separated from the endopod of Plp² in the 3 species. However, in *D. dumerili* the stylet is pointed and has a broad base. If the exopod of Plp³ in *D. dumerili* is jointed, the essential character of all of the pleopods is identical in these three species. The combination of features characterizing *D. tumidicauda* are the number and arrangement of swellings on the pleotelson (4 pairs in males, 2 in females), the bifurcated pleonal sutures, and in males the elongate, apically blunt stylet with a narrow base.

Etymology: Specific name derived from combination of *tumidus* (L.) meaning swollen, and *cauda* (L.) for tail, referring to the swollen appearance of the terminal portion of the pleotelson.

***Dynamenella plicatura* n. sp.**

(Figs. 5, 6, 7 and 8)

Diagnosis: Pereonal somites 5, 6 and 7 with posteriorly directed extensions or flanges. Flange on 7th somite best developed but not directed far posteriorly covering anterior pleonal segment; medial indentation relatively narrow. Pleonal suture with 2 incisions, 1 directed medially, the other forward. Tubercles on pleon are discrete elevations and not elongate extensions forming carinae. Area immediately forward of foramen devoid of any projection. Ventrums of pleonal vault with a broad fold posteriorly (Fig. 8A). Foramen not obviously cordate, anterior border with only a slightly convex extension. Mouthparts normal; Mxp palp articles 2, 3 and 4 slightly produced, exite with 3 large teeth near apical border. Md palp articles 2 and 3 with 6 and 10 plumose setae, respectively. Ant¹ basal

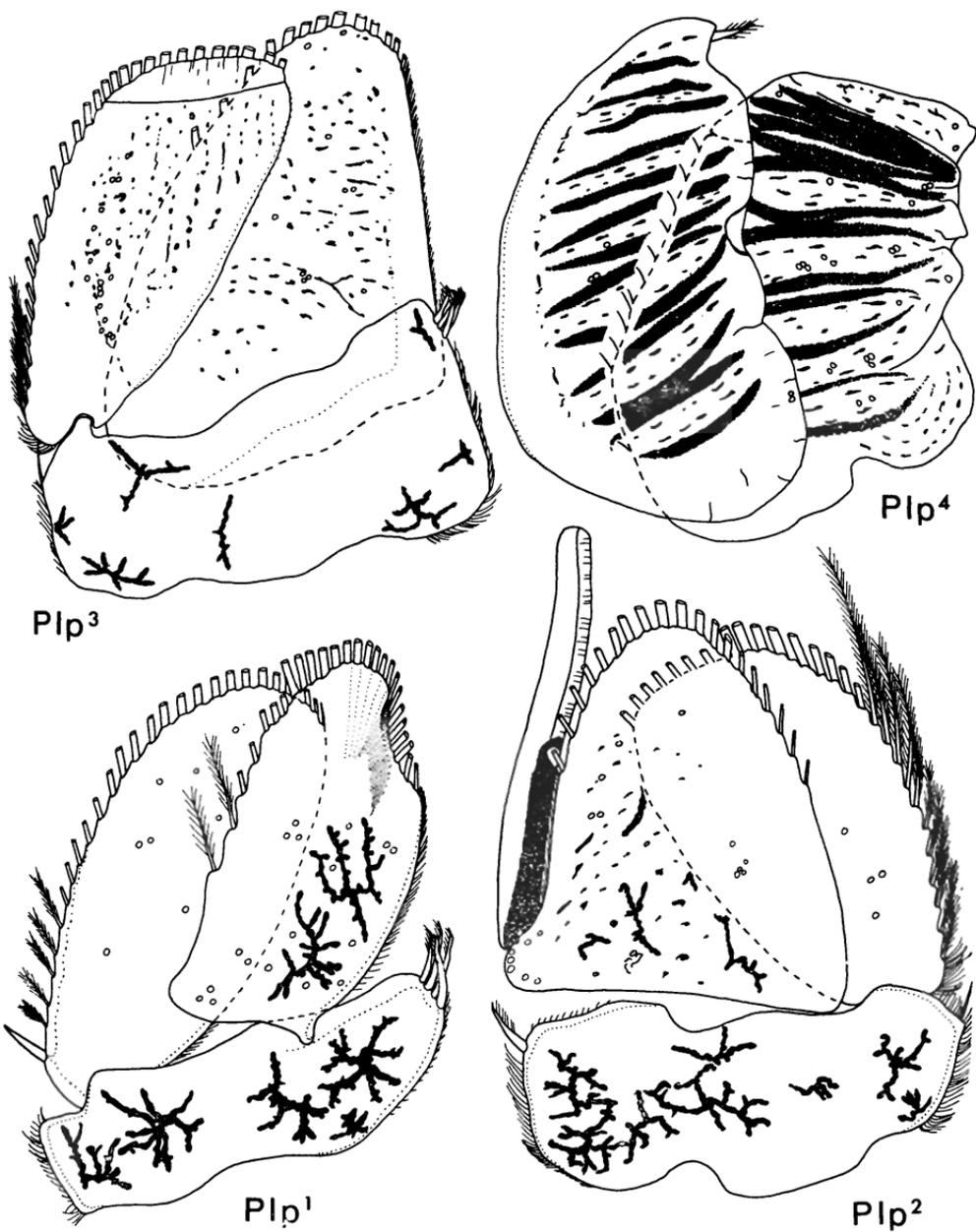


FIGURE 6

Dynamenella plicatura, n. sp. All illustrations from holotype.

articles slightly swollen; flagellum of 9 articles; at least 10 esthetascs present on distal articles. Ant² flagellum of 14 articles. Setae dense along medial borders of articles 4, 5 and 6 of hind pereopods. Penis bifurcate, elongate and filiform. Plp¹ endopod with 26 PMS, medial border flexed or slightly folded; exopod with 27 PMS plus 1 spine. Plp² endopod with 20 PMS, S broad, extending 1/3 length beyond ramus; exopod with 28 PMS. Plp³ endopod with 13 PMS; exopod with 30 PMS, jointed. Basis of Plp¹, Plp² and Plp³ with 4 coupling hooks. Plp⁴ endopod with apical plumose seta and 6 pairs of branchiae; exopod with cleft on upper lateral border and 6 pairs of branchiae. Plp⁵ endopod with 7 pairs of branchiae; exopod articulated, squamiferous protuberances well formed, numerous setae laterally and with 4 pairs of branchiae. Rami of uropods not strongly crenulate.

Coloration (based on freshly formalized specimens): Pigmentation dense posteriorly. Pereonal somites 5, 6 and 7 usually weakly pigmented medially in both sexes. Mature males often with clear, club-shaped area medially on mid-pleonal segment. Seventh pereonal somite in mature males frequently with a pair of yellowish, circular areas astride midline.

Measurements: Male holotype, length 3.8 mm, width 2.2 mm. Mean length and size range of 10 largest male and female paratypes, males 4.0 mm (3.9-4.1 mm), females 3.6 mm (3.4-3.6 mm).

Type-locality: Sta. N^o 1, rock jetty of Estación de Investigaciones Marinas de Margarita, Punta de Piedras, Margarita Island, Venezuela. Male holotype, USNM Cat. N^o 127707; 468 paratypes, USNM Cat. N^o 127708.

Other material examined: Paratypes of *Dynamenella diana* (MENZIES, 1962), San Quentín Bay, Baja California, Mexico (USNM Cat. N^o 109262, 144 specimens). *Dynamenella diana*, Mayagüez seawall (Sta. N^o V), Mayagüez Bay, Puerto Rico, sample no. 1, Jan. 18, 1966, from under *Chiton tuberculatus* Linné, boulders and in dead barnacle shells; sample no. 2, Aug. 5, 1966, formalin wash of boulders and algae (MENZIES & GLYNN, 1968); station no. 12, Nov. 29, 1965 (GLYNN, 1968); 28 specimens collected by C. E. CUTRESS, Aug. 27, 1969. *Dynamenella diana* from ENIWETOK ATOLL, Marshall Islands, 72 specimens collected by P. CASTRO, Aug. 21, 1967; formalin wash of rocks on lagoon side of Fred Island.

Distribution: Type locality and 53 specimens (33 in USNM, Cat. N^o 127709) from Manzanillo (Sta. N^o III), 6 specimens (USNM Cat. N^o 127710) from Isla de Cubagua (Sta. N^o VIII), and 109 specimens (deposited in EIMM collections) from Juan Griego (Sta. N^o IX). All collected on rocky substratum in the intertidal zone.

