SCI. MAR., 66 (4): 407-415 SCIENTIA MARINA 2002

Two new cumacean species (Crustacea: Peracarida) from shallow waters off Thailand*

JORDI CORBERA[1] and DANIEL MARTÍN[2]

[1]Carrer Gran, 90, 08310 Argentona, Catalunya, Spain. E-mail: corbera@sct.ictnet.es
[2]Centre d'Estudis Avançats (CSIC), carrer d'accés a la Cala Sant Francesc, 14, 17300 Blanes (Girona), Catalunya, Spain.

SUMMARY: The examination of a collection of benthic macroinvertebrates from the Gulf of Thailand led to the erection of two new species of cumaceans (Crustacea), namely *Pseudosympodomma carinatum* sp. nov. (Vaunthompsoniinae, Bodotriidae) and *Paradiastylis capillata* sp. nov. (Diastylidae). Among the four species of the genus *Pseudosympodomma*, *P. carinatum* sp. nov. is related to *P. indicum* by having the first uropodal endopod article shorter than the second, but differs from it in lacking spines on the articles of the third maxilliped, as well as in having a high number of setae on the mandible and a more developed median carina on pedigerous somites two to four. The genus *Paradiastylis* is characterized by the absence of an exopod on the third maxilliped of females. Among the species of the genus, *P. capillata* sp. nov. is related to *P. bathyalis* by lacking folds in the carapace and having a long telson with a cylindrical pre-anal part. However, the two species may be differentiated by the relative length of the uropod endopod (longer than the exopod in *P. capillata*) and the basis of the third maxilliped (non-distally produced in *P. bathyalis*).

Key words: Cumacea, new species, West Pacific.

RESUMEN: DOS NUEVAS ESPECIES DE CUMÁCEOS (CRUSTACEA: PERACARIDA) DE LAS AGUAS SUPERFICIALES FRENTE A TAILANDIA. – El estudio de una colección de macroinvertebrados bentónicos del golfo de Tailandia ha permitido la descripción de dos nuevas especies de cumáceos: *Pseudosympodomma carinatum* sp. nov. (Vaunthompsoniinae, Bodotriidae) y *Paradiastylis capillata* sp. nov. (Dyastilidae). De las cuatro especies del género *Pseudosympodomma*, *P. carinatum* está relacionada con *P. indicum* por tener el primer segmento del endopodio del urópodo más corto que el segundo, pero puede diferenciarse de esta por la ausencia de espinas en los artículos del tercer maxilípedo así como por tener un mayor número de sedas en la mandíbula y una arista dorsal mucho más desarrollada en los segmentos torácicos 2-4. El género *Paradiastylis* se caracteriza por la ausencia de exopodio en el tercer maxilípedo de las hembras. *Paradiastylis capillata* sp. nov. se asemeja a *P. bathyalis* por carecer de pliegues sobre el caparazón y por tener un telson largo y cilíndrico con una parte preanal mayor que la postanal. No obstante, ambas especies pueden diferenciarse por la longitud relativa del endopodio del urópodo (más largo que el exopodio en *P. capillata*) y la morfología del basis del tercer maxilípedo (no dilatado distalmente en *P. bathyalis*).

Palabras clave: Cumacea, especies nuevas, Pacífico Occidental.

INTRODUCTION

The tropical Indo-West Pacific Region has been considered as being among the areas containing the highest biodiversities in the world from the point of view of terrestrial vegetation (Myers *et al.*, 2000), but this seems to be also true for the marine environment (Clarke and Crame, 1997; Gray, 2001). Although certainly potentially rich, the cumacean fauna of the region is, however, little known.

The first knowledge of the cumaceans of that region was obtained from the material of the Siboga

*Received March 4, 2002. Accepted June 19, 2002.

