

FIG. 30. — *Acanthodromia erinacea* A. Milne Edwards, 1880, ♀ ovig. 16.7 x 17.7 mm, holotype, Guadeloupe, "Blake", stn 166, 275 m (MCZ 6509): **a**, dorsal view of right half of carapace; **b**, ventral view of right orbital area; **c**, outer face of right cheliped; **d**, dorsal view of right cheliped; **e**, posterior view of terminal articles of right fourth pereopod; **f**, posterior view of terminal articles of right fifth pereopod; **g**, ventral view of telson and terminal segments of female abdomen (uropods concealed by strong spinulation).

Five pairs of pleopods in female, first pair vestigial and not carrying eggs, remainder biramous. Male pleopod characters unknown.

COLOUR. — Pale cream when preserved.

GEOGRAPHIC DISTRIBUTION. — Along the chain of Caribbean islands from the Arrowsmith Bank (20°N, 86°W), off the Yucatan coast of Mexico, to St. Vincent (13°N, 61°W) in the Windward Ids. *Acanthodromia erinacea* seems to be an insular species like the other Atlantic dynomenid, *Dynomene filholi*.

DEPTH. — The depth range for this species is 158-540 m. *Acanthodromia erinacea* lives at a greater depth than most of the species of *Dynomene*. The only information about its habitat comes from the specimen collected at 158 m off St. Vincent, Windward Ids where the substrate is described as "coral bottom".

SIZE. — Only three females of *Acanthodromia erinacea* are known as well as a carapace of unknown sex. These collection records have been summarized by RATHBUN (1937). The largest female (the holotype), which was ovigerous, measured 16.7 x 17.7 mm and carried about 100 eggs of 0.5 mm diameter. This female was collected in January, 1878 and the eggs were newly laid. The egg size is similar to that of the other dynomenid species. RICE (1981) examined eggs from a female collected in February 1933 which were very close to hatching.

DISCUSSION. — RICE (1981) described the pre-zoea of *Acanthodromia erinacea* dissected from the eggs of a crab collected by the Johnson-Smithsonian Expedition off Mona Id, West Indies. Although the material was rather unsatisfactory, he concluded that the larva of this species is most similar to those of the Dromiidae and that anomuran characteristics are strongly evident in both families. This pre-zoea remains the only known larval material of any of the dynomenids.

The most accurate and detailed description of the reduced last pereopods of any dynomenid is given for *Acanthodromia erinacea* by A. MILNE EDWARDS and BOUVIER (1896, pl. 3, fig. 12) where they describe for the female "...la pince parfaite qui termine ces appendices est munie de soies spiniformes sur le bord des doigts, qui sont deux fois plus courts que la région palmaire". The presence of spines on the propodus and dactyl has largely escaped the attention of other dynomenid researchers. The number and arrangement of these spines in *Acanthodromia erinacea* is similar to that found in the other dynomenids, but the teeth on the propodal spines are unusual in being curved inwards. The number of these teeth is very reduced compared to *Dynomene hispida*, for e.g., but similar to the situation found in *Paradynomene tuberculata* and *Hirsutodynomene ursula* females. In these species the teeth are only found on the margins and are restricted to the proximal region of the spines. The last leg of the *A. erinacea* male is unknown. In both *P. tuberculata* and *A. erinacea* the basis-ischium and merus articles of the fifth pereopods are fused to make a single bent or curved article.

BOUVIER (1896) compared the chelate nature of the last legs of *Acanthodromia erinacea* with that found in *Dicranodromia ovata* A. Milne Edwards, 1880 and *Homolodromia paradoxa* A. Milne Edwards, 1880. He noted that in the sequence *D. ovata* - *H. paradoxa* - *A. erinacea* the propodus becomes more developed so that a subchelate limb becomes a "...pince parfaitement caractérisée". He argued that *A. erinacea* was probably derived from a very primitive form in which the last pair of legs were similar to that found in *H. paradoxa*. This idea about the origin of dynomenids may well be correct but BOUVIER could not have known that there are considerable differences in the fine structure of the limbs between dynomenids and homolodromiids. His intuitive idea ignores the fact that the propodal and dactyl spines of *A. erinacea* are constructed on a different plan, and the dactyl itself is also very different from that found in any brachyuran crab: at least in females, it is more like a blunt, flattened, articulated plate, with the spines arranged around the margins, rather than an articulated claw with a single row of medial spines. Considerable evolutionary change is required to transform a camouflage-carrying homolodromiid limb into what may have been some kind of cleaning appendage.