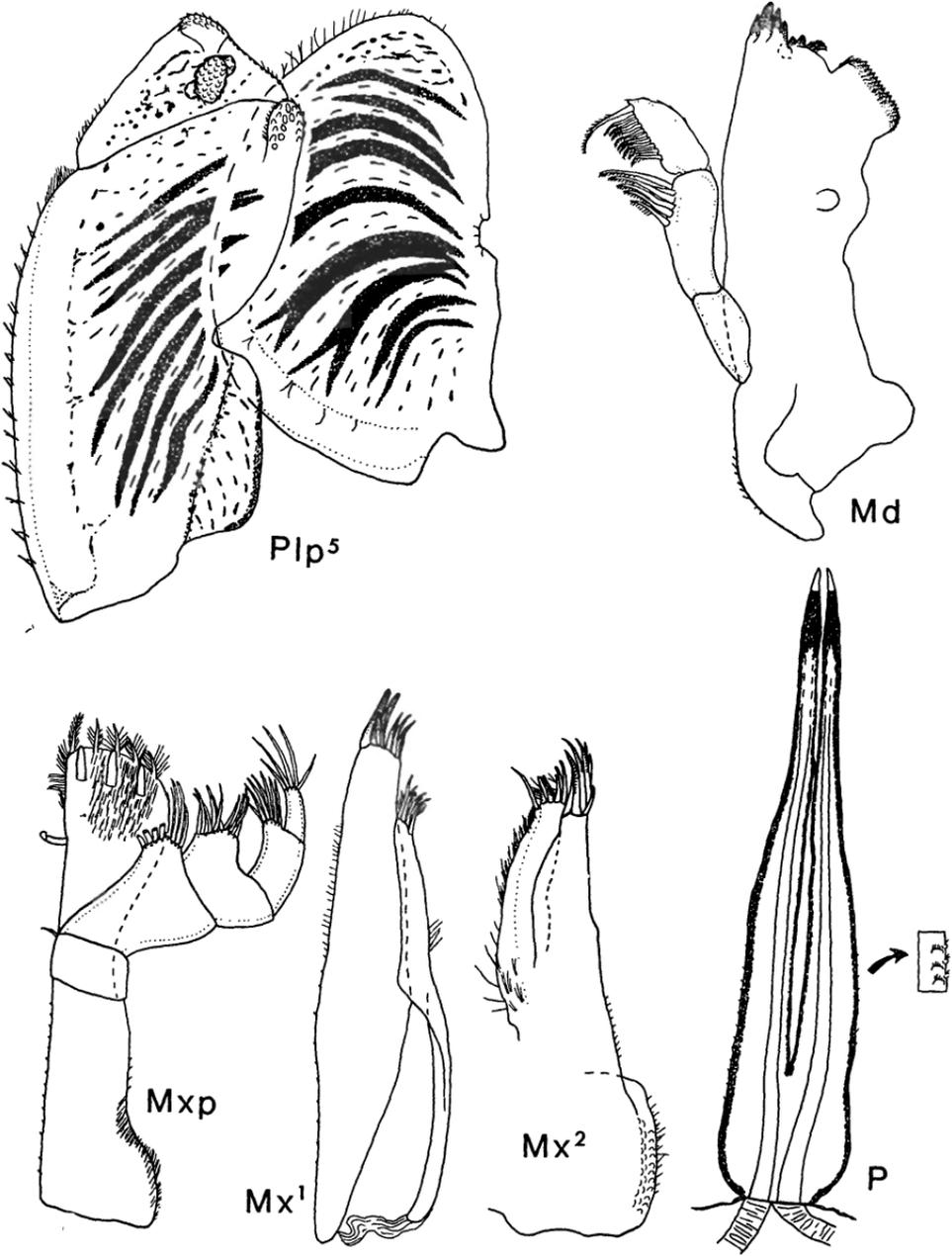


FIGURE 7

Dynamenella plicatura, n. sp. All illustrations from holotype.

Supplementary descriptive notes: In some males the posteriorly directed flange on the 7th pereonal somite overlaps the anterior half of the mid pleonal segment. Pleonal suture of 2 incisions in both sexes and all growth stages. Pattern of sculpturing on pleotelson of females similar to males, but often weaker and with more elongate tuberculations. Females also have small flattened area on either side of medial perforation. Moreover, lateral edges of medial perforation do not converge but flare out gradually. Sculpturing absent from midline near apex of pleotelson in both sexes. Several mature males with 4 coupling hooks on Plp¹-Plp³, other individuals with more usual number of 3. Rami of Plp¹ usually with fewer setae than present in holotype, exopod commonly with 23 PMS, endopod with 18 PMS.

Differential diagnosis: A critical comparison of *Dynamenella plicatura* n. sp. with *D. diana*e from the western coast of Mexico and from Puerto Rico reveals numerous distinctive features which allow recognition of 2 separate species. Some minor differences are also evident between the 2 allopatric populations of *D. diana*e; however, these are not considered adequate to justify further division of the species. Before attempting to discriminate between *D. plicatura* n. sp. and *D. diana*e, it will be useful to amplify the descriptions of *D. diana*e given by MENZIES (1962b) and MENZIES & GLYNN (1968).

In mature males of *D. diana*e (Fig. 9B), the pleonal suture appears bifurcate with medially and forwardly directed branches; re-examination of the type material confirmed this condition in the Mexican specimens (not as illustrated by MENZIES, 1962b, Fig. 3). Mxp palp articles 2, 3 and 4 slightly produced into lobes. Penis bifurcate, tenuiform, as long as ramus of Plp² including PMS (Fig. 10). S on Pip² acute apically, nearly 2 times length of ramus, reaching peripherally to PMS (Fig. 10). Plp³ exopod articulated. Plp⁴ exopod with simple cleft on upper lateral margin, not 2-jointed (contrary to MENZIES, 1962b, p. 341). Plp⁵ exopod articulated, squamiferous protuberances well developed. Anterior border of cephalon with ridge in both sexes, in dorsal view appearing as low, shelf-like extension. Pleotelson in mature females with tubercles elongate, more like carinae; only medial indentation present and this is usually visible from above; terminally part of pleotelson appears to be separated from area adjacent to medial indentation; a vault shelf is lacking; uropods do not extend much beyond end of body (Fig. 9A). All pereopods in females with sparse, setose border medially on articles 4, 5 and 6.

The sample of *Dynamenella diana*e from the western, temperate coast of Mexico contained the largest specimens; *D. plicatura*, n. sp. from Venezuela and *D. diana*e from Puerto Rico are comparatively small and equal

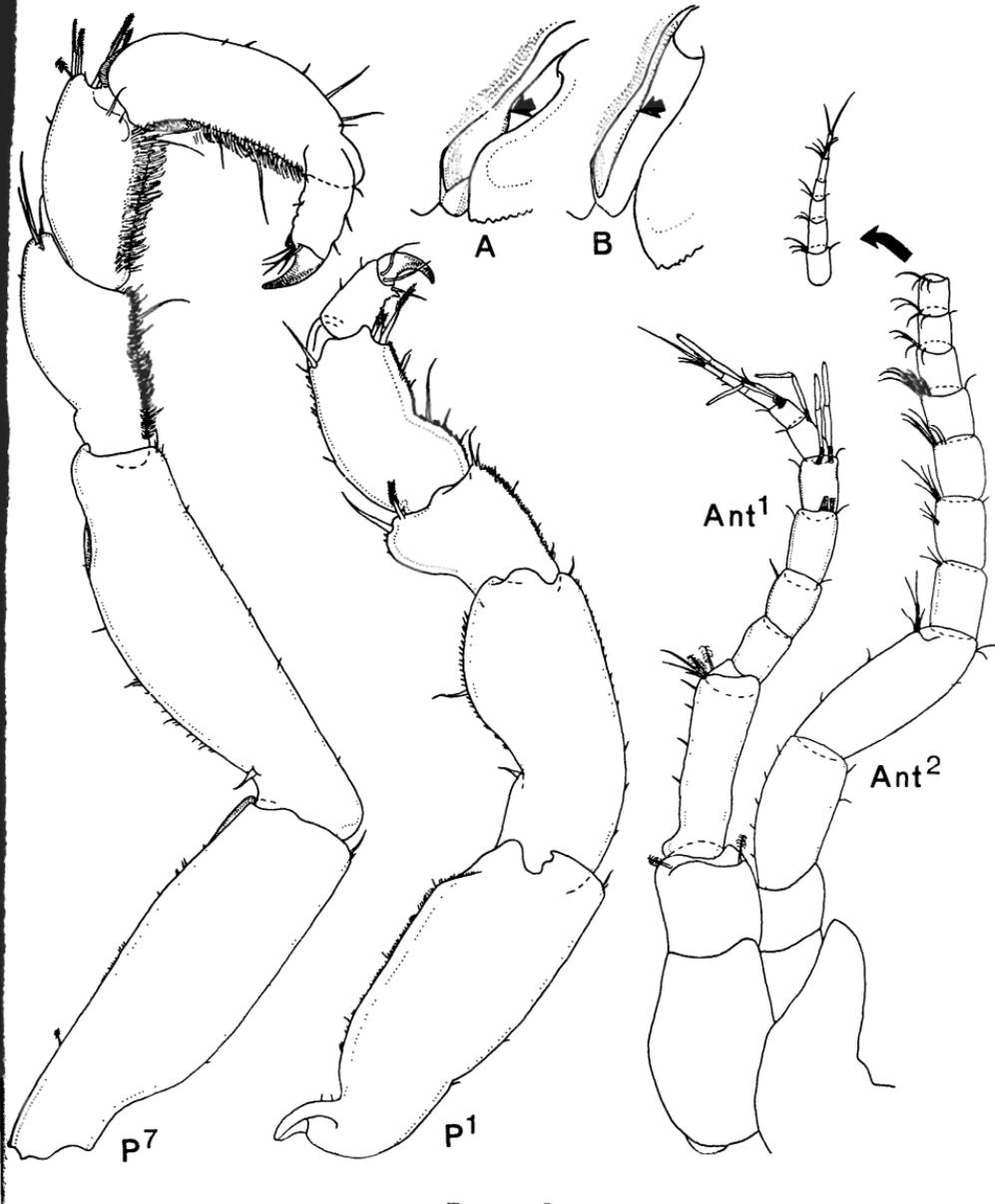


FIGURE 8

Dynamenella plicatura, n. sp. A. ventral view of lefthand portion of pleonal vault, male holotype. B. ventral view of lefthand portion of pleonal vault, male paratype of *D. diana* (MENZIES, 1962) San Quintín, México. Arrows in A and B indicate the appearance of cutfolded expansion of vault shelf.

