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Some copepods parasitic on elasmobranch fishes from the Peruvian coast, with the description of two new species of *Eudactylina* van Beneden, 1853 (Eudactylinidae) and four new records

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(Accepted 15 July 1991)

Six species of copepods parasitic on elasmobranch fishes from the Peruvian coast has been recorded. Two of them, *Eudactylina peruensis* and *E. myliobatidos* parasitic on *Rhinobatos planiceps* (Rhinobatidae) and *Myliobatis chilensis* (Myliobatidae), are considered new species. New geographical and host records for *Pseudocharopinus narcinae* Pillai, *Pseudocharopinoides myliobatidos* Castro and Baeza, *Perissopus oblongus* (Wilson) and *Trebius latifurcatus* (Wilson) are included, as also is a checklist of copepod species parasitic on elasmobranch fishes from the coast of the South American Pacific.

KEYWORDS: Copepoda, fish parasite, elasmobranch fishes, Perú, South American Pacific.

Introduction

Studies on copepods parasitic on elasmobranch fishes from coasts of the South American Pacific are scanty. Hitherto only 17 species have been recorded (see Table 1).

During a parasitological survey of elasmobranch fishes of Perú numerous parasitic copepods were collected. The present paper gives a preliminary taxonomic report on them. Two of the copepods collected are considered to be new species. New host and geographical records for four species previously described are also included.

Material and methods

Fish were obtained from the Chorrillos Bay (12°30'S, 76°50'W) along the central Peruvian coast. Host identification was made according to Chirichigno (1974). The copepods collected were fixed in 70% ethanol. Their appendages were dissected after clearing with lactic acid. Drawings were made with the aid of a camera lucida. Measurements are given in millimetres, as mean followed by the range in parentheses. Systematics and nomenclature follow those of Kabata (1979).

The following institutional abbreviations apply: USNM, United States National Museum of Natural History; LPURP, Laboratorio de Parasitología de la Universidad Ricardo Palma, Perú.

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Table 1. Copepoda parasitic on elasmobranch fishes from the South American Pacific coast.

| | |
|----------------|---|
| Trebiidae | <i>Trebius latifurcatus</i> (Wilson, 1921) (5-A) |
| Pandariidae | <i>Perissopus oblongus</i> (Wilson, 1907) (1-A) <i>Pandarus katoi</i> Cressey, 1967 (2-C) <i>Pandarus satyrus</i> Dana, 1852 (2-A) <i>Phyllothyreus cornutus</i> (Milne-Edwards, 1840) (1, 2-A) <i>Gangliopus pyriformis</i> (Gerstaecker, 1854) (1, 2-A) <i>Gloiopotes watsoni</i> (Kutisinghi, 1934) (1, 2-A) <i>Dinemoura latifolia</i> (Steenstrup and Lutken, 1861) (2-C) <i>Dinemoura producta</i> (Muller, 1785) (2-C) <i>Echthrogaleus denticulatus</i> Smith, 1874 (2-C) <i>Echthrogaleus pellucidus</i> Shiino, 1963 (9-C) |
| Dichelesthidae | <i>Anthosoma crassum</i> (Abilgaard, 1794) (1, 2-C) |
| Eudactylinidae | <i>Eudactylina chilensis</i> Ho and MacKinney, 1981 (3-B) <i>Eudactylina tuberifera</i> Castro and Baeza, 1987 (8-B) <i>Eudactylina peruensis</i> sp. nov. (6-A) <i>Eudactylina myliobatidos</i> sp. nov. (5-A) <i>Nemesis lamna</i> (Risso, 1826) (2-C) |
| Lernaeopodidae | <i>Lernaeopoda tenuis</i> Castro and Baeza, 1986 (4-B) <i>Pseudolernaeopoda caudocapta</i> Castro and Baeza, 1986 (4-B) <i>Brianelia corniger</i> (Wilson, 1915) (6-B) <i>Pseudocharopinus narcinae</i> Pillai, 1962 (5-A) <i>Pseudocharopinoides myliobatidos</i> Castro and Baeza, 1987 (5-C) |

Hosts: *Prionace glauca* (1), *Isurus oxyrinchus* (2), *Aculeola nigra* (3), *Triakis maculata* (4), *Myliobatis chilensis* (5), *Sympterygia brevicaudata* (6), *Rhinobatos planiceps* (7), *Squatina armata* (8), *Alopias* sp. (9).

Localities: Peruvian coast (A), Chilean coast (B), both Peruvian and Chilean coasts (C).

References: Cressey, 1967 a, b; Ho and McKinney, 1981; Castro and Baeza, 1986, 1987 a, b.

Results

Family TREBIIDAE

Trebius latifurcatus (Wilson, 1921)

Host. *Myliobatis chilensis* Philippi (Myliobatidae).

Site of infection. Gills.

Locality. Chorrillos, Perú.

Record of specimens. Three ovigerous females (taken in May 1989); all deposited in LPURP Collection N:191.

Remarks. *Trebius latifurcatus* (Wilson, 1921) is a species described originally from specimens collected from elasmobranchs of the genera *Urolophus* and *Myliobatis* from Californian waters. Recently, Deets and Dojiri (1989) thoroughly reviewed the type material and published an adequate redescription. *Myliobatis chilensis* is a new host record for *T. latifurcatus*.