The branchial formula of *Acanthodromia erinacea* is summarized in the table at the top of the next page.

The branchial formula given by A. MILNE EDWARDS and BOUVIER (1902) for this species is 19 gills + 7 epipods. However there seem to some errors in this interpretation. Firstly, they omitted the podobranch of the second maxilliped and secondly, they indicated that the third maxilliped had two arthrobranchs. It seems likely that

Somite	VII (Mxp1)	VIII (Mxp2)	IX (Mxp3)	X (P1)	XI (P2)	XII (P3)	XIII (P4)	XIV (P5)
Pleurobranchiae	-	-	-	-	1	1	1	-
Arthrobranchiae	-	1	1	2	2	2	2	-
Podobranchiae	-	1	1	1	1	1	1	-
Epipods	1	1	1	1	1	1	1	-

the correct number is only one arthrobranch, as found in all other dynomenids which have been examined. Thus the total number of gills is still 19, but for different reasons. The gill structure of *A. erinacea* is very different from other dynomenid species: there are no epibranchial lobes and the gills consist of paired plates surrounding the gill axis. A. MILNE EDWARDS and BOUVIER (1902, pl. 4, fig 4) show a small epibranchial projection between these plates, but I could not find this. The anterior and posterior margins of each plate are slightly notched. The gill structure of *A. erinacea* most closely resembles that found in *Dynomene hispida* and *D. praedator*. The gill structure of *Acanthodromia margarita* is virtually identical. A. MILNE EDWARDS and BOUVIER (1902, pl. 3, fig 7) show three long setae on the posterior margin of the scaphognathite. This number of setae is only found in *Dynomene filholi* and *D. pilumnoides*. All the other dynomenid species only have two such setae.

The mature female *Acanthodromia erinacea* has spinous coxal projections on the third maxillipeds and the first three pereopods which appear to help hold the abdomen in place. In order to release the abdomen, it would be necessary for these pereopods to move posteriorly. In other dynomenids, neither males nor females, have any really effective abdominal locking mechanism, and the abdomen is only held loosely against the sternum. In immature dromiids both sexes have an abdominal locking mechanism, usually involving pereopodal coxae and the uropods, which only persists in mature males. Therefore *A. erinacea* is unusual in having a locking mechanism in mature females. Unfortunately the male of this species is unknown but presumably it also has a similar mechanism.

For two species inhabiting widely separated regions (Indo-West Pacific and Caribbean Sea), *Acanthodromia margarita* and *A. erinacea* are extraordinarily similar: the only differences are in the shape of the supraorbital spines, and the pearl-like lobes on the fourth and fifth abdominal segments. A likely scenario for the origins of these two species might be as follows: species of *Acanthodromia* originated in the Tethys Sea and spread to seas that eventually became the Atlantic and Caribbean, perhaps as early as the Upper Jurassic (145 mybp). This dispersal could have been as late as the Middle Miocene (25 mybp), when connections between these two oceans was severed, but an earlier date seems more likely because even by Palaeocene times (65 mybp) the Atlantic was already well formed and the Caribbean isolated. Therefore these two species could have been separated at least since the Palaeocene (or at latest the Middle Miocene), but there has scarcely been any divergence in their morphology. Both are deeper water species although *A. erinacea* extends to a greater depth (540 m). They grow to a similar maximum size and inhabit muddy coral bottoms. *A. erinacea* appears to be a relict Tethyan species.