Expedition (Calman, 1905) and from the specimens of the Gulf of Siam collected by Th. Mortensen for the Zoological Museum of Copenhagen (Calman, 1907, 1911). Later on, Fage (1945) studied the littoral species from the coast of Vietnam and Jones (1969) those from deep water collected by the Galathea Expedition. Petrescu (1992, 1995, 1997a) published the results of the "Grigore Antipa" Natural History Museum expedition to Indonesia, and described four new species from Malayan waters (Petrescu, 1997b). More recently, Watling and Angsupanich (2002a) described a new species from the Andaman Sea.

The above-mentioned authors recorded up to 67 species in the Indo-West Pacific region (Australian coast excluded). However, only 24 have been found in the Gulf of Thailand (Watling and Angsupanich, 2002b). Thanks to the macrobenthic samples collected by the French company CREOCEAN as part of a large environmental monitoring carried out in the Gulf, the present paper fully describes and illustrates two new species of Cumacea (Crustacea), namely *Pseudosympodomma carinatum* sp. nov. (Bodotriidae, Vaunthompsoniinae) and *Paradiastylis capillata* sp. nov. (Dyastilidae). Additional data on the habitat where the species occur is also provided.

MATERIAL AND METHODS

The Gulf of Thailand is a shallow, semi-enclosed bay covering an approximate area of $35 \cdot 10^4$ km^2. The bottom sediments of the Gulf are mainly mud, with sand confined to shallow areas. The average depth is about 45 m, with much of the Gulf being less than 60 m deep (maximally about 85 m deep).

Sampling was performed by CREOCEAN as part of an environmental monitoring in the Gulf (about 180 km east of Songkhla, Thailand). In the study area, water temperature and salinity at the bottom level were 27-28°C and 35‰ respectively. The samples were collected by means of a van Veen grab covering about 0.3 m^2. Additional cores were collected for granulometry and organic matter content analyses. The grab contents were mixed in a sufficiently large container, and then sieved out on board by pouring the contents through a 1 mm mesh sieve. The retained sediment was then transferred into a plastic bag, fixed with a 10% formaldehyde/seawater solution, stained with "Rose of Bengal" and stored until sorted. An initial sorting was performed under a dissecting stereomicroscope (Zeiss Stemi 2000-C) to count the number of individuals. Among the sediment samples collected, 4 contained specimens of *Paradiastylis capillata* sp. nov. while *Pseudosympodomma carinatum* sp. nov., occurred only in one sample.

The granulometry, expressed as the % in volume of fine sediments (i.e. < 60 μm), was estimated from a laser grain size distribution performed on dry sediment after sieving through a 2 mm mesh sieve, using a Coulter Ls 230 laser granulometer. Total organic matter content was calculated as the % in volume after calcinations at 550°C.

For the morphological observations, the cumaceans were dissected in lactic acid and stained with Chlorazol black. Material preserved in permanent glass slides was mounted in Fauré medium sealed with nail varnish. Drawings were prepared using a camera lucida on an Olympus microscope. The terminology follows Bacescu and Petrescu (1999). The material is deposited in the cumacean collection of the Institut de Ciències del Mar (ICM), Barcelona.

RESULTS

Order CUMACEA Kröyer, 1846
Family BODOTRIIDAE Scott, 1901
Subfamily VAUNTHOMPSONIINAE Sars, 1878
Genus *Pseudosympodomma* Kurian, 1954

Pseudosympodomma carinatum sp. nov.
(Figs 1-3)

Type material. Holotype: preadult male partially dissected on 2 slides, Gulf of Thailand, station 12, 7°38'05''N 102°41'47''E, 70 m depth, M. Lebas, coll. (ICM: CUM-0031). Paratype: one preadult female partially dissected on 1 slide, same locality as the holotype, M. Lebas, coll. (ICM: CUM-0032).

Etymology. Referring to the high development of middorsal carina on the pereon.