Previously, Faggeti and Stuardo (1961) recorded a closely related species, *Trebius akajeii* (Shiino, 1954), parasitic on *M. chilensis* from the Chilean northern coast.

However, in their paper the illustration of the first maxilla shows the presence of a small accessory process on the inner surface of the lateral tine. According to Deets and Dojiri (1989), this process has not been reported in any species of *Trebius*, other than *T. latifurcatus*.

Family PANDARIIDAE

Perissopus oblongus (Wilson, 1907)

Host. *Prionace glauca* (Linnaeus) (Carcharhinidae).

Site of infection. Corporal surface.

Locality. Chorrillos, Perú.

Record of specimens. Six ovigerous females (taken in November 1988).

Material deposited. Two ovigerous females USNM N: 251287; four ovigerous females LPURP Collection N: 192.

Dimensions of specimens. Total length 7.19 (6.35–8.40). Maximum width 2.37 (1.90–3.25). Cephalothorax length 2.64 (2.40–3.00). Cephalothorax width 2.37 (1.95–2.50). Genital segment length 3.88 (3.20–4.00). Genital segment width 3.01 (2.80–3.15).

Remarks. According to the criteria of Cressey (1967 a), in his revision of the family Pandariidae, also assumed by Kabata (1979), the genus *Perissopus* comprises only two species: *Perissopus dentatus* (Steenstrup and Lutken, 1861) and *P. oblongatus* (= *P. oblongus*) (Wilson, 1907). The specimens considered herein bear characteristics of the latter species, which differs from *P. dentatus* by a combination of characters that include the rounded posterior corners of the genital segment and the presence of armature on legs 1 and 2 endopods. *Perissopus oblongus* has been found previously on the anterior body surface of sharks of the genera *Triakis* and *Acanthias*. This is a first record of this genus in the South American Pacific. *Prionace glauca* is also a new host record for *P. oblongus*.

Family EUDACTYLINIDAE

Eudactylina peruensis sp. nov.

(Figs 1–12)

Type host. *Rhinobatos planiceps* Garman (Rhinobatidae).

Site of infection. Gills.

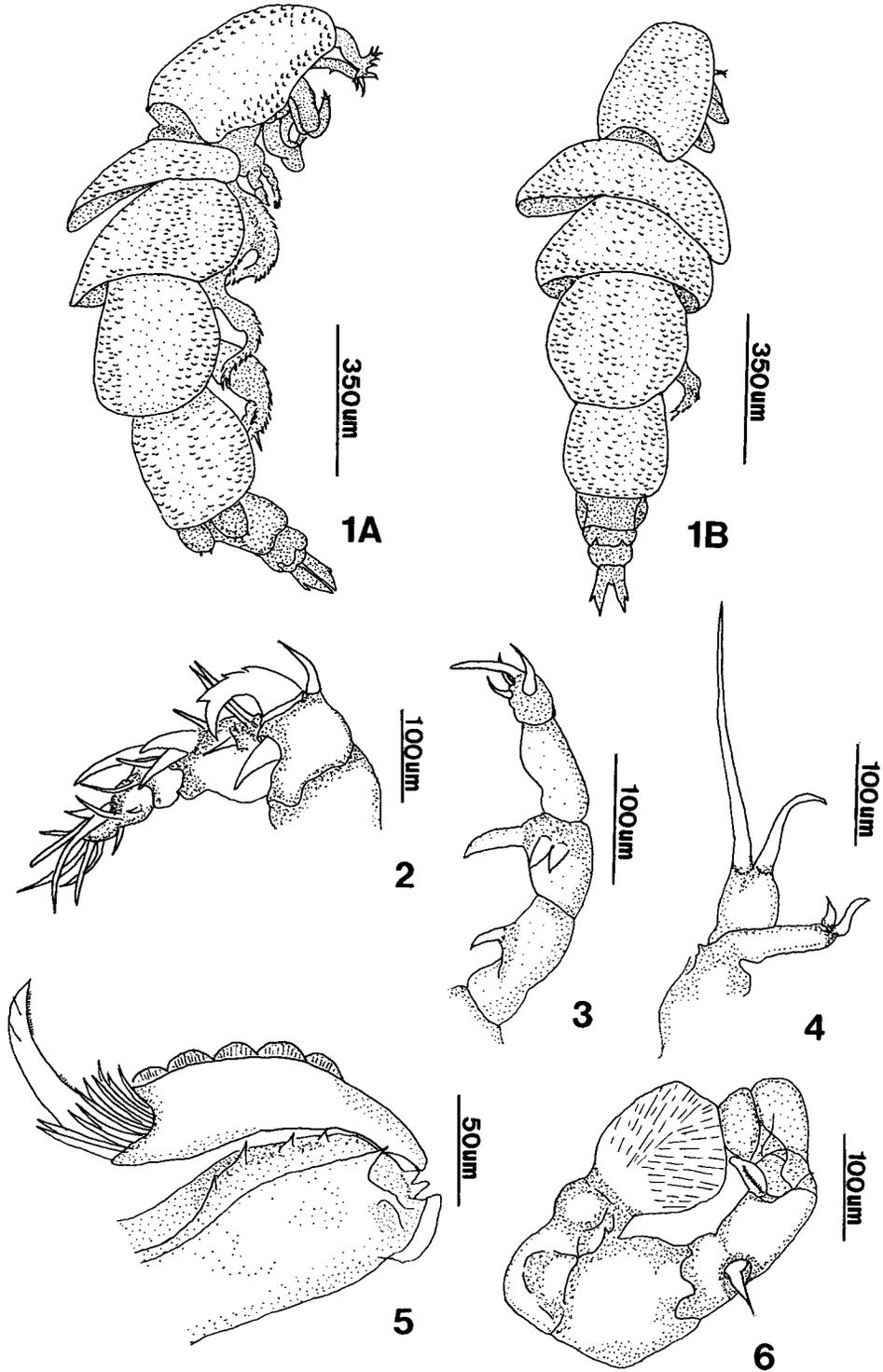
Type locality. Chorrillos, Perú.