### *Acanthodromia margarita* (Alcock, 1899)

Fig. 31

*Dynomene margarita* Alcock, 1899: 19, pl. 2, fig 3.

*Acanthodromia margarita* - ALCOCK, 1900: 134; 1901: 36, pl. 1, fig. 3, 3a. — IHLE, 1913: 92 (list). — SAKAI, 1965b: 43; 1976: 31, pl. 7, fig 2. — SERÈNE, 1968: 37 (list). — MIYAKE, 1983: 196 (list). — NAGAI, 1989: 43.

MATERIAL EXAMINED. — **Japan**. Wakayama, 120 m, 1989, S. NAGAI coll.: 1 ♀ 12.0 X 13.0 mm (see NAGAI, 1989).

TYPES. — *Dynomene margarita* Alcock, 1899: holotype is a male 4.5 x 5.0 mm, collected by the "Investigator", from 13°16.00'N, 93°08.00'E, Andaman Sea, 135 m, held by the Indian Museum, Calcutta, registration number 2690/10.

DESCRIPTION. — Carapace longer than wide, ratio of CW/CL = 0.92, ovoid in outline; surface evenly convex, with a dense cover of acute spines and spinules with occasional long setae. Microscopic details of setae not investigated. Density of spines completely obscures body surface. Frontal, cervical, and post-cervical grooves not evident, crescentic lateral cardiac grooves and branchial groove faint, posterior cardiac area not defined. Anterolateral carapace margin poorly defined, begins below level of postorbital corner, subparallel and adorned with longer spines but these are not arranged in a well-defined row. Posterolateral border convergent alongside which lies the reduced last leg. Posterior carapace margin recessed in order to accommodate first segment of abdomen which is visible dorsally.

Frontal margin V-shaped, spinous, ventrally-directed, joined to epistome. Supraorbital margin projecting, continuous above orbits, eave-like, not interrupted by a notch, adorned with long spines which become smaller and blunter near postorbital corner and are not curved posteriorly. Suborbital margin concave, adorned by small spines with a larger spine at inner corner. Cornea of eye and suborbital margin clearly exposed dorsally.

First article of antennule large, filling a large part of ventral orbital region, prominent spine mid-way along length; distal margin spinous, obliquely angled and not continuous with distal margin of second antennal article. Remainder of antennule folded into orbit. First article of antenna moveable, wider than long, bearing a row of spines, not medially beaked, opening of antennal gland is on medial margin and concealed against base of antennule. Second article spinous, longer than wide, medial margin longest produced as a spine, to which is fixed the third article. Exopod short, spinous, blunt extending behind third antennal article and curving over base of eyestalk. Remaining antennal articles absent from specimen. Eyestalk can be completely folded into orbit, outer surface spinous; cornea light brown, well developed, occupying all of tip. Epistome triangular, surface slightly concave; dorsal arm joined to tip of carapace margins bearing spines; lateral arms shorter. Joint between epistome and carapace marked by a narrow suture.

Subhepatic area inflated, covered with tubercles. A groove (pleural suture or linea dromica) begins near base of antenna, curving round under branchial region and on to carapace to meet faint branchial groove. A short groove branches off, ascending and curving towards postorbital corner marking posterior margin of inflated subhepatic area. Third maxillipeds operculiform, bases widely separated by tip of sternum. Female sternal sutures 7/8 short, ending wide apart under an overhanging lip immediately below female gonopores.

Branchial formula unknown. In cross section gills consist of pairs plates, one on each side of the gill axis, with epibranchial tips of each plate ending in a blunt thickened lobe. Lateral margins of each plate are faintly notched about mid-way along their length.