in size. Only males in *D. plicatura*, n. sp. have a broad fold on the vault shelf of the pleotelson; this fold is narrow in *D. diana*e. The sculpturing of the pleotelson is weakest in *D. plicatura*, n. sp., and the medial indentation in females is relatively narrow with the sides of the perforation flaring out gradually. In addition, the apex of the pleotelson is truncate with flattish areas present on either side of the slit. Large mature individuals of *D. diana*e have the flagella of Ant¹ and Ant² made up of the greatest

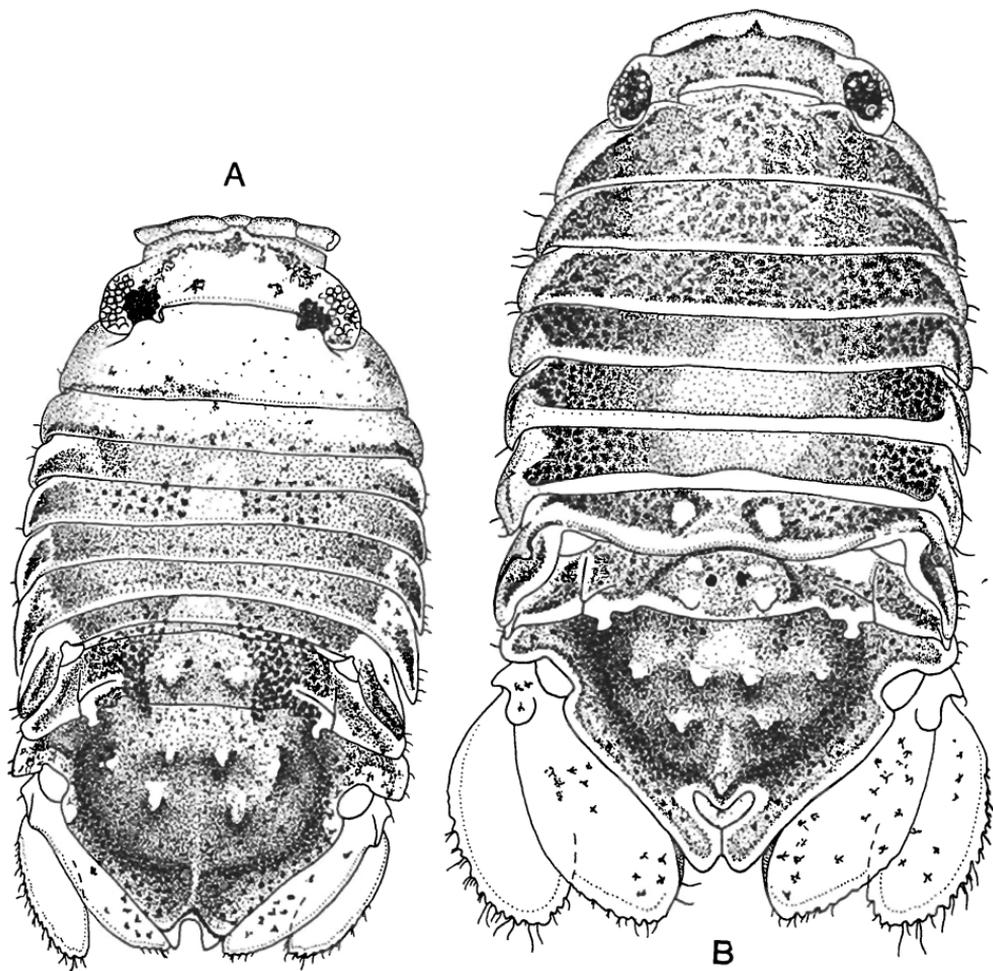


FIGURE 9

*Dynamenella diana*e (MENZIES, 1962). A. female, dorsal view, length 3.5 mm; B. male, dorsal view, length 4.3 mm. From Mayagüez, Puerto Rico, Aug. 27, 1969.

number of articles; however, the number present in animals of comparable size is nearly equal in the 2 species. Articles 4, 5 and 6 of P^6 and P^7 have a dense setal border in males of *D. plicatura*, n. sp., whereas setae are sparse on article 6 in *D. diana*. All of the above characters and a few additional ones are summarized in Table 1.

It is of interest to note that *D. diana* has been collected recently at

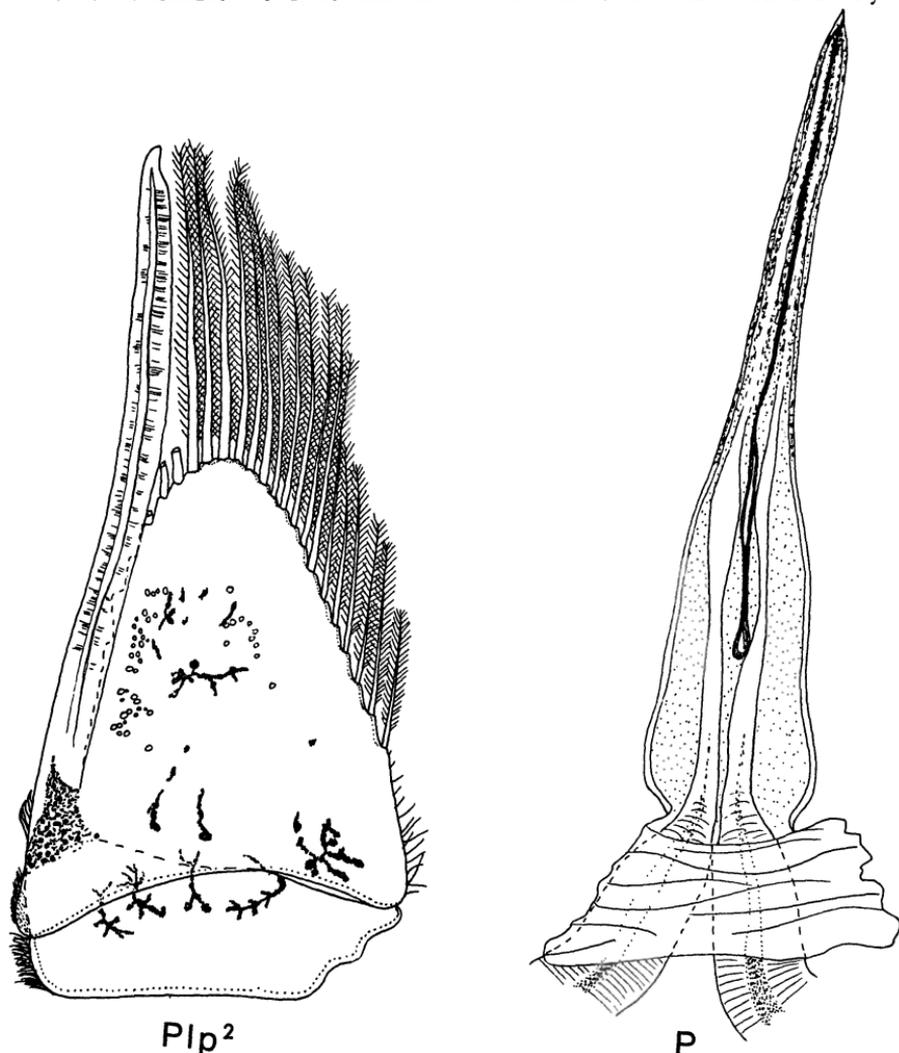


FIGURE 10

Dynamenella diana (MENZIES, 1962). P, length 0.58 mm; illustrations from male in fig. 9B.

Eniwetok Atoll. The individuals from this central Pacific area resemble most closely *D. diana*e from Puerto Rico.

Affinities: The preceding character analysis reveals a very strong affinity between *D. plicatura*, n. sp. and *D. diana*e. While several morphological differences are evident, these are rather minor, suggesting that evolutionary divergence has not proceeded far. The occurrence of both species on the undersides of rocks at shallow depth in relatively protected areas also indicates a similar ecological role. If further collecting shows the two populations of *D. diana*e to be effectively isolated geographically, greater differentiation of this species might be expected to occur.

Etymology: The specific name is derived from *plicatura* (L.), a folding, referring to the wide, ventro-lateral extension of the vault shelf.

Genus *Paracerceis* HANSEN, 1905

Type-species. *Naesa caudata* SAY, 1818.

Diagnosis: Male with paired denticles in medial notch of pleotelson; exopod of uropods elongate and curved; no mesial process on 6th pereonal somite. Female with tubular channel on ventrum of pleotelson; rami of uropods subequal; mandibles coalesced with cephalon; brood in internal pouches. Plp³ exopod jointed distally.

Paracerceis caudata (SAY, 1818) (Fig. 11B & C)

References: *Naesa caudata* SAY, 1818, p. 482. *Paracerceis caudata* (SAY, 1818), RICHARDSON, 1905, p. ix and pp. 314-318, figs. 343-348. Descriptions of this well known species have appeared most recently in MENZIES and FRANKENBERG (1966) and in MENZIES and GLYNN (1968).

Remarks: The apex of the pleotelson in females from Margarita, Is., Venezuela appears more acute than in individuals described previously from higher latitudes (Fig. 11C).