Record of specimens. Fifteen females (taken in June 1989), eleven females (taken in September 1989).

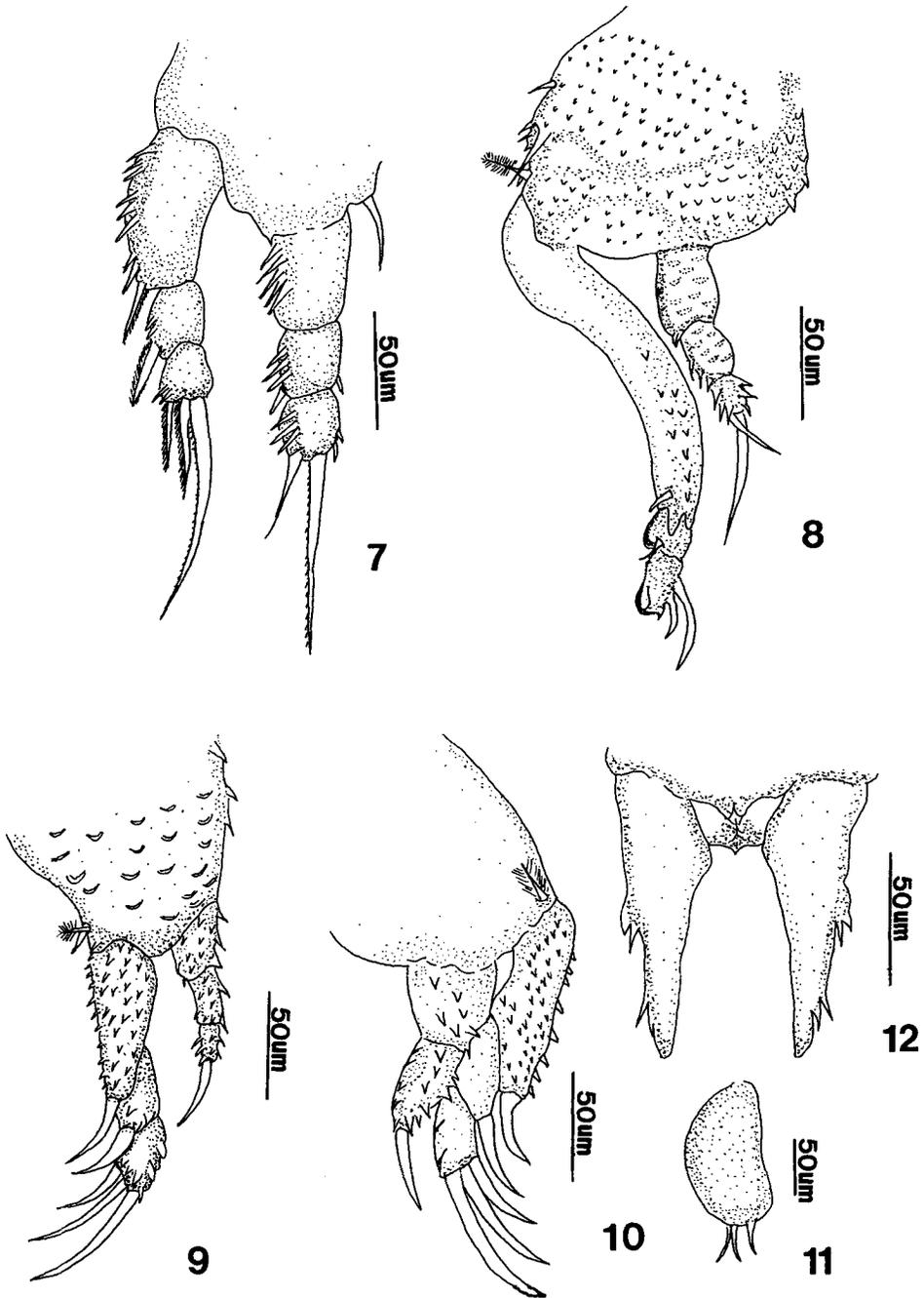
Type material. HOLOTYPE (one female) USNM N: 251288. PARATYPES: (five females) USNM N: 251289; 20 females LPURP Collection N: 193.

Description

Female (Figs 1A, 1B). Dorsal shield of cephalothorax with slightly rounded anterior end, concave posterior margin and rounded posterolateral corners; lateral and central dorsal surface with numerous cuticular flaps arranged in irregular rows. First free thoracic segment with slightly rounded anterior end, much wider than the cephalothorax and with similar ornamentation, posterior margin slightly concave. Second free thoracic segment similar to first, but without posterior concavity and slightly less wide. Third free segment subcircular, transversely oval. Fourth free segment subquadrangular, about as long as third. Genital segment subquadrangular, with somewhat convex lateral margins. Abdomen two-segmented, both segments of similar length.