Description: Preadult male, total length 11.9 mm. Carapace (partially damaged) about one fifth of total length; dorsal median carina with three teeth directed forwards occupying two thirds of dorsal margin. Eyelobe narrow and linguiform reaching beyond the pseudorostral lobes. Anterolateral angle rounded, with three small teeth on the lower margin.

Pereon as long as the carapace, first somite very short, somites second to fourth with a developed median carina acute in front; fifth somite with a dou-

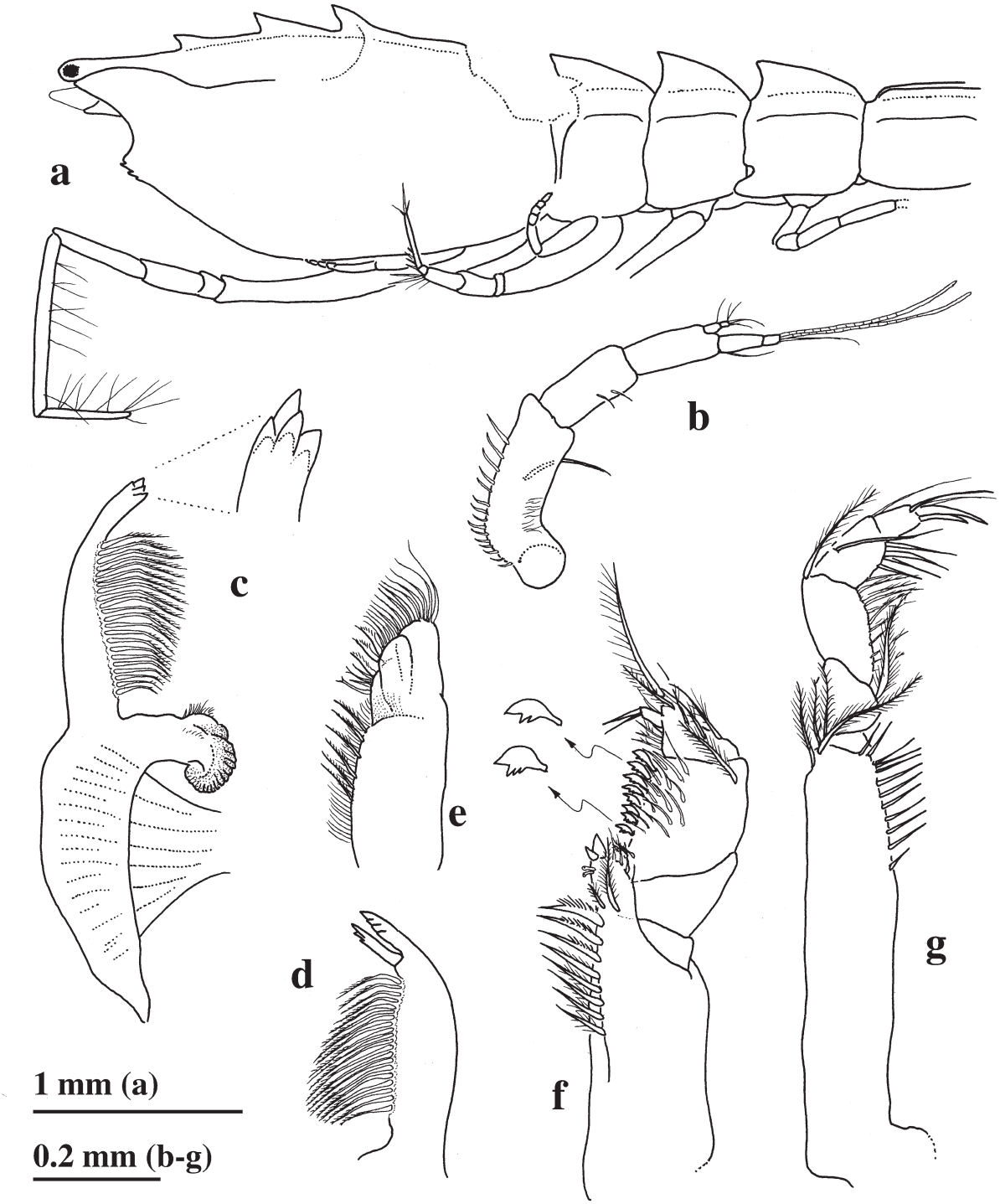

FIG. 1. – *Pseudosympodomma carinatum* sp. nov., preadult male Holotype (ICM: CUM-0031); **a**, carapace and pedigerous somites in lateral view; **b**, antenna 1; **c**, right mandible; **d**, left mandible; **e**, maxilla; **f**, maxilliped 1; **g**, maxilliped 2.

ble median carina less developed than in preceeding somites.

Peduncle of first antenna three-articulated, first article as long as the other two combined, second and third article of the same length; accessory flagellum two-articulated. Mandible with four teeth on the pars incisiva, lacinia mobilis exceeding pars incisiva and with three teeth; with 20 setae on the left mandible and 22 on the right. Second maxilla, protopod with a row of setules and some plumose setae; endites exceeding protopod and with simple setae. Basis of first maxilliped with eight plumose setae on inner margin, its endite with two retinacula, a pair of broad spines, two plumose setae and some