Measurements: Maximum length of males, 8.1 mm, females 6.4 mm. (Sta. N^o VI); males 7.7 mm, females 5.5 mm (Sta. N^o VII).

Distribution: This species is known only from the western Atlantic region, and though largely confined to tropical or subtropical areas it has been collected as far north as New Jersey (RICHARDSON, 1905; MILLER, 1968).

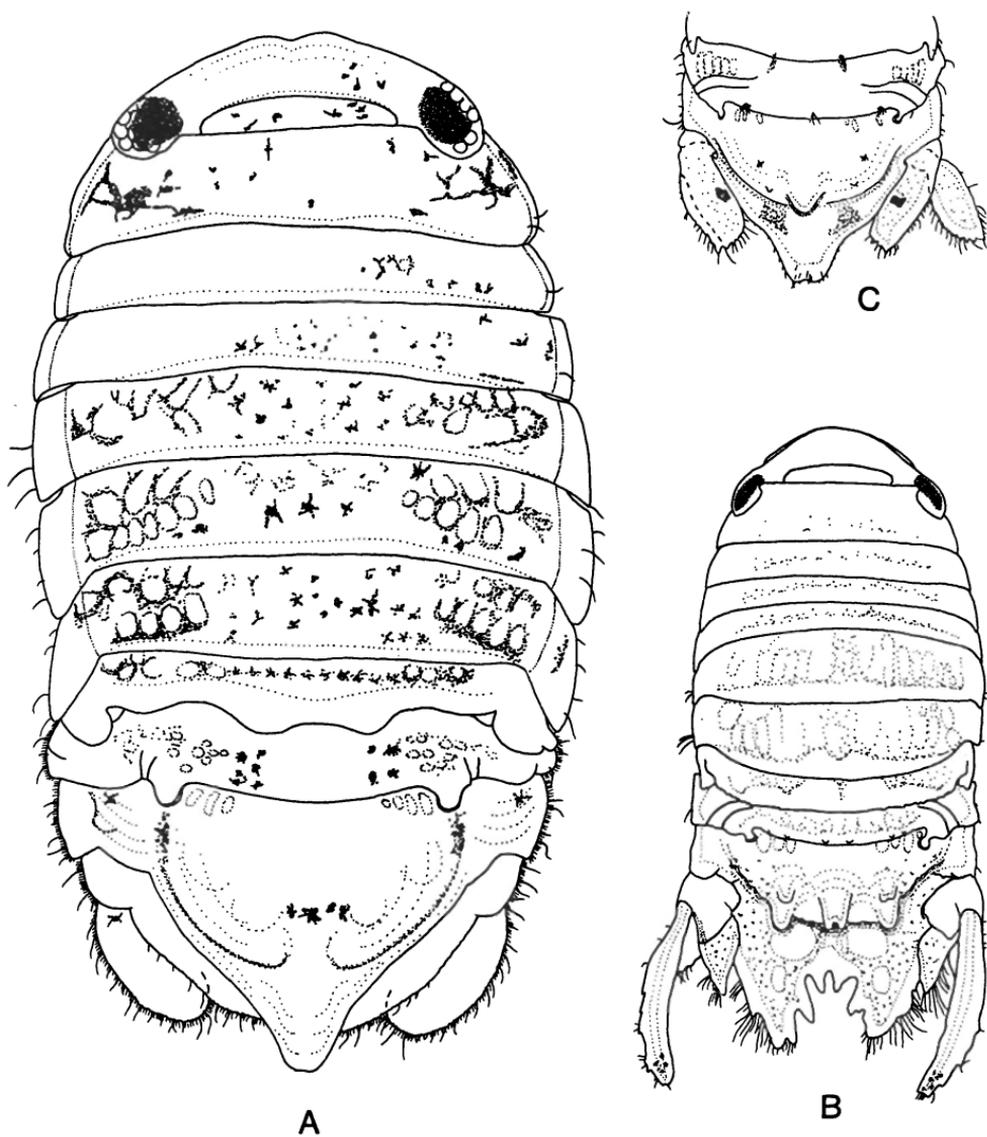


FIGURE 11

A. *Dynamenella acutitelson* MENZIES & GLYNN, 1968; gravid female, dorsal view, length 2.8 mm. B. *Paracerceis caudata* (SAY, 1818); male, dorsal view, length 5.9 mm. C. *P. caudata*; female, dorsal view of pleon, length 5.6 mm.

The present collections extend the range from Puerto Rico to the northern coast of South America. Eleven specimens (5 in collections of EIMM) dredged near Cubagua Island (Sta. N^o VI); 6 specimens (USNM Cat. N^o 127717) also dredged near Cubagua Island (Sta. N^o VII).

Genus *Cerceis* MILNE EDWARDS, 1840

Type-Species. *Cerceis tridentata* Milne Edwards, 1840.

Diagnosis: Plp³ exopod jointed. Ant¹ basal article with distal posterior angle produced into an acute process lying close to hind margin of 2nd article. Pleotelson with well-developed notch. Uropod exopod about as large as or much larger than endopod. Male without mesial process on 6th pereonal somite. Female with semicircular notch on pleotelson; mouth parts strongly metamorphosed, Md coalesced with cephalon. Male with mesial lobe, but lacking paired denticles in notch of pleotelson. Female carries brood in marsupium (after HANSEN, 1905).

***Cerceis carinata*, n. sp.**

(Figs. 12, 13 and 14)

Diagnosis: Cephalon about 1.5 times length of 1st pereonal somite, with conspicuous and unique arrangement of carinae. On dorsum a carina extends along midline from frontal margin posteriorly to about midlength of cephalon. Dorsolateral carinae relatively thick and prominent. Altogether there are 3 pairs of carinae extending along length of cephalon; 2 carinae also present on ventrolateral margin of 1st pereonite. Width of pereon increases gradually from 1st to 5th somite, all somites subequal in length. Anterior pleonal segment about twice length of 7th pereonite. Pleonal sutures separate, anterior incision short and directed medially (best seen in side view), posterior incision deep, extending from lateral border to near midline; sculptured ridge present immediately anterior to this incision. Large, centrally located swelling on anterior portion of pleotelson; carina present on midline, extending nearly to posterior border. A pair of smaller swellings astride centrally inflated area. Two circular, pigment-free areas posteriorly, on either side of medial ridge. Terminal border of pleotelson smooth, not indented. Rami of uropods weakly serrate, with short setae; only exopod reaches terminal border of pleotelson. Ant¹ basal articles and frontal lamina clearly visible in dorsal view. Ant¹ basal article more than 2 times length of 2nd article, its ventral aspect produced and bluntly pointed

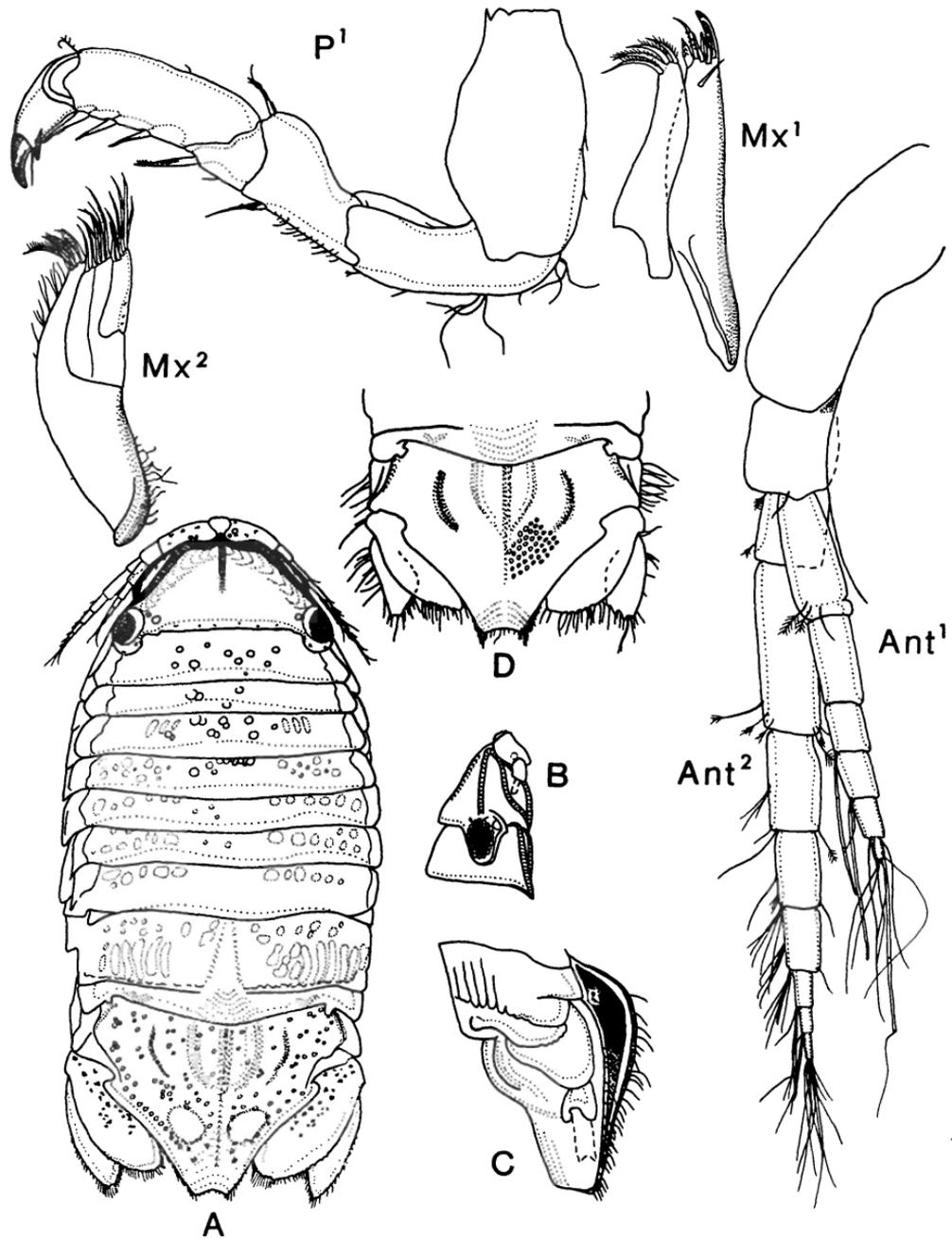


FIGURE 12

Cerceis carinata, n. sp. A. male holotype, dorsal view, length 3.8 mm. B. lateral view of cephalon of holotype. C. lateral view of pleon of holotype. D. dorsal view of pleotelson of female allotype, only a small area of the pustulate surface is shown, length 3.9 mm. Remainder of illustrations from holotype.