Cheliped stouter and longer than first leg. Merus trigonal, inner face roughened with rounded tubercles and fitting closely against pterygostomial region of carapace; borders spinous, superior border has a faint subterminal restriction which separates a thickened distal ridge, on which there are several spines, from a row of five or six similar spines on the superior border. Outer face of carpus convex with small blunt tubercles interspersed among longer, sharper spines; inner superior border lacks a flattened, distomedially directed, spur restricting closure of cheliped. Instead, both superior and inferior inner margins are spinous like the outer face. Entire surface of propodus covered with spines which are longer on superior and outer faces. Outer surface of fingers covered with small spines. Dactyl strongly downcurved, margin sinuous but not interrupted by teeth except at tip where there are two blunt teeth, roof of finger strongly concave. Fixed finger almost straight with three evenly spaced blunt teeth on the outer margin, three further teeth on tip (interlocking with pair of teeth on dactyl), inner margin without teeth and floor strongly concave. Small groups of long stiff setae, inserted near base of dactyl and fixed finger, are directed across the space between the two fingers. Spoon-shaped fingers gape proximally on internal face but there is no gape externally.

First three pairs of walking legs decreasing in length posteriorly. Meri elongate, both faces of meri of first two legs and anterior face third leg merus covered with low rounded tubercles, inferior distal margin hollowed out to accommodate carpal article. Superior border of meri of second to fourth pereopods with numerous long spines, length of merus of third pereopod about 2.0 x width and equal to about one quarter of CL. Dorsal margins of carpi bearing several long spines, and produced distally to overhang base of propodi. Propodi bearing numerous long spines. Dactyli curved, bearing numerous shorter spines; inferior margin armed with four small spines similar to tip which is dark brown and subacute.