FIGS 1–6. *Eudactylina peruensis* sp. nov., female. 1A, Lateral view; 1B, dorsal view; 2, first antenna; 3, second antenna; 4, first maxilla; 5, second maxilla; 6, maxilliped.



FIGS 7-12. *Eudactylina peruensis* sp. nov., female. 7, First leg; 8, second leg; 9, third leg, 10, fourth leg; 11, fifth leg; 12, uropods.

Dimensions (based on ten specimens):

| | |
|----------------------|------------------|
| Total length | 1.24 (1.00–1.45) |
| Cephalothorax length | 0.71 (0.60–0.81) |
| Cephalothorax width | 0.37 (0.32–0.40) |
| Abdomen length | 0.17 (0.15–0.20) |
| Abdomen width | 0.10 (0.07–0.13) |
| Uropod length | 0.10 (0.08–0.13) |
| Uropod width | 0.03 (0.02–0.04) |
| Egg sac length | 0.50 (0.32–0.61) |
| Egg sac width | 0.19 (0.16–0.24) |

First antenna (Fig. 2) five-segmented, with geniculate flexion between second and third segment, basal segment subquadrangular and unarmed; second segment with claw-like spine in distomedial corner, one spiniform and one long, slender seta; third segment with armature comprising five setae near anterior margin and three strong claw-like spines in anterodistal corner; fourth segment with one seta in anterodistal margin; fifth segment bearing five setae and aesthete near anterior margin, and apical armature of four setae. Second antenna (Fig. 3) five-segmented, basal segment unarmed, second with spiniform process on posterior margin, third with large spiniform process on posterior margin and two smaller spines on the flat surfaces of the segment, fourth segment longer and more slender than third, unarmed, fifth segment claw-like with auxiliary spine on lateral side of basal part and two slender setae on posterior margin. First maxilla (Fig. 4) biramous, both rami unisegmented of about equal length, endopod thinner than exopod, latter with two long and unequal setae; endopod with two short unequal setae. Second maxilla brachiform (Fig. 5), lacertus robust with four spinules on the posterior margin, brachium slightly longer and more slender with a tuft of setae near apex and five straited flaps on posterior margin, terminal claw with a fringe of diminutive setules on the concave margin and tip, bearing two secondary teeth. Maxilliped (Fig. 6) chelate, indistinctly segmented, distally bearing strong outgrowth ending in spoon-like structure, chela with seta in the center of convex margin. First leg (Fig. 7) biramous, rami three-segmented, sympod with a prominent lateral spine near to base of the endopod, exopod with basal segment longer than other two combined. Second leg (Fig. 8) biramous, sympod with six lateral spines and one plumose seta near to exopod; exopod modified, three-segmented, basal segment comprising more than 80% of its length, bearing spiniform seta and two short unequal digitiform processes, medial margin with some minute spinules, middle segment quadrangular with spiniform seta on distolateral margin, third segment slightly longer than second and with three spiniform processes of unequal size, and characteristic rounded process; endopod three-segmented with numerous flaps on its surface and the sympod. Third leg (Fig. 9) with rami three-segmented. Fourth leg (Fig. 10) with

Table 2. Armature of rami.

| Segments | Leg 1 | | Leg 2 | | Leg 3 | | Leg 4 | |
|----------|-------|-----|-------|-----|-------|-----|-------|-----|
| | ex. | en. | ex. | en. | ex. | en. | ex. | en. |
| 1 | 0–1 | 0–0 | 0–1 | 0–0 | I–0 | 0–0 | I–0 | 0–0 |
| 2 | 0–1 | 0–0 | 0–1 | 0–0 | I–0 | 0–0 | I–0 | I–0 |
| 3 | 0–3 | 0–2 | III | II | III | I–0 | III | — |

endopod two-segmented and exopod three-segmented. Fifth leg (Fig. 11) uniramous, one-segmented, with three apical setae of subequal size. Rami of legs 2, 3 and 4 with spinules and/or numerous subtriangular cuticular flaps. Armature of rami (setae, in Arabic; spines, in Roman numerals) as in Table 2. Uropod (Fig. 12) with tapering tip, two strong lateral spines and two slender setae between them.

Male. Unknown.

Etymology. The specific name refers to the geographical area where the new species was collected.

Remarks. The species described above was compared with other *Eudactylina* with three-segmented modified second exopod; according to Laubier (1968) there are six such species: *E. aspera* (Heller, 1865), *E. minuta* (Scott and Scott, 1913), *E. corrugata* Bere, 1930, *E. spinula* Pearse, 1950 and *E. valei* Nunes-Ruivo, 1954. Kabata (1970) described an additional species, *E. papillosa*. However, the new *Eudactylina* can be easily differentiated from them by its three-segmented rami of the first leg. Raibaut and Essafi (1979) described *Eudactylina rhinobati* parasitic on *Rhinobatos rhinobatus* (Linnaeus, 1758) and *R. cemiculus* (Geoffroy Saint-Hilaire 1817) from the southern Tunisian coast. This species is very similar to *E. peruensis* in the form of the appendages, including the presence of three long spines on the second last exopod segment, but differs by having unmodified second leg and by the absence of cuticular flaps and spinules on the legs.

***Eudactylina myliobatidos* sp. nov.**

(Figs 13–25)

Type host. *Myliobatis chilensis* Philippi (Myliobatidae).