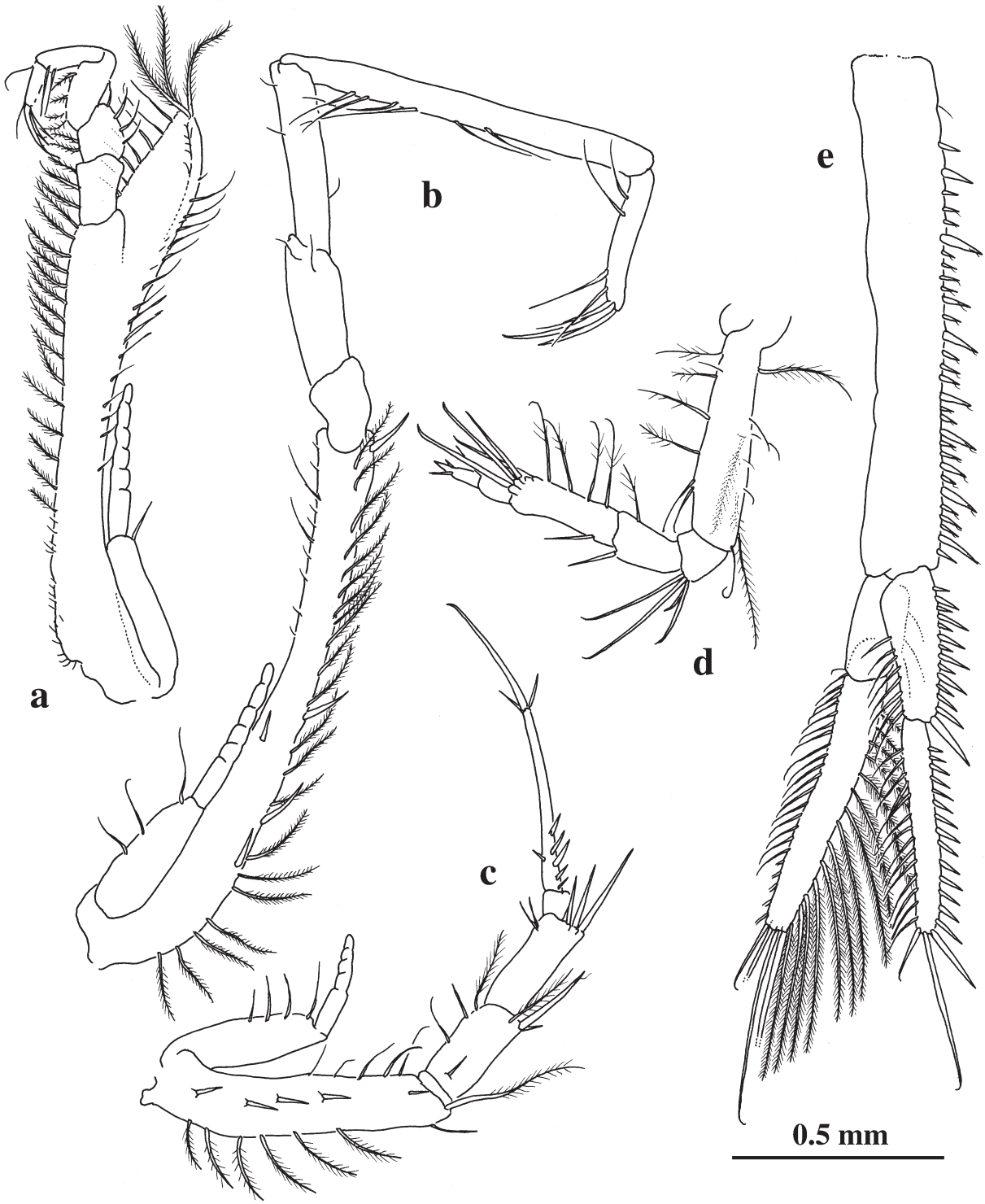

FIG. 2. – *Pseudosympodomma carinatum* sp. nov., preadult male Holotype (ICM: CUM-0031); **a**, third maxilliped; **b**, first pereopod; **c**, second pereopod; **d**, third pereopod; **e**, uropod.

simple ones; carpus with eight flattened hand-like setae on inner margin; propodus with a long plumose seta. Basis of second maxilliped longer than the rest of appendage, with plumose setae on distal outer corner and simple setae on the distal third of inner margin; carpus as long as propodus and dactylus combined. Third maxilliped, first and second pereopods with exopods. Basis of third maxilliped one and a half times as long as the rest of appendage, with plumose setae on inner margin and