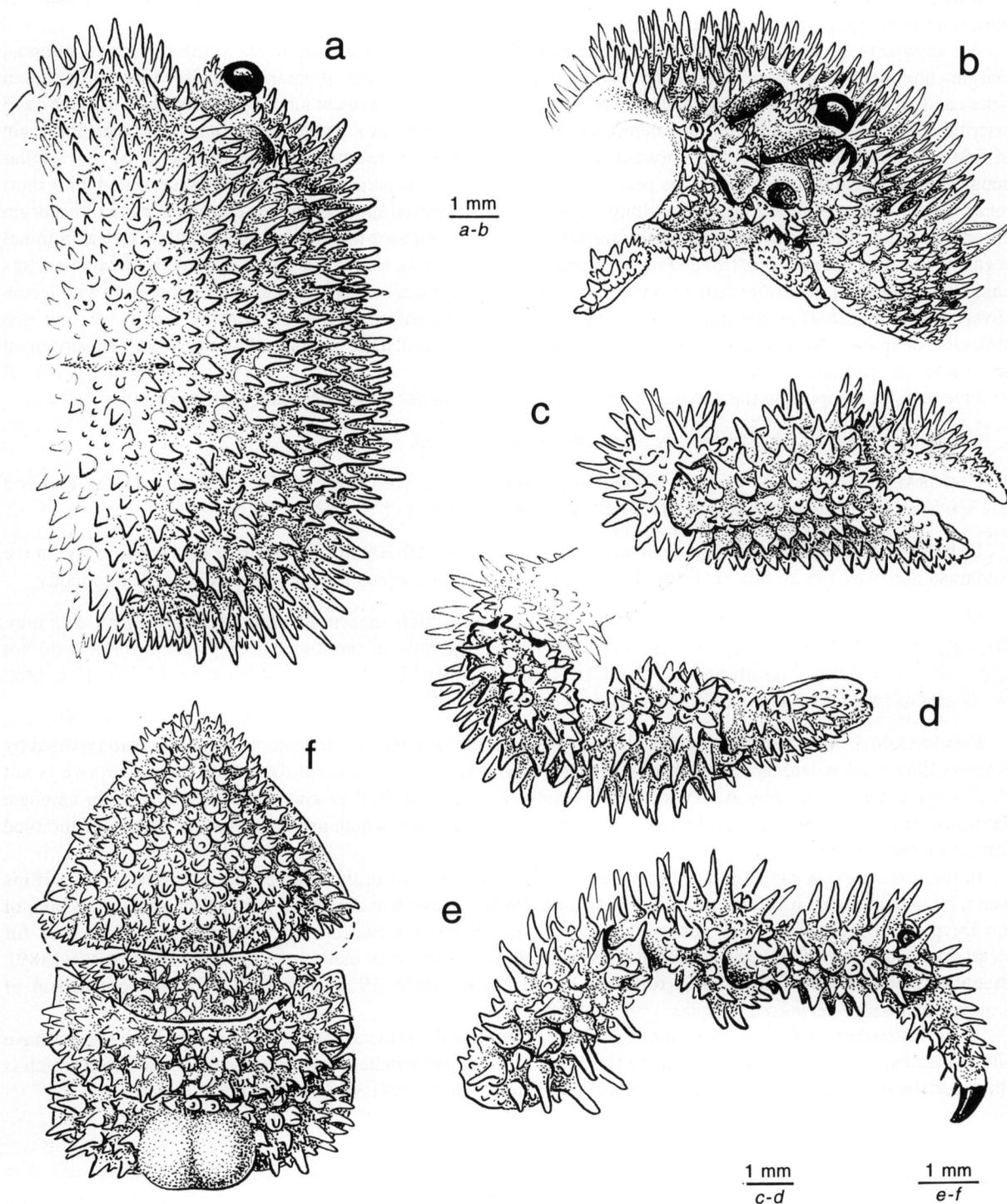


FIG. 31. — *Acanthodromia margarita* (Alcock, 1899): a-f, ♀ 12.0 x 13.0 mm, Wakayama, Japan, 120 m: a, dorsal view of right half of carapace; b, ventral view of left orbital area (note that most of antenna is missing); c, outer face of right cheliped; d, dorsal view of right cheliped; e, posterior view of terminal articles of right fourth pereopod; f, ventral view of telson and terminal segments of female abdomen (note that uropod plates are missing).

Last pair of legs greatly reduced; articles spinous, lying along posterolateral carapace border above bases of posterior walking legs. Structural details of subchelate mechanism not available.

All segments of abdomen freely moveable, length and breadth of all segments similar, surface spinous, margins unarmed. First segment partially concealed under posterior border of carapace, visible portion fits into a recess and articulates with carapace margin, anterior margin of second segment sinuous, medial region convex and inserted under margin of preceding segment, lateral margins produced as a flange which fits over posterior margin of first segment thereby preventing forward slippage of abdomen. Subsequent segments articulated in a similar manner. Fourth segment with two large pearl-like medial tubercles separated by a narrow fissure filled with short setae. Telson spinous, much wider than long; anterior margin angled to accommodate uropod; posterior margin broadly rounded. In female uropod plates are large, filling about two-thirds of space between last abdominal segment and telson, excluding last abdominal segment from reaching lateral margin of abdomen. Male characters unknown. Abdomen of mature female occupies all of ventral surface, covering coxae of all pereopods with telson covering proximal half of the third maxillipeds. Abdominal locking mechanism well developed: when at rest abdomen of mature female lies between bordering flanges on first three pereopods with telson beneath coxal projections of third maxillipeds.

Five pairs of pleopods in the female, first pair vestigial, remainder biramous. Male characters unknown.

COLOUR. — Pale cream. Eyes deeply pigmented when preserved.

GEOGRAPHIC DISTRIBUTION. — Andaman Sea, Indian Ocean, Tosa Bay, and Kii Peninsula, Japan. This is a rare species: there are only three records of *Acanthodromia margarita* (1 ♂, 2 ♀).

DEPTH. — The depth range for *Acanthodromia margarita* is 120-200 m. The depth at the type locality, in the Andaman Sea, was 135 m. SAKAI (1976) describes the bottom from which his specimen came as being muddy.

SIZE. — The only male specimen known is the type which measured approximately 4.5 x 5.0 mm. The largest female has been reported by SAKAI (1976) but the ratio of the dimensions given in the text do not agree with his figure: assuming that the CL is correct, then the dimensions must be 15.5 x 17.0 mm. No ovigerous females of *Acanthodromia margarita* are known.