Site of infection. Gills.

Type locality. Chorrillos, Perú.

Record of specimens. Nine females (taken in July 1989).

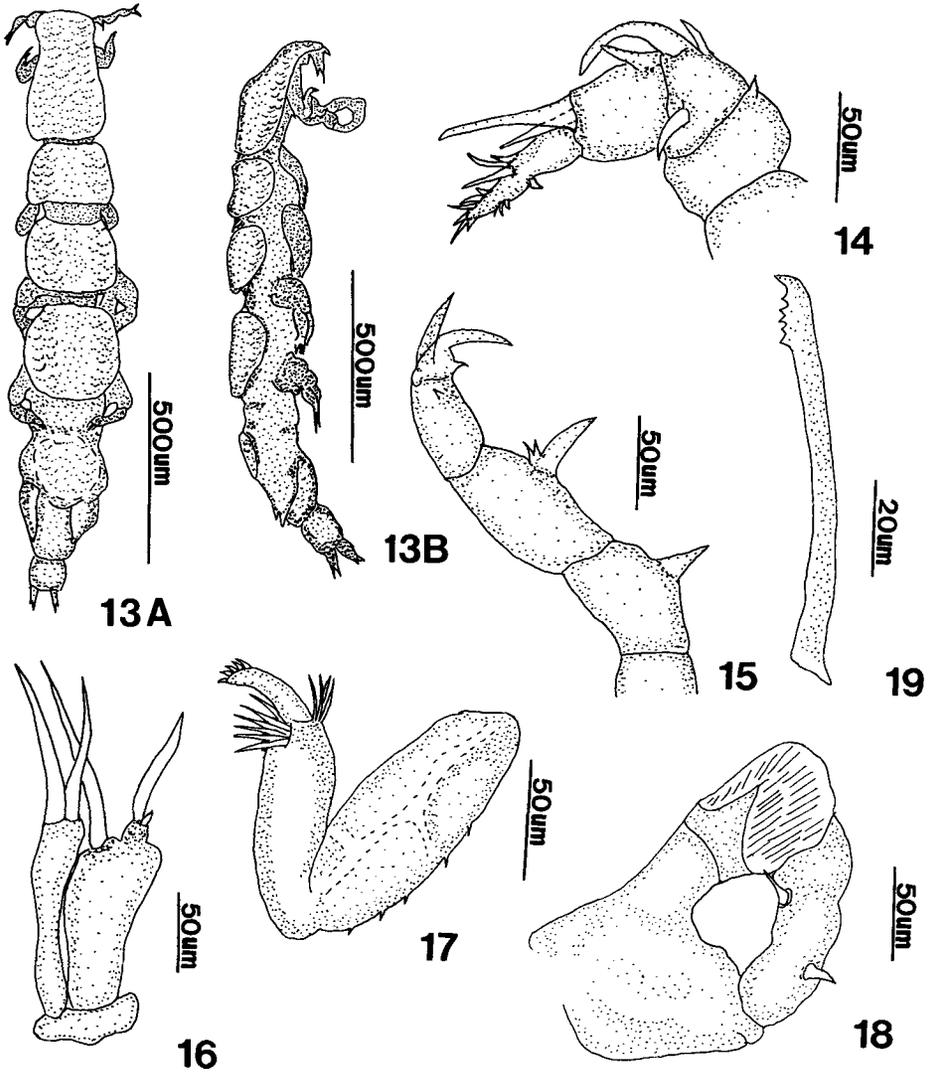
Type material. HOLOTYPE (one female) USNM N: 251290. PARATYPES: (two females) USNM N: 251291; (six females) LPURP Collection N: 194.