terminally; flagellum of 5 articles. Ant² flagellum of 5 articles. Length of pereopods increases posteriorly; without dense setal fringe. P¹ propodus with 3 large, combed setae on medial border. Penis bifurcate, long (equal in length to ramus and basipodite of Plp¹) and relatively stout. Border of exopod of Plp¹ and Plp² with strong spines; S short and robust basally. Plp³ exopod articulated. Both rami of Plp⁴ and Plp⁵ with branchiae. Plp⁵ exopod unjointed.

Coloration (based on freshly formalized specimens): Few red chromatophores scattered over dorsum, more numerous on cephalon.

Measurements: Male holotype, length 3.8 mm, width 1.8 mm. Female allotype (illustrated), length 3.9 mm, width 2.0 mm. Female paratypes, length 3.8 mm, width 1.6 mm; length 3.8 mm, width 2.0 mm.

Type-locality: Sta. N^o VI, Isla de Cubagua, Margarita Island, Venezuela Formalin wash of dredge haul (shell fragments coated with algae, barnacles, etc.) from about 5 m depth. Male holotype, USNM Cat. N^o 127703; 2 paratypes, USNM Cat. N^o 127704; 1 paratype deposited in EIMM collections.

Other material examined: Present collection and 1 male specimen from Cubagua Is., Venezuela, January 21, 1965; associated with *Pinctada* at 7 m depth; collector M. L. JONES, USNM Cat. N^o 114013. Paratypes of *Paradynome benjamensis* RICHARDSON, 1905 (Harvard Univ., MCZ Cat. N^o 6733, 1 male and 1 female).

Distribution: Known only from type-locality.

Supplementary descriptive notes: The 3 female paratypes are provided with cephalic carinae, and the pleotelson is very similar in both sexes. The more obvious sexual differences include a relatively broad cephalon and body and the presence of marginal setae along entire length of pleon and pereon in females. Both sexes with faint sculpturing along lateral border of pereon, indicating demarcation of epimera. Entire dorsal surface of body pustulate. Mxp palp articles 2, 3 and 4 with produced lobes, exite densely setose laterally. Mx¹ medial article with 4 plumose setae; exite thickened laterally, with 3 stout setae and 6 sclerotized teeth. Mx² inner lobe with 5 plumose setae; outer lobes with 6 and 7 setae each, some finely plumose. Md palp terminal article with 8 plumose setae, 2nd article with 5 weakly plumose setae; incisor trifold, lacinia mobilis bifid; setal row of 5 plumose setae; molar process with 20 teeth. Mouth parts metamorphosed in female, Md fused with cephalon. Ant¹ flagellum with only 3 esthetascs. Plp¹ endopod about 1/2 width of exopod; with 9 PMS; medial border densely setose.

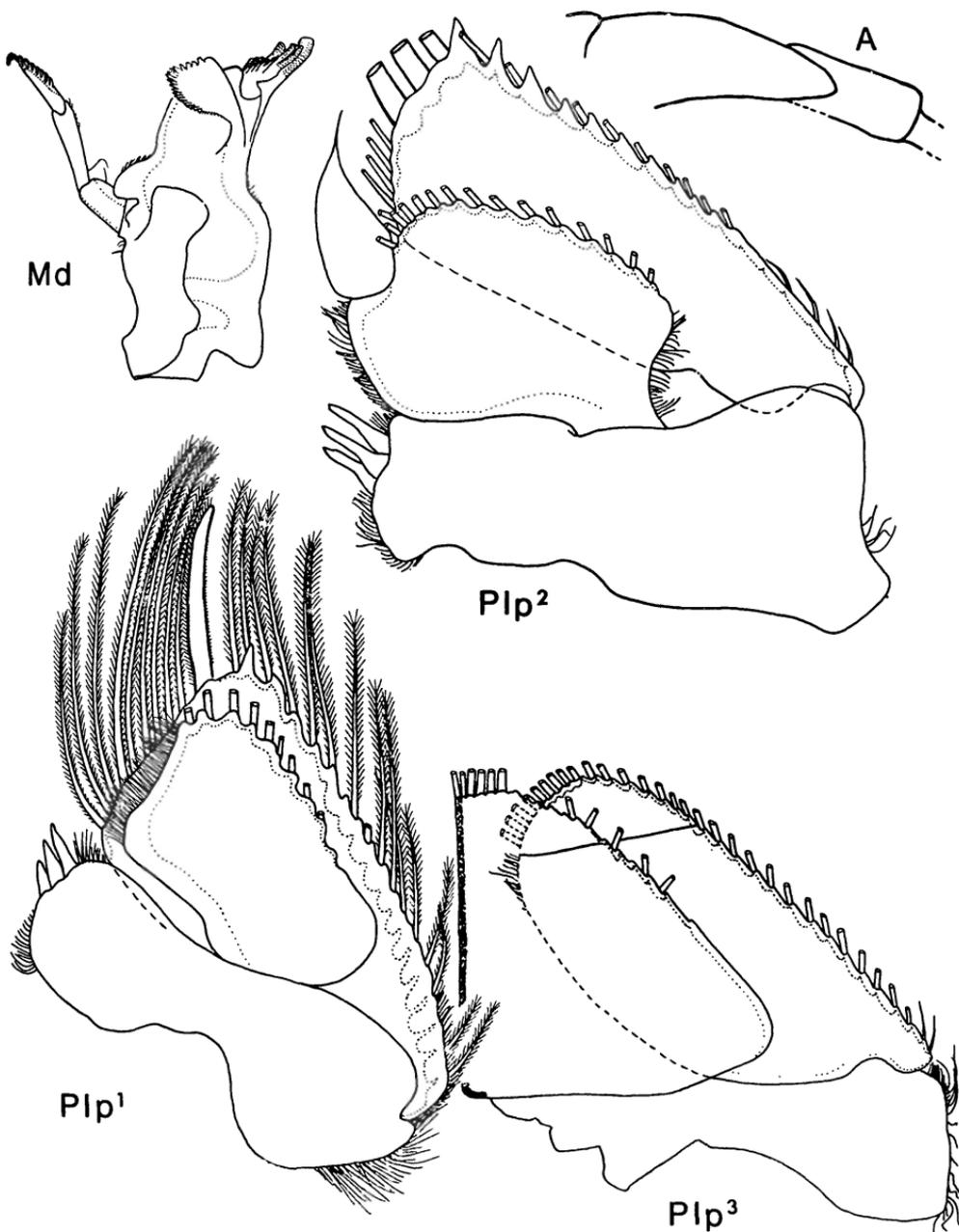


FIGURE 13

Cerceis carinata, n. sp. A, ventral view of 1st and 2nd articles of Ant'. All illustrations from holotype.

Plp¹ exopod with 28 PMS; stout seta apically on medial border. Plp² endopod with 15 PMS; S inflated at base and tapering apically, located on upper border of ramus, equal to endopod in length. Plp² exopod with 24 PMS, 3 of these located on the upper medial border very stout. Both rami of Plp² with densely setose medial borders. Plp³ exopod with 31 PMS, endopod with 18 PMS. Plp⁴ exopod weakly spinose apically, lateral border with 4 setae, 5 pairs of branchiae. Apical border of endopod of Plp⁴ with minute setae, 5 minute setae laterally, 5 pairs of branchiae. Plp⁵ exopod unjointed, lateral border with 10 setae, squamiferous protuberances prominent, 4 pairs of branchiae. Plp⁵ exopod also unjointed in females. Plp⁵ endopod densely setose apically, 4 pairs of branchiae. Lower margin of pleotelson with long, stout setae. Brood pouches not discernible in females.

Affinities: The rather close similarity between the Australian *Cerceis tridentata* (BAKER, 1908; NAYLOR, 1966) and *C. carinata* has resulted in some confusion as to the true identity of the West Indian species. That these 2 sphaeromatids are closely allied is certainly evident; however, a number of features allow easy separation of the 2 species. *Cerceis carinata* is considerably smaller than *C. tridentata* (ca. 4 mm versus 14 mm) and the male of *C. carinata* is without a pleonal notch and median process. The cephalic carinae are distinctive in *C. carinata*, as well as the development of the pleonal sutures, uropods and stylet. A related American species, *Paradynamene benjamensis* RICHARDSON, 1905, is also easily distinguished from *C. carinata*. *Paradynamene benjamensis* is large (10.7 and 10.9 mm), with a pair of pleonal sutures extending far medially, emarginate pleotelson in both sexes, and uropods long and lanceolate.