DISCUSSION. — The description given above is based on the specimen of *Acanthodromia margarita* reported by NAGAI (1989) and is largely in agreement with the original description except that the branchial groove is not clearly evident as claimed by ALCOCK (1899). Admittedly the branchial groove is difficult to discern amongst the forest of spines. There are no features of the Japanese specimen which are different from those of the type from the Indian Ocean.

In the text ALCOCK (1899) placed this species in *Dynomene*, but in the Corrigenda, at the beginning of his paper, he indicated that it should be placed in *Acanthodromia*. There was a delay in publication of the "Account of the Deep-Sea Brachyura..." and meanwhile the generic designation had been corrected in his "Materials for a carcinological fauna of India" (ALCOCK, 1900) where reference is made to A. MILNE EDWARDS (1880). Essentially the same description is repeated by ALCOCK (1899, 1900, and 1901) but no comparison of *A. margarita* with *A. erinacea* is made.

The gill structure of *Acanthodromia margarita* is essentially the same as that of *A. erinacea*. Both species have gills which lack epibranchial lobes, making them almost phyllobranchiate, except for the marginal notch which is characteristic of dynomenid gills. The relationships of these two species is discussed under *A. erinacea*.

#### Genus *PARADYNOMENE* Sakai, 1963

*Paradynomene* Sakai, 1963: 230; 1965a: 13. — GUINOT, 1993: 1226.

DIAGNOSIS. — Carapace subquadrangular in shape, slightly longer than wide; surface convex, granulate, well areolated; individual areolae each having one or two low conical tubercles. Lateral carapace margins well defined,

subparallel and armed with irregular teeth. Narrow frontal groove split in two posteriorly; cervical, postcervical grooves evident. Frontal carapace margin well produced anteriorly, cut into three teeth; median tooth small; lateral teeth broad and cristate; eyestalks short; eyes protected by well defined orbits. Sternal sutures 7/8 of female end well apart on low tubercles behind bases of second walking legs.

Antennule can be concealed inside orbit at base of eyestalk. Antennal flagella shorter than half of carapace width. All articles of antenna moveable; first article (urinal) beaked medially and second article has an exopod firmly fixed. Third maxillipeds opercular, completely covering buccal cavern, separated at their bases by a plate at the same level as the sternum; basis and ischium of endopod fused but joint always marked by a shallow groove. Crista dentata present. Chelipeds robust, equal, stouter than walking legs. Last pair of legs very reduced; dactyl rudimentary, forming an obsolete chelate mechanism with an extension of propodus only in female. Branchial formula 19 gills + 7 epipods.

Abdomen of six segments and telson folded loosely under thorax; uropods comparatively small; effective abdominal locking mechanism absent. Both sexes have five pairs of pleopods, first pair vestigial in female, last three pairs rudimentary in male. First pair of male pleopods consist of a stout, setose semi-rolled tube with an apical plate; second pair needle-like bearing a linear row of tiny inset spines along anterior surface (modified from SAKAI, 1963).

TYPE SPECIES. — *Paradynomene tuberculata* Sakai, 1963 by original designation and monotypy.

DISCUSSION. — *Paradynomene* Sakai, 1963, collected from Sagami Bay, Japan, was the third extant genus of dynomenids to be discovered. As with *Acanthodromia*, this genus is radically different from the type genus of the family (*Dynomene*). While both have a carapace which is longer than wide, in *Paradynomene* the carapace is subquadrangular with tuberculate areolae and in *Acanthodromia* it is ovoid and densely covered with spines. However, all three genera share the distinctive characters associated with the last pereopods. The characters of the second male pleopod are also similar to those found in *Metadynomene* and *Dynomene*. It is intriguing to make the same kind of comparison between members of the Dromiidae: the genus *Epigodromia* McLay, 1993 is to *Dromia* or *Cryptodromia*, what *Paradynomene* is to *Dynomene*. *Epigodromia* has a highly areolate carapace and obsolete last two pairs of legs, while *Dromia* and *Cryptodromia* have a smooth setose carapace and functional last two pairs of legs. Perhaps this tendency to evolve a thickened, ornamented carapace has occurred independently in the two families (see Discussion below). Also SAKAI (1963) noted that the general features of the front, thoracic appendages and the external maxillipeds of *Paradynomene* resemble those of the family Dromiidae, rather than those of *Dynomene* or *Acanthodromia*.