Description

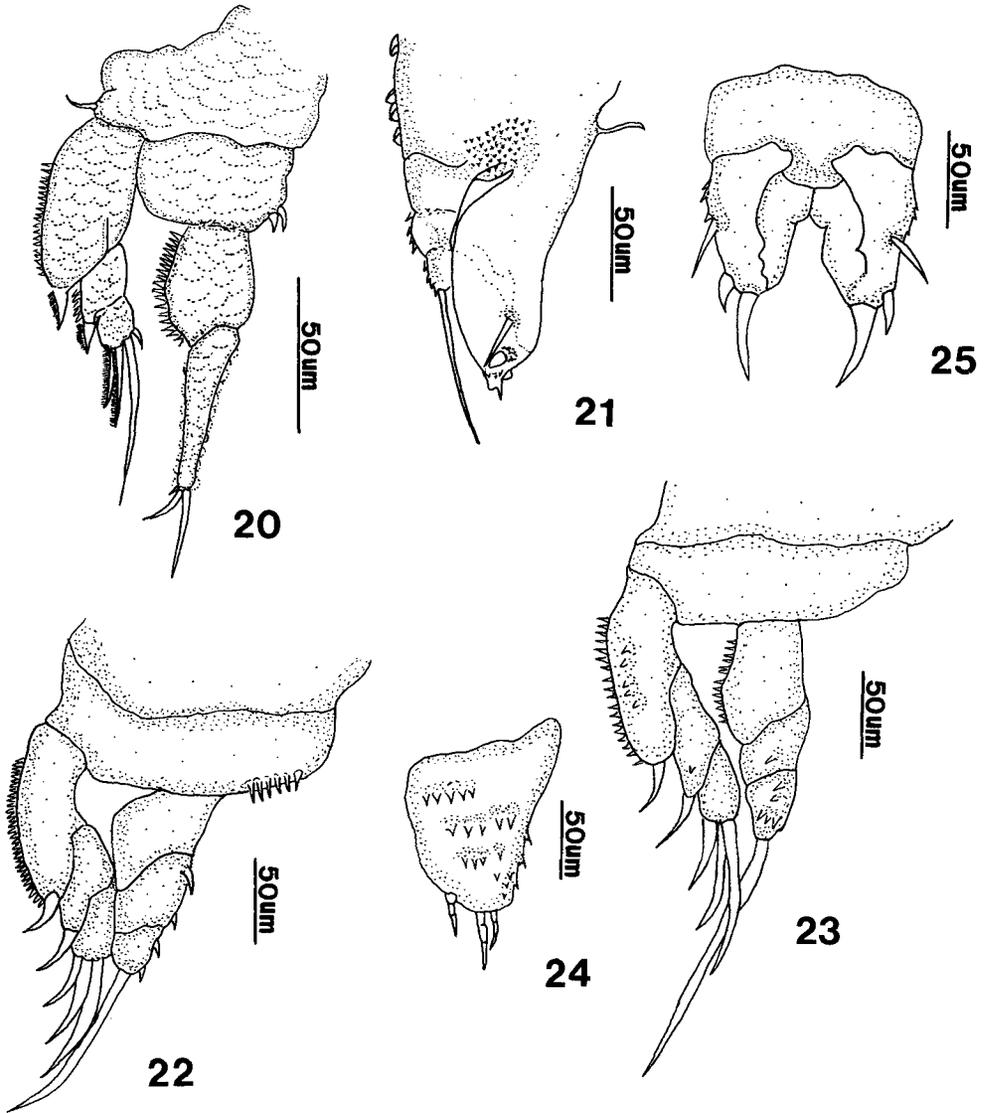
Female (Figs 13A, 13B). Dorsal shield of cephalothorax with rounded anterior end, slightly rounded posterolateral margins. Dorsal surface ornamented with cuticular flaps. First free thoracic segment of equal width with the preceding tagma, terga with similar ornamentation. Second free segment similar to first, slightly longer. Third free segment subquadrangular, longer than preceding ones. Fourth free segment smaller than third. Genital segment subquadrangular, with somewhat convex lateral margins. Abdomen two-segmented, first segment slightly longer than second.

Dimensions (based on six specimens):

| | |
|--|------------------|
| Total length | 1.77 (1.58–2.18) |
| Cephalothorax length | 1.25 (1.18–1.43) |
| Cephalothorax width | 0.37 (0.33–0.40) |
| Abdomen length | 0.12 (0.10–0.13) |
| Abdomen width | 0.10 (0.09–0.13) |
| Uropod length | 0.13 (0.10–0.15) |
| Uropod width | 0.06 (0.03–0.08) |
| Egg sac length (based on one individual) | 0.50 |
| Egg sac width | 0.10 |



FIGS 13–19. *Eudactylina myliobatidos* sp. nov., female. 13A, dorsal view; 13B, lateral view; 14, first antenna; 15, second antenna; 16, first maxilla; 17, second maxilla; 18, maxilliped; 19, mandible.



FIGS 20–25. *Eudactylina myliobatidos* sp. nov., female. 20, First leg; 21, second leg; 22, third leg, 23, fourth leg; 24, fifth leg; 25, uropods.

First antenna (Fig. 14) four-segmented with geniculate flexion; basal segment subquadrangular with short spine on distolateral corner; second segment with a robust spine on medial margin, claw-like spine in distomedial corner, ventral surface bearing one large seta; third segment with two spiniform setae (one in proximal lateral corner and other on distomedial margin), also claw-like spine in distolateral corner is observed; fourth segment with three setae in anterior margin, four setae on posterior margin and apical armature of six setae. Second antenna (Fig. 15) apparently five-segmented, basal segment unarmed, second segment with spiniform process on posterior margin, third segment with prominent spiniform process slightly longer than that of second segment and with two short and slender setae at base, fourth segment shorter than third with one short seta on distomedial surface, fifth segment claw-like with auxiliary spine on lateral side of base and one slender seta on posterior margin. First maxilla (Fig. 16) biramous, unisegmented, endopod thinner and slightly longer than exopod, both with two long setae; exopod with a third, small setule. Second maxilla (Fig. 17) brachiform, lacert robust, with spinulated lateral margin; brachium of similar length but more slender, with two tufts of setae; terminal claw with spinulated tip. Maxilliped (Fig. 18) chelate, apparently segmented, distally bearing strong outgrowth ending in spoon-like structure, chela with two setae, one on convex margin another on concave margin. Mandible (Fig. 19) siphonosthome, armature comprising six teeth. First leg (Fig. 20) biramous, rami three-segmented, endopod with longest third and exopod with longest basal segment. Second leg (Fig. 21) biramous, endopod three-segmented with numerous spinules near to the basal segment; exopod modified, indistinctly two-segmented, basal segment comprising about 80% length, bearing slender and spiniform seta near to second segment, latter narrower distally, its armature comprising apical gently curving spine on dorsolateral surface with digitiform process adjacent and strong acuminate spine on ventrolateral surface. Third and fourth legs (Figs. 22, 23) with rami three-segmented. Fifth leg (Fig. 24) uniramous, one-segmented, bearing spinules on dorsal surface and three apical unarmed setae. Cuticular flaps only observed on surface of first leg. Armature of rami as shown in Table 3. Uropod (Fig. 25) with tapering subtriangular tip, two apical spines (one longer, other very short), one seta on lateral border and spinules on near margins.