Etymology: Specific name *carinata* derived from *carina* (L.) meaning a keel, referring to the keel-like ridges on the cephalon.

Group Hemibranchiatae

Plp⁴ and Plp⁵ endopods thick, fleshy, with prominent branchiae; exopods submembranaceous and rather pellucid, 2-jointed; both rami of both pairs without PMS; proximal subapical squamiferous protuberance on exopod of Plp⁵ very high. Both rami of Plp³ with closely set PMS, at least distally. Plp¹ endopod relatively broad (from HANSEN, 1905).

Genus *Exosphaeroma* STEBBING, 1900

Type-species. *Sphaeroma gigas* LEACH, 1818. *Exosphaeroma gigas* (LEACH, 1818), STEBBING, 1900.

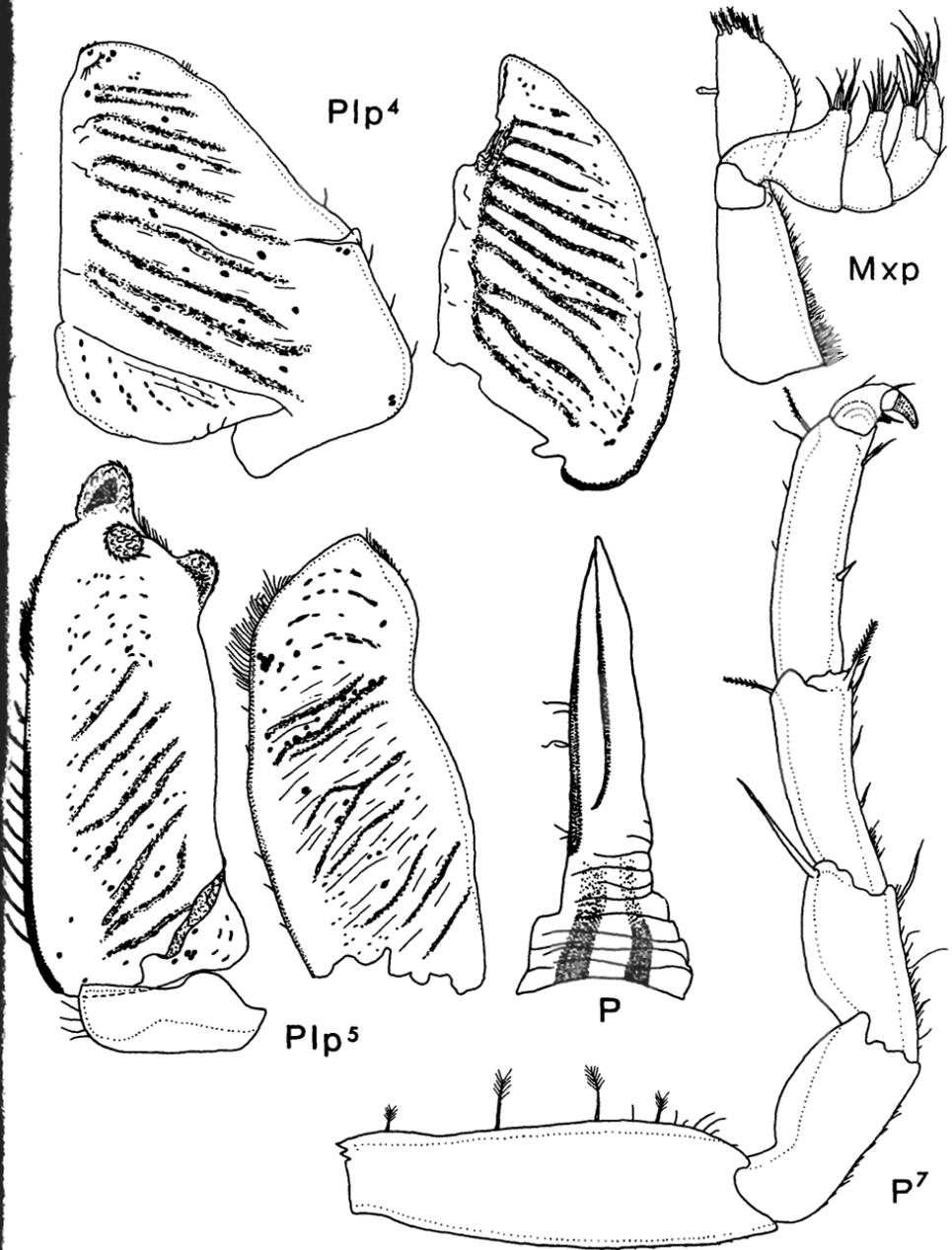


FIGURE 14

Cerceis carinata, n. sp. All illustrations from holotype.

Diagnosis: Mxp palp articles 2, 3 and 4 produced into lobes. Last pereonite of male lacking a slender mesial process. Apex of pleotelson similar in both sexes, not produced, and without an obvious groove on the ventrum. Uropoda exopods not crenulate along posterolateral margin (after STEBBING, 1900 and MENZIES, 1962a). The last character (noted by STEBBING, op cit) has subsequently been interpreted more broadly, resulting in the inclusion of species in this genus with weakly crenulate uropods. *Exosphaeroma crenulatum* RICHARDSON (1902) is an example of such a species, as is *E. diminutum* (see below).

Exosphaeroma diminutum MENZIES & FRANKENBERG, 1966
(Figs. 15 & 16)

Reference: *Exosphaeroma diminutum* MENZIES & FRANKENBERG, 1966, pp. 45-46, fig. 21.

Diagnosis: The original diagnosis of this species included the following features: Uropoda not quite reaching to apex of pleotelson; margin of exopod smooth, not crenulate. Cephalon wider than long, with short, median, tubular rostrum. First pereonite 1.5 times length of others. Appendix masculina of Plp² lanceolate, just reaching apex of margin of endopod. Plp³ exopod unjointed. Plp⁴ and Plp⁵ exopods lacking branchiae (judging from illustrations).

Coloration: In alcohol-preserved material, the amount of pigmentation varies from a few, scattered minute chromatophores on a light background to dense clusters of pigment rendering the entire body dark. Numerous, large chromatophores usually present on the basal segments and proximal areas of the rami of Plp¹ through Plp³.

Measurements: Mean length of 5 largest males, 2.42 mm, range 2.1 mm to 2.6 mm, length of largest female, 2.3 mm (Sta. N^o IV). Mean length of 8 largest males, 2.82 mm, range 2.6 mm to 3.0 mm, length of largest female (illustrated), 2.2 mm (Sta. N^o V).

Type-locality: Sandy beach, Sapelo Island, Georgia, USA. Male holotype, USNM Cat. N^o 111078.

Material examined: Two collections from Margarita Island, Venezuela, Sta. N^o IV, 32 specimens, USNM Cat. N^o 127716 and Sta. N^o V, 149 specimens (20 deposited in EIMM collections). Radio Island Beach, Morehead City, North Carolina, July 18, 1968, 22 specimens, collector D. DEXTER. Puerto Yabucoa, 2.8 km SSW of Playa de Guayanés, Puerto



FIGURE 15

Exosphaeroma diminutum MENZIES & FRANKENBERG, 1966. A. Mature female, dorsal view, length 2.2 mm; B. Mature male, lateral view of pleon, length 3.0 mm; C. Immature, dorsal view of pleon, length 1.4 mm. P, P¹ and P⁷ from 2.6 mm male.

Rico, July 12 & 13, 1969, Sta. N^o PR-1, 2 specimens, collector S. L. H. FULLER, presently in the collections of The Academy of Natural Sciences of Philadelphia. Type lot of *Exosphaeroma crenulatum* (RICHARDSON, 1902), 10 specimens, Peabody Mus. Nat. Hist., Cat. N^o 3250.

Distribution: Type locality at Sapelo Island, Georgia; near Morehead City, North Carolina; Margarita Island, Venezuela; Puerto Yabucoa, Puerto Rico.