GUINOT (1993) suggested that there are certain resemblances between *Paradynomene* and the fossil genera *Rathbunopon* Stenzel, 1945 and *Mithracites* Gould, 1859. The similarities relate to the ornamentation of the carapace.

***Paradynomene tuberculata* Sakai, 1963**

Figs 4 e-f, 6 e-f, 7 c, e, 10 b-d, 14 a, 25 d, 32

*Paradynomene tuberculata* Sakai, 1963: 231, fig. 8; 1965a: 13, pl. 6, fig. 1; 1976: 31, pl. 7, fig. 1. — SERÈNE, 1968: 37 (list). — MIYAKE, 1983: 196 (list). — NAGAI, 1989: 43. — GUINOT, 1993: 1227, figs 1-2.

MATERIAL EXAMINED. — **Gulf of Aden.** "Meteor": stn Me 5/230-KD2, 12°43.5'N, 43°14.8'E, 214-277 m, 5.03.1987: 1 ♂ 7.8 x 8.6 mm (SMF).

**Indonesia.** KARUBAR: stn DW 18, Kai Ids, 5°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♀ ovig. 13.8 x 14.5 mm. — Stn DW 49, Tanimbar Ids, 8°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ 11.2 x 12.5 mm.

**Chesterfield Islands.** CORAIL 2: stn DW 159, 19°46.04'S, 158°19.98'E, 52 m, 1.09.1988: 1 ♀ 18.5 x 18.3 mm.

**New Caledonia.** LAGON: stn 444, 18°15.3'S, 162°58.8'E, 300-350 m, 28.02.1985: 1 ♂ 17.0 x 17.2 mm.

SMIB 3: stn DW 14, 23°40.1'S, 167°59.7'E, 246 m, 22.05.1987: 1 ♂ 22.0 x 22.8 mm.

SMIB 4: stn DW 44, 24°46.0'S, 168°8.2'E, 300 m, 8.03.1989: 1 ♂ 17.0 x 17.8 mm.

SMIB 8: stn DW 184, 23°18'S, 168°05'E, 305-320 m, 31.01.1993: 1 ♂ 19.2 x 19.0 mm. — Stn DW 189, 23°18'S, 168°05'E, 400-402 m, 31.01.1993: 2 ♂ 12.2 x 13.1, 21.0 x 21.9 mm.

BATHUS 3: stn DW 830, 23°19'S, 168°01'E, 361-365 m, 23.11.1993: 1 ♂ 14.7 x 15.8 mm.

BATHUS 4: stn DW 931, 18°55'S, 163°24'E, 360-377 m, 7.08.1994: 1 ♂ 23.7 x 23.0 mm.

HALICAL 1: stn DW 02, 18°54'S, 163°24'E, 352-397 m, 23.11.1994: 1 ♀ 23.2 x 24.0 mm.

Loyalty Islands. MUSORSTOM 6: DW 406, 20°40.65'S, 167°06.80'E, 373 m, 15.02.1989: 1 ♂ 21.5 x 22.3 mm; 1 ♀ 21.5 x 21.2 mm; 1 ♀ ovig. 20.6 x 21.4 mm.

Guam (H. T. CONLEY coll.). Piti Lagoon, 13°27'N, 144°47'E, 1.2-7.5 m deep in dead coral, 26.05.1994: 1 ♂ 21.7 x 20.0 mm (UGM). — *Ibidem*, 4-8 m, among dead coral, 5.06.1994: 1 ♂ 17.2 x 16.4 mm (UGM). — *Ibidem*, 1.5-5 m, in coral rubble, 12.05.1997: 1 ♀ ovig. 20.5 x 19.4 mm (UGM).