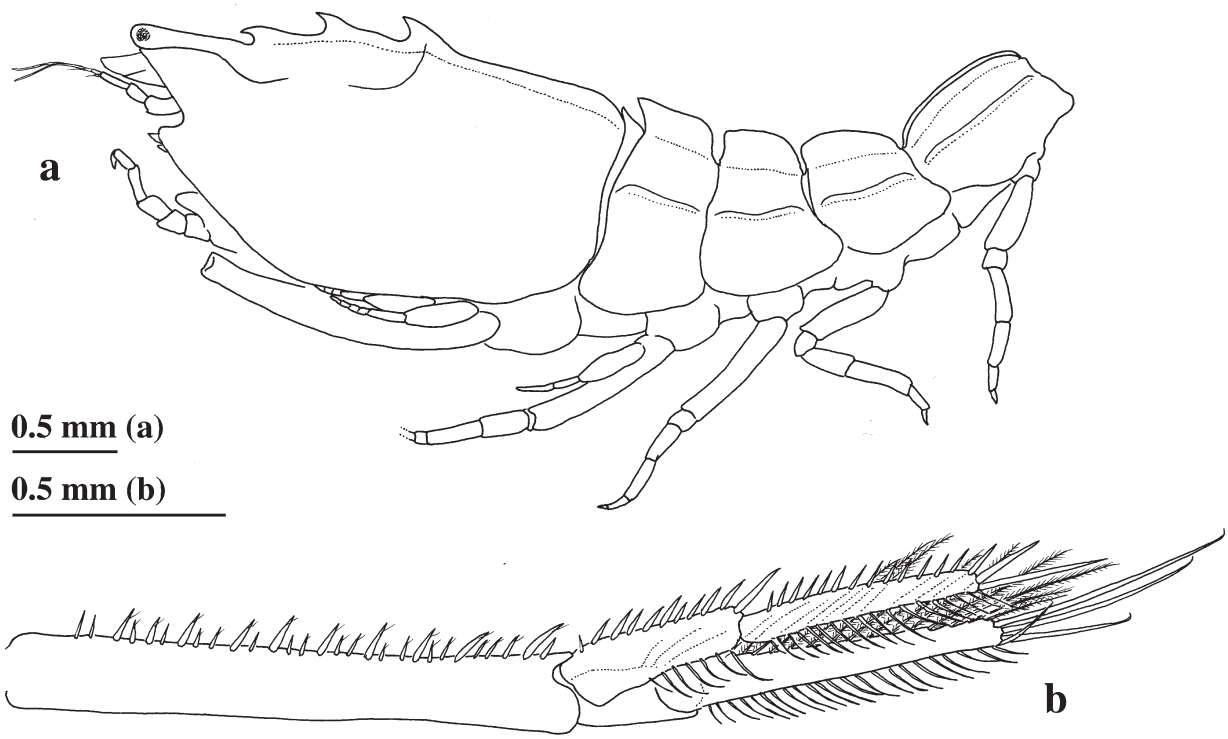

FIG. 3. – *Pseudosympodomma carinatum* sp. nov., preadult female Paratype (ICM: CUM-0032): **a**, carapace and pedigerous somites in lateral view; **b**, uropod.

simple setae on outer margin, produced distally reaching the end of merus; ischium longer than merus with three plumose setae on inner margin. Basis of the first pereopod less than two thirds of the total appendage length, with a row of plumose setae and four slender spines on the inner margin; propodus as long as the three preceeding segments, with some simple setae; dactylus as long as merus, with two claws. Basis of second pereopod about one third of total appendage, with plumose setae on the outer margin; merus slightly shorter than carpus with a long spine-like seta on the outer distal corner; carpus with three spine-like setae on the outer distal corner; propodus very short; dactylus long and slender with five short acuminate setae on the proximal third of the outer margin and a distal spine-like seta longer than half dactylus. Basis of the third pereopod shorter than the rest of appendage, carpus longer than merus, with four setae longer than propodus and dactylus.

Uropod peduncle 1.4 times longer than rami, with 30 acuminate setae on inner margin. Endopod as long as exopod, two-segmented; first segment shorter than second, with 14 acuminate setae on inner margin and eight simple setae on the