Supplementary descriptive notes: Based on material from Venezuela and North Carolina. Differing from the original description were the weakly crenulate margins to the uropodal exopod and the presence of prominent branchiae on the exopods of Plp⁴ and Plp⁵. The uropods tend to be crenulate in both sexes; only a few individuals have the exopod with a smooth margin. Considerable individual variation was noted within samples in respect of the number and degree of development of the branchiae. This is evident in Table 2, where the pairs of branchiae ranged from 2 to 5; in 1 individual branchiae were absent from the exopod of Plp⁵. Plp³ exopod not articulated. Pleotelson similar in both sexes and in young, only slightly swollen on dorsum above pleonal vault. Vault shelf present rather far

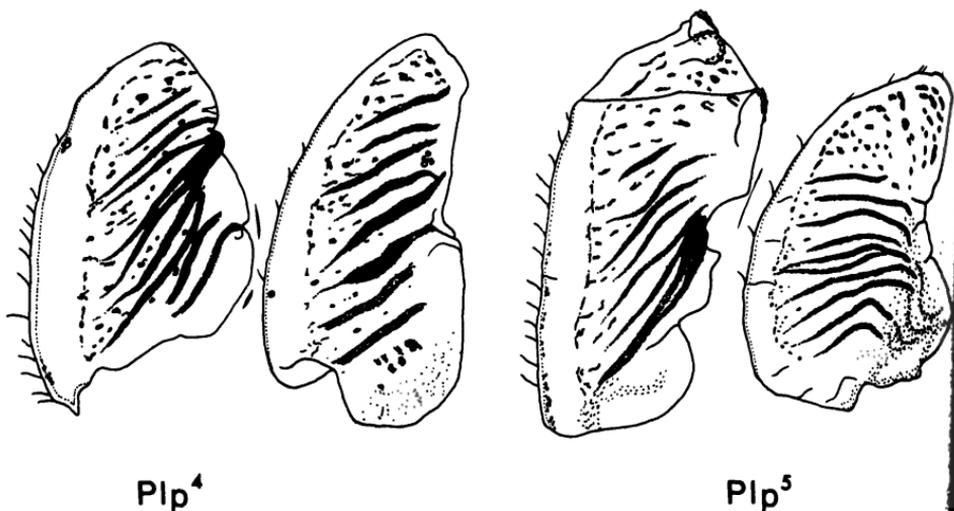


FIGURE 16

Exosphaeroma diminutum MENZIES & FRANKENBERG, 1966. Pleopods from 2.6 mm male.

internally. Penes bifurcate, tenuiform and acute apically. Pereopods with lateral edges of articles 3, 4 and 5 supplied with numerous, long, stout setae; medial border of articles 3, 4, 5 and 6 from P² through P⁷ with short, dense setal fringe. Antennae with basal articles normal; Ant¹ flagellum of 7-8 articles and 7 esthetascs, Ant² flagellum of 10-11 articles. Mouth parts normal; Md not metamorphosed in females; Mxp palp articles not greatly elongate.

Remarks: Study of the type collection of *Exosphaeroma crenulatum* showed that MENZIES and FRANKENBERG (1966) were correct in recognizing the distinctive character of *E. diminutum*. The relative length of the 1st pereonite and the presence or absence of crenulations on the uropods, 2 features used to distinguish between these species, show a fair degree of intraspecific variation. For example, in some individuals of *E. crenulatum* the 1st pereonite is longer than the remainder, as in *E. diminutum*. Also, the crenulate exopods of the uropods appeared rather weaker in *E. crenulatum* than indicated by RICHARDSON (1902, 1905) and stronger in *E. diminutum* than first described. The pereopods show a similar development and disposition of long, stout setae, but the medial borders lack a dense setal fringe in *E. crenulatum*. The penes in *E. crenulatum* are blunt apically. The pleon and associated structures in *E. crenulatum* are also quite different. In lateral view, the central area of the pleotelson is more inflated. The medial suture line on the anterior pleonal segment extends more toward the midline. The stylet is broad along its entire length, blunt apically and slightly exceeding the length of the endopod. Plp³ exopod is jointed. Plp⁴ and Plp⁵ rami with 4 pairs of well developed branchiae.

Affinities: The varying degrees of development of branchiae on the exopods of Plp⁴ and Plp⁵ among members of *Exosphaeroma* and *Pseudosphaeroma* have resulted in considerable confusion relative to assignment of species to either the eubranchiate or hemibranchiate groups. MONOD (1931) regarded *Pseudosphaeroma*, originally described as a eubranchiate species by CHILTON (1909), to be more closely allied with the Hemibranchiata. Even discounting the condition of the branchiae, it is still difficult to find a set of features which unequivocally set these 2 genera apart. The diagnostic characteristics listed by MENZIES (1954) are now known to be inconsistent. Certain similarities in the pleotelson, such as absence of pronounced sculpturing and emargination of the apex, similarity of both sexes, and the arrangement

of pleonal sutures, probably attest to a rather close relationship of the 2 genera.

LOCAL DISTRIBUTIONS AND ZOOGEOGRAPHIC RELATIONSHIPS

Information on the nature of the various habitats sampled shows that the distributions of the 6 species were fairly well associated with rather obvious environmental conditions (see Station List). Occurring abundantly in the intertidal zone were *Dynamenella plicatura*, *D. acutitelson*, *D. tumidicauda* and *Exosphaeroma diminutum*. *Dynamenella plicatura* and *D. acutitelson* were collected from protected or partially exposed habitats on the north and south coasts. The undersurfaces of rocks, along shores subject to moderate or strong circulation, provided shelter for *D. plicatura*. This species often occurred in the open, clinging to the rock surface, among a variety of encrusting, sessile animals. *Dynamenella diana* is found under similar conditions in Puerto Rico, as well as in empty barnacle shells and occasionally with *Chiton tuberculatus*. *Dynamenella acutitelson* seemed to prefer a close association with algae. It was most abundant along the south coast on algal encrusted cobbles on a beach receiving moderate wave action (Sta. N^o IV). A marked reduction in density was noted further to the east (Sta. N^o V) on a sand and silt beach where reducing conditions were evident. *Dynamenella acutitelson* also occurs on cobbles overgrown with algae toward the outer part of San Juan Bay, Puerto Rico. *Dynamenella tumidicauda* and *Exosphaeroma diminutum* were more restricted in distribution, the former was found only with cirripeds along the north shore and the latter with algae on cobbles or in fine sand on the south side of the island. *Exosphaeroma* was most abundant in a sand-silt substratum. This species has been reported as a member of the sand beach fauna in Georgia (MENZIES & FRANKENBERG, 1966) and in North Carolina (DEXTER, 1969), where it ranked fifth in numerical density.

Two species were collected subtidally, namely *Paracerceis caudata* and *Cerceis carinata*. These were dredged from a sand-coral rubble bottom of 3 m to 5 m depth, where the Atlantic Pearl Oyster (*Pinctada radiata*) occurs. The depth range of *Paracerceis caudata* has been reported to extend to 46 m (RICHARDSON, 1905).

The occurrence of *Dynamenella acutitelson* and *Paracerceis caudata* in

northeastern Venezuela extends the range of these species from Puerto Rico by about 7° south latitude. *Exosphaeroma diminutum* was formerly reported from the southeastern coast of the USA, a member of the Carolinian fauna. Recently *E. diminutum* was collected in Puerto Rico by S. L. H. FULLER (The Philadelphia Academy of Sciences), indicating that this species may occur throughout much of the tropical western Atlantic region. *Dynamenella plicatura*, probably an ecological analog of *D. diana*, *D. tumidicauda* and *Cerceis carinata* are presently known only from Margarita Island.

In spite of the difficulties of inferring faunal relationships on the basis of an incompletely known group, a brief discussion does seem justified in the light of some apparent trends brought out by the present collections. It is perhaps significant that only 3 of the 11 sphaeromatid species occurring in Puerto Rico were found at Margarita Island; identical horizons on the shore and comparable habitat niches (where present) were sampled intensively. For example, *D. perforata* in association with the chiton *Acanthopleura granulata* was searched for but not found at Sta. No's. II, III, VIII, IX and X. This partnership is common throughout the West Indies (GLYNN, 1968) and has been observed more recently in Panama on offshore coral reefs at San Blas. Collections of *D. perforata* from *Chiton tuberculatus* (Sue Wood Bay, Sept. 19, 1969) obtained by D. DEVANEY in Bermuda, extend the range of the commensal habits of this species. The early record of *Exosphaeroma crenulatum* associated with *Chiton* (AREY & CROZIER, 1919) is considered in error as regards the identity of the inquiline.

Certain species common on coral reefs in Puerto Rico, for example *Dynamenella quadripunctata* and *Geocerceis barbarae*, were conspicuously absent at Margarita Island. A preliminary assessment of the composition of the sphaeromatid fauna associated with coral reefs along the Atlantic coast of Panama, with a relatively constant and high year round thermal structure, indicates a strong affinity with Puerto Rico. Emergent, coral rubble mounds subject to moderate wave action, the type of shore inhabited by typical reef species, were not present in the vicinity of Margarita Island. ANTONIUS (pers. comm.) has noted an absence of coral reefs over an even greater area, including much of the eastern coast of Venezuela. If the depauperate isopod fauna is a result of diminished coral reef growth and the attendant hydrographic conditions, it may be found to encompass an area between 63° to 65° W and 10.5° to 11° N (LJÖEN & HERRERA, 1965).

LOYOLA e SILVA's (1960, 1962, 1963, 1965) survey of the Sphaeromatidae of Brazil has revealed a distinctive fauna markedly different from that found in the West Indian-Caribbean region. Discounting pantropical cosmopolites, only one species —*Cymodoce barrerae* (BOONE, 1918) from Cuba— or about 8% of the Brazilian fauna is also known to occur in the Caribbean Sea or farther north. Comparing all 44 species of Isopoda from Puerto Rico and South America, MENZIES and GLYNN (1968) also found a low affinity (equal to 7%) between the two regions. These data indicate a rather effective separation of the faunas and the presence of a relatively narrow region of transition between the equator and northeastern South America. Two factors that may contribute to this are the major patterns of circulation along the Brazilian coast and the location of the Amazon and Orinoco River basins. The South Equatorial Current flows toward the coast near Cabo São Roque, where it divides sending branches to the north and south. Thus, the Brazil Current moving on a southerly course and the northerly flowing stream feeding the Caribbean Sea could be expected to oppose an interchange of species along this coastline. Northerly migrations would be further limited by conditions of reduced salinity. The bulk of the Brazilian Sphaeromatidae actually does occur below Cabo São Roque, in areas under the influence of the Brazil Current. Also, a high endemism in scleractinian corals in this region has been attributed to the isolating effect of these hydrographic conditions (VERRILL, 1901; LABOREL, 1967).