TYPES. — The holotype is a male 9.5 x 10.5 mm, collected by His Majesty the Emperor of Japan, from 35°08.00'N, 139°37.00'E, west of Jogashima Misaki, Sagami Bay, Japan, 85 m, deposited in His Majesty's Museum at the Imperial Palace.

DESCRIPTION. — Carapace sparsely setose, longer than wide, ratio of CW/CL approx. 0.95, oblong in outline; posterior margin truncate; surface convex, areolate and granulate. There are about eighteen to nineteen swellings each marked by a subacute tubercle carrying three or four long (0.11 x CW), stiff serrate setae, and whole surface is covered in evenly distributed, rounded granules. Largest tubercles on inner branchial area. Pereopods also carry a few stiff setae, and abdomen margins and bases of third maxillipeds are densely covered with long, soft serrate setae. General body surface thickly covered with short setae, although these are only evident under high magnification. Structure of short and long setae are different. In short setae the proximal 40% of shaft is erect and lacks ornamentation, then the setae bend at about 45° and bear two opposite rows of fine setules decreasing in size distally. These setae are feather-like, lack an acute smooth tip, and are especially common in areas between carapace swellings. In long setae the proximal 50% of shaft is covered with small setules, then next 45% bears longer setules, projecting at right angles, increasing distally in size and finally last 5% is smooth, narrowing to an acute tip. Distal 50% of each setae curved, forming a U-shape, so that tip of setae is directed towards body.

A narrow frontal carapace groove separates a pair of small tubercles behind frontal margin, and then divides into separate grooves which terminate beside a similar median tubercle. Just in front of cardiac region two laterally-directed grooves originate: first groove (cervical) arises separately (but close together) from small gastric pits and runs directly anterolateral just in front of the largest tubercles on to branchial region. Second, shallower groove extends across mid-line and joins two deep, longitudinal pits bordering anterior cardiac region. Cardiac area is defined by grooves and adorned by two large tubercles. Branchial groove not evident. A row of four large tubercles curve across posterior region of carapace. Anterolateral carapace margin begins below level of postorbital corner, is slightly convex and bears six rather irregular, laterally directed, subacute teeth or tubercles. First, fourth and sixth teeth largest, and about equidistant, while second, third and fifth are mere tubercles in between. Posterolateral margin bears two teeth which are much larger than any of preceding anterolateral teeth. Posterior carapace margin is recessed in order to accommodate first segment of abdomen part of which is visible dorsally.

Frontal margin projecting, tridentate, ventrally-directed, joined to epistome (which separates orbits). Median tooth on a lower level, lateral teeth lie above on beginning of the orbital margin. Supraorbital margin has two small tubercles followed by a small notch closer to postorbital corner, which is granulated; suborbital margin with similar granules followed by a subacute tooth (visible dorsally) and then notched before inner corner. Orbits obliquely arranged, clearly exposed dorsally.

First article of antennule large, granulated, filling a large part of ventral orbital region; distal margin obliquely angled and not continuous with distal margin of second antennal article. Remainder of antennule folded into orbit. Antennal articles granulated; first article moveable, wider than long, medially beaked; inferior tooth well developed, blunt; superior tooth above opening of antennal gland is much smaller. Second article wider than long; distal margin widest, to which exopod is fixed, curving over base of eyestalk and becoming broader and terminating bluntly. Third antennal article longer than wide, and attached to remaining distal border of second article, slotting in behind exopod, and along with fourth article just surpassing length of exopod. Fourth antennal article smaller, as long as wide; remaining antennal articles directed laterally, extending well beyond postorbital corner, and can be partially folded under supra-orbital margin. Ratio of length of antennal flagella to CW = 0.35. Eyestalk can be completely folded into orbit, and cornea is well developed, occupying all of tip. Epistome broadly triangular, surface granulate and concave; dorsal arm, joined to tip of carapace, is very elongate and narrow; lateral arms shorter and thicker. Joint between epistome and carapace is marked by a faint suture.