outer; second segment with 15 acuminate setae on inner margin, two distally and 14 simple setae on outer margin. Second segment of exopod with a row of long plumose setae on inner margin, a row of simple setae on outer margin and four terminal spine-like setae.

Preadult female, total length 12.1 mm. Closely resembles the preadult male. Carapace with a single median dorsal carina on its hinder half; anterolateral angle with two teeth. Uropods as in male but with less acuminate setae (11) on the first segment of endopod.

Taxonomical remarks: Only four species are known for the genus *Pseudosympodomma* (Table 1): *P. africanum* (Stebbing, 1912) from south east Africa, *P. indicum* Kurian, 1954 from south east India, *P. hoinicae* Petrescu, 1998 from the coast of Tanzania and *Pseudosympodomma* sp. from the Red Sea (Mühlenhardt-Siegel, 1996). *P. carinatum* sp. nov. and *P. indicum* are related because both have the first article of the uropodal endopod shorter than the second. The former differs from the latter by having a larger number of setae on the mandible and a highly developed median carina on pedigerous somites two to four, and by lacking spines on the articles of the third maxilliped. In addition, *P. carinatum* differs from all other species of the genus in the extent to which the teeth occupy the dorsal margin.

TABLE 1. – Morphological features of the species of the genus *Pseudosympodomma*.