Etymology. The specific name refers to the generic name of the fish host.

Remarks. This species has been compared with the species of *Eudactylina* that have two-segmented modified exopods on their second legs. These species are *E. acuta*, *E. similis*, *E. breviabdominalis*, *E. pusilla* and *E. tuberifera* (see Pearse, 1952; Cressey, 1967 b; Laubier, 1968; Kabata, 1979; Castro and Baeza, 1987 a).

The new species differs from *E. acuta* in the shape of the thoracic segments and characteristics of the first and second legs. *Eudactylina similis* differs in the shape of the cephalic and thoracic segments and armature of the second exopod. *Eudactylina breviabdominalis* can be distinguished from the present species by the presence of lateral

Table 3. Armature of rami.

| Segments | Leg 1 | | Leg 2 | | Leg 3 | | Leg 4 | |
|----------|-------|------|-------|-----|-------|-----|-------|-----|
| | ex. | en. | ex. | en. | ex. | en. | ex. | en. |
| 1 | 0-1 | 0-0 | 0-0 | 0-0 | I-0 | 0-0 | I-0 | 0-0 |
| 2 | 0-1 | 0-0 | II-0 | 0-0 | I-0 | 0-0 | I-0 | 0-0 |
| 3 | I-3 | II-1 | — | I-0 | III | I-0 | III | I-0 |

lobes near the anterior margin of the cephalothorax and by the structure of the second exopod. *Eudactylina pusilla* differs in the second antenna and armature of second and fourth legs as well as in the shape of the fifth legs. *Eudactylina tuberifera* can be distinguished from the new species by the characteristics of the first leg, second antenna, shape and armature of the uropods.

Family LERNAEOPODIDAE

Pseudocharopinus narcinae Pillai, 1962

(Figs 26–33)

Host. *Myliobatis chilensis* Philippi (Myliobatidae).

Site of infection. Spiracles.

Locality. Chorrillos, Perú.

Record of specimens. Four ovigerous females and four males (taken in July 1989).

Material deposited. One ovigerous female USNM N: 251292; three ovigerous females LPURP Collection N: 195. One male USNM N: 251292; three males LPURP collection N: 196.