Our knowledge of the distribution of the molluscan fauna along the eastern coast of South America is not in accord with the above argument and perhaps sheds some light on the importance of biological factors in limiting migrations. For example, several West Indian-Caribbean elements do occur along the northeastern and central eastern coasts of Brazil, steadily diminishing in importance to the south (MARCUS & MARCUS, 1967; WORK, 1969). Here a southerly extension of the fauna has become established across hydrographic barriers, in a group where planctotrophic larvae are common. The occurrence of an endemic, tropical molluscan fauna centered along the northeastern and central coasts of Brazil is also known. That this assemblage has only a southerly range extension is possibly evidence of the effects of competitive exclusion by the more highly diversified West Indian-Caribbean fauna (BRIGGS, 1967a & b). This factor may also be used to explain the absence of movement of Brazilian sphaeromatid species into the Caribbean Sea, assuming that this region represents a major center of

evolutionary radiation. This point cannot now be decided unequivocally—23 species are known north of the equator whereas the Brazilian fauna comprises 18 species. The southerly migrations of mollusks, and evidently not isopods, may be due to the greater powers of dispersal possible in groups with larval stages of development.

In summary, the sphaeromatid fauna of Margarita Island has its greatest affinity with the West Indian-Caribbean region. However, several tropical western Atlantic species appear to be absent from this locality. A plausible explanation for this is sought in the marked seasonal decline of the thermal structure, approaching that of a subtropical or warm temperate region. Further information on the distributions of the 3 new species described here will have important bearing on this question.

RESUMEN

Estudio sistemático de los Sphaeromatidae (Crustacea: Isópoda) de is'a Margarita, Venezuela, con la descripción de tres especies nuevas.

El estudio del material de esferomátidos colectado en 9 localidades de is'a Margarita, ha ampliado el rango de distribución de tres especies Caribe-Antillanas (*Paracerceis caudata* y *Dynamenella acutitelson*, ambas pertenecientes a los Eubranchiate y de *Exosphaeroma diminutum* de los Hemibranchiate) hasta la costa norte de América del Sur. Se describen tres nuevas especies de Eubranchiate de esta área (*Dynamenella tumidicauda*, *Dynamenella plicatura* y *Cerceis carinata*). *Dynamenella tumidicauda*, estrechamente relacionada con *D. dumerili*, *D. bakeri* y *D. globicauda*, puede distinguirse por la siguiente combinación de caracteres: número y disposición de los engrosamientos del pleotelson, suturas pleonales bifurcadas, estilete romo apicalmente con la base estrecha. *Dynamenella plicatura* es muy similar a *D. diana*; sin embargo, puede reconocerse fácilmente por la presencia de una expansión ventro-lateral, ancha, del caparazón. *Cerceis carinata* está relacionada con *C. tridentata*, pero difiere de ésta por un determinado número de caracteres, entre los que se incluyen la presencia de tres pares de carenas cefálicas.

La distribución local de las especies se correlacionaba bien con los parámetros físicos peculiares del habitat. Por ejemplo, *Exosphaeroma* fue más abundante sobre sustrato arenoso-arcilloso a sotavento de la isla. Pero,

al menos en una especie, *D. tumidicauda*, la distribución estaba más condicionada por factores biológicos. Solamente se alcanzaban densidades altas en los espacios habitables situados entre cirrípedos grandes, los cuales estaban restringidos principalmente a las protuberancias rocosas de la costa de mar abierto situada al norte.

Los esferomátidos de la isla de Margarita muestran una estrecha afinidad con la fauna Caribe-Antillana aunque no se colectaron algunas especies características de esta región.

La ausencia de ciertas especies asociadas con arrecifes coralinos puede estar relacionada con las especiales condiciones hidrográficas de esta área. Un afloramiento estacional causa un descenso significativo de la temperatura, de 27° a 19°C en superficie, condición que influye en el escaso crecimiento de los corales. Una revisión de la distribución de los Sphaeromatidae en las aguas cálidas del Atlántico Occidental indica la existencia de una fauna subregional Brasileña que tiene un inicio en algún lugar de la costa nordeste del Brasil. Se discute la separación de estas faunas en relación a la posible existencia de barreras hidrográficas (baja salinidad a causa de aportes fluviales, fuertes corrientes superficiales) y exclusión competitiva debida al contacto con especies que se han desarrollado a partir de un centro de radiación evolutiva.

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TABLE 1

SUMMARY OF MORPHOLOGICAL FEATURES ALLOWING DIFFERENTIATION
OF *DYNAMENELLA PLICATURA*, N. SP. AND *D. DIANAE*
FROM BAJA CALIFORNIA, MEXICO AND MAYAGÜEZ, PUERTO RICO.

Characters		<i>D. plicatura</i>	<i>D. dianae</i> (Mexico)	<i>D. dianae</i> (Puerto Rico)
Mean length (mm) of 10 largest, mature individuals	♂ ♀	4.00 3.56	5.16 4.22	4.02 (6 spec.) 3.32 (6 spec.)
Median concavity of posteriorly directed extension (flange) of 7th pereonite (♂)		narrow	wide	wide
Pleon				
ventro-lateral extension of vault shelf (♂)		wide	narrow	narrow
sculpturing (♂ α ♀)		weak	prominent	prominent
tubercle or carina forward of foramen (♂ α ♀)		absent	present	present
shape of foramen (♂)		oval	cordate	cordate
medial perforation (♀)		narrow, flaring	broad, convergent	broad, convergent
apex (♀)		truncate	acute	acute
Ridge along anterior margin of cephalon (♂ α ♀)		absent	present	present
Number of flagellar articles (♂ α ♀)				
Ant ¹		8-9	10-11	9-10
Ant ²		13-15	16-18	13-17
Setae on medial border of pereopods, articles 4, 5 and				
6 (♂)				
P ⁶		dense	dense	dense
P ⁷		dense	sparse art. 6	sparse art. 6
Length of stylet relative to endopod		1 1/3X	XZ	2X
Crenulate border of uropods (♂ α ♀)		moderate	strong	strong

TABLE 2

NUMBER OF PAIRS OF BRANCHIAE PRESENT ON PLEOPODS
OF MATURE INDIVIDUALS OF *EXOSPHEAROMA DIMINUTUM*.
ALL MALES EXCEPT FOR THE SINGLE FEMALE MARKED
WITH AN ASTERISK

Locality	Plp ⁴		Plp ⁵	
	exopod	endopod	exopod	endopod
Venezuela	3	3	3	3
	5	4	4	5
	3	4	absent	3
North Carolina	4	4	4	5
	3	3	3	3
	(*) 3	4	2	4

STATION LIST

Sta. No.	Date	Habitat	Species Collected	Number
I	V-27-68	Rock jetty of Estación de Investigaciones Marinas de Margarita, Punta de Piedras; undersides of boulders and cobbles a few cm below low tide level.	Dynamenella plicatura , n. sp.	469
II	V-28-68	Exposed rocky promontory of metamorphic gneiss; several species of large, fleshy algae in intertidal zone.	None	—
III	V-28-68	Partially exposed platform of metamorphic gneiss in intertidal zone; undersides of boulders and from algae; dense clusters of cirripeds <i>Tetraclita squamosa stalactifera</i> (Lamarck), <i>Newmanella radiata</i> (Bruguère) and <i>Balanus</i> (<i>Megabalanus</i>) <i>tintinnabulum antillensis</i> Pilsbry.	Dynamenella plicatura , n. sp. <i>Dynamenella acutitelson</i> Dynamenella tumidicauda , n. sp.	53 14 32
IV	V-29-68	Cobble beach exposed to moderate wave action; cobbles overgrown with the algae <i>Enteromorpha intestinalis</i> (Linnaeus) Link, dominant, <i>Ulva lactuca</i> L., <i>Cladophora fascicularis</i> (Mertens) Kützing, and <i>Ceramium byssoides</i> Harvey.	<i>Dynamenella acutitelson</i> <i>Exosphaeroma diminutum</i>	230 32
V	V-29-68	Protected sand-silt beach; reducing environment; cobbles embedded in silt and overgrown with the algae <i>E. intestinalis</i> , dominant, <i>Enteromorpha lingulata</i> J. Agardh, <i>Chaetomorpha brachygona</i> Harvey, and <i>Cladophora fascicularis</i> (Mertens) Kützing.	<i>Dynamenella acutitelson</i> <i>Exosphaeroma diminutum</i>	3 149
VI	V-30-68	Dredge haul of oysters (<i>Pinctada radiata</i> Leach), shell fragments encrusted with algae, cirripeds, etc. from ca. 5 m depth.	Cerceis carinata , n. sp. <i>Paracerceis caudata</i>	4 11
VII	V-30-68	Same as VI, from ca. 3 m depth.	<i>Paracerceis caudata</i>	6
VIII	V-30-68	Pier at Nueva Cadiz; undersides of boulders and cobbles.	Dynamenella plicatura , n. sp.	6
IX	V-31-68	Partially exposed rocky shore of metamorphic gneiss; algae and clusters of <i>T. squamosa stalactifera</i> in intertidal zone.	Dynamenella plicatura , n. sp. Dynamenella tumidicauda , n. sp.	109 17
X	V-31-68	Same as IX, except entirely exposed.	Dynamenella tumidicauda , n. sp.	28