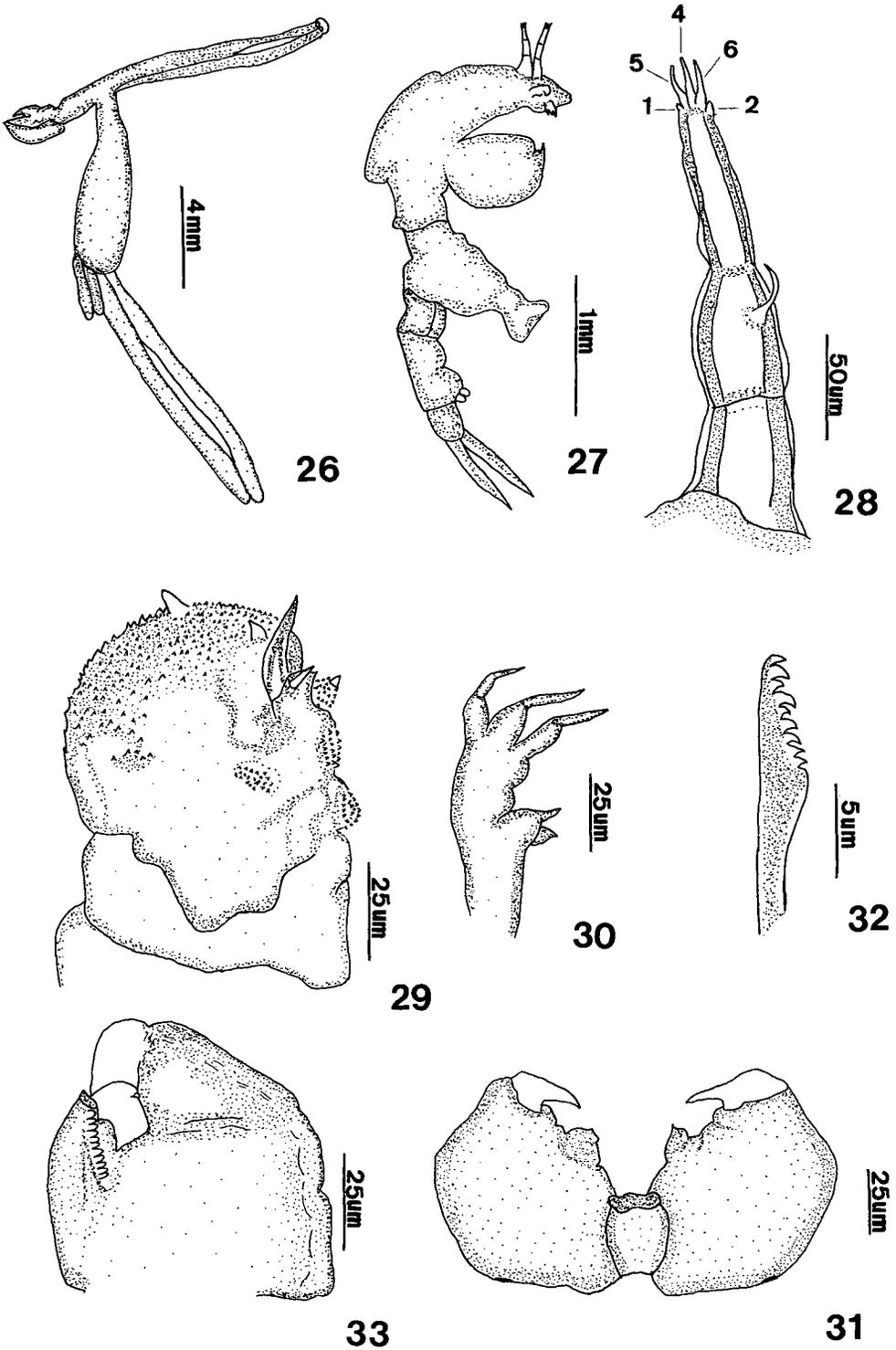
Description

Female (Fig. 26). Similar to that given in the original description by Pillai (1962), with minor differences in the armature of the second antenna, which includes two spinulated processes on the endopod. Dimensions: cephalothorax length 4.83 (4.75–5.0), width 1.27 (1.23–1.33). Trunk length 6.25 (5.38–7.13), width 2.31 (1.55–2.88). Second maxilla length 9.67 (8.13–11.88), width 0.92 (0.80–1.05). Posterior processes length 2.59 (2.55–2.63), width 0.60 (0.58–0.63). Egg sacs length 12.75 (10.75–14.75), diameter 0.75 (0.63–0.80).

Male. (Fig. 27). Total length 3.26 (2.25–3.95). General body shape typical of the genus. Conical posterior extremity bearing uropods. First antenna (Fig. 28) three-segmented, basal segment unarmed, medial segment with a slender seta on lateral side, distal segment longer than other segments, its apical armature comprising tubercles (1, 2, 3) (tubercle 3 not shown in Fig. 28), one digitiform seta (4), one seta (5), and one flagelliform seta (6). Second antenna (Fig. 29) similar to that of female described by Pillai (1962), exopod strongly developed and rounded, with spinulated surface. First maxilla (Fig. 30) biramous, similar to that of female. Second maxilla (Fig. 31) with subquadrangular corpus and short, sharply bent subchela. Mandible (Fig. 32) with dental formula: P2S1, P1S1, B4. Maxilliped (Fig. 33) with subquadrangular, strong corpus, subchela short, typical of the genus.

Remarks. This species was originally described by Pillai (1962), as parasitic on *Narcine timlei* (Bloch and Sch.) from Trivandrum, Indian coast. This description was based on female specimens only, with insufficient measurements. Our specimens of *P. narcinae* differ slightly from Pillai's specimens in the general dimensions (Peruvian specimens are longer than Indian specimens) and minor details of some appendages (the endopod of the second antenna bearing two spiniform patches in the Peruvian specimens).

According to Kabata (1979), *P. narcinae* can be placed in the group of *Pseudocharopinus* species parasitic on hypotrematous hosts, *P. concavus* (Wilson, 1913), *P. pteroplatae* (Yamaguti and Yamasu, 1959), *P. malleus* (Rudolphi and Nordmann, 1832), *P. dasyaticus* (Rangnekar, 1957), *P. pillaii* (Pillai, 1962) and *P. pteromylii*, Raibaut and Maamouri, 1975. The discovery of *P. narcinae* in South American Pacific waters is the first case of a *Pseudocharopinus* with wide geographical distribution parasitic on hypotrematous host.



FIGS 26–33. *Pseudocharopinus narcinae* Pillai, 1962, female, 26, lateral view; male, 27, lateral view; 28, first antenna; 29, second antenna; 30, first maxilla; 31, second maxilla; 32, mandible; 33, maxilliped.

Pseudocharopinoides myliobatidos Castro and Baeza, 1987

Host. *Myliobatis chilensis* Philippi (Myliobatidae).

Site of infection. Nasal fossae.

Locality. Chorrillos, Perú.

Record of specimens. Eleven ovigerous females (taken in May 1989).

Material deposited. One female USNM N: 251293; 10 females LPURP collection N: 197.

Dimensions (based on nine specimens). Cephalothorax length 4.31 (3.58–4.88), width 0.99 (0.88–1.13). Trunk length 3.65 (3.0–4.13), width 2.47 (1.63–2.93). Second maxilla length 2.91 (2.38–3.68), width 1.16 (0.85–1.38). Posterior processes length 2.36 (1.98–2.73), width 0.55 (0.45–0.75). Egg sac length 5.71 (4.88–6.25), diameter 1.14 (0.95–1.38).

Remarks. This species was originally described and illustrated by Castro and Baeza (1987b) on the basis of three specimens collected on the same host from the northern Chilean coast. The morphometric characteristics of our specimens are in agreement with those given in the original description. The presence of *Pseudocharopinoides myliobatidos* in the Peruvian coast can be attributed to the geographical distribution of the host, which extends along both Chilean and Peruvian coasts (Chirichigno, 1974).

Acknowledgement

The authors wish to thank Dr Z. Kabata (Pacific Biological Station, Nanaimo BC, Canada) for his critical review of the manuscript.

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