	P. indicum	*P. africanum*	*P. hoinicae*	*P.* sp.	*P. carinatum*
References	Kurian, 1954	Stebbing, 1912; Day, 1975	Petrescu, 1998	Mühlenhardt-Siegel, 1996	this study
Total length (mm)	9.7	18	4.6-8.2	unknown	11.9-12.1
Extent to which the teeth occupy the dorsal margin of the carapace	1/2	1/2	1/2	1/2	2/3
Lower margin of the carapace	serrated	serrated	smooth	slightly serrated	with 2-3 teeth
Dorsal median carina on the carapace	paired on the hinder half	single on the hinder half	single on the hinder half	paired on the hinder half	single on the hinder third
Dorsal median carina on pedigerous segments	single after the 2nd segment	paired after the 2nd segment		unknown	paired only on the 5th segment
N. setae on the mandible	17	20	15	unknown	20-22
Accessory flegellum of 1st antenna	3-segmented	2-segmented	2-segmented	2-segmented	2-segmented
Basis of 3rd maxilliped	with spines	with spines	without spines	with spines	without spines
Basis of 1st pereopod	with spines	without spines	with few spines	without spines	with few spines
Relative lengths of the two segments of uropod endopod	1st < 2nd	1st > 2nd	1st > 2nd	unknown	1st < 2nd

TABLE 2. – Environmental characteristics of the samples localities in the Gulf of Thailand.

Station	Longitude	Latitude	Depth (m)	Fine sediments (%)	Organic matter (%)	Species
5	7°36'03''N	102°50'32''E	64	92.2	6.9	*Paradiastylis capillata*
10	7°32'50''N	102°35'25''E	66	92.5	9.1	*Paradiastylis capillata*
12	7°38'05''N	102°41'47''E	70	96.1	6.7	*Pseudosympodomma carinatum*
15	7°44'23''N	102°34'58''E	75	93.8	9.9	*Paradiastylis capillata*
16	7°43'22''N	102°28'39''E	77	90.7	6.6	*Paradiastylis capillata*

Ecological remarks: The density of *P. carinatum* at the studied location was 7 ind. m^{-2}. The environmental characteristics of the bottoms where the species was found are summarized in Table 2.

Family DIASTYLIDAE Say, 1818
Genus *Paradiastylis* Calman, 1904

Paradiastylis capillata sp. nov.
(Figs. 4-5)

Type material. Holotype: one adult female partially dissected on 2 slides, Gulf of Thailand, station 5, 7°36'03''N 102°50'32''E, 64 m depth, M. Lebas, coll. (ICM: CUM-0037). Paratypes: one adult male (carapace damaged), station 15, M. Lebas, coll. (ICM: CUM-0038); one adult female, station 16, M. Lebas, coll. (ICM: CUM-0039); one adult female, station 10, M. Lebas, coll. (ICM: CUM-0040).

Etymology. From the Latin *capillus* meaning hair, referring to the long setae on the carapace.

Description: Adult female, total length 5.7 mm. Carapace more than a third of total length, about twice as long as broad, covered by long hairs mainly dorsally and on the anterior half; pseudorostral lobes acutely pointed, without antennal notch; anterolateral margin finely serrated. Eyelobe rounded with few lenses.

Peduncle of first antenna three-segmented, the second segment being the longest; main flagellum three-segmented, longer than the last peduncle segment and with two aesthetascs distally; accessory flagellum three-segmented, the first and the third being very short, the whole longer than the proximal segment of the main flagellum. Mandible with three teeth on the pars incisiva as well as on lacinia mobilis, 14 seta between pars incisiva and truncated pars molaris. Palp of first maxilla with two unequal filaments; inner endite with four setae, two acuminate, one trifid and one microsetulated; outer endite with seven acuminate setae. Second maxilla with the endites exceeding the protopod and with plumose setae. Basis of first maxilliped with five simple setae and one plumose short seta, two retinacula and a pair of broad spines; merus with a long seta on the distal outer corner; carpus with seven flattened hand-like setae and few rows of simple setae on the inner margin, and a long plumose seta on the distal outer corner; propodus with two long plumose setae on the distal margin and simple setae on the inner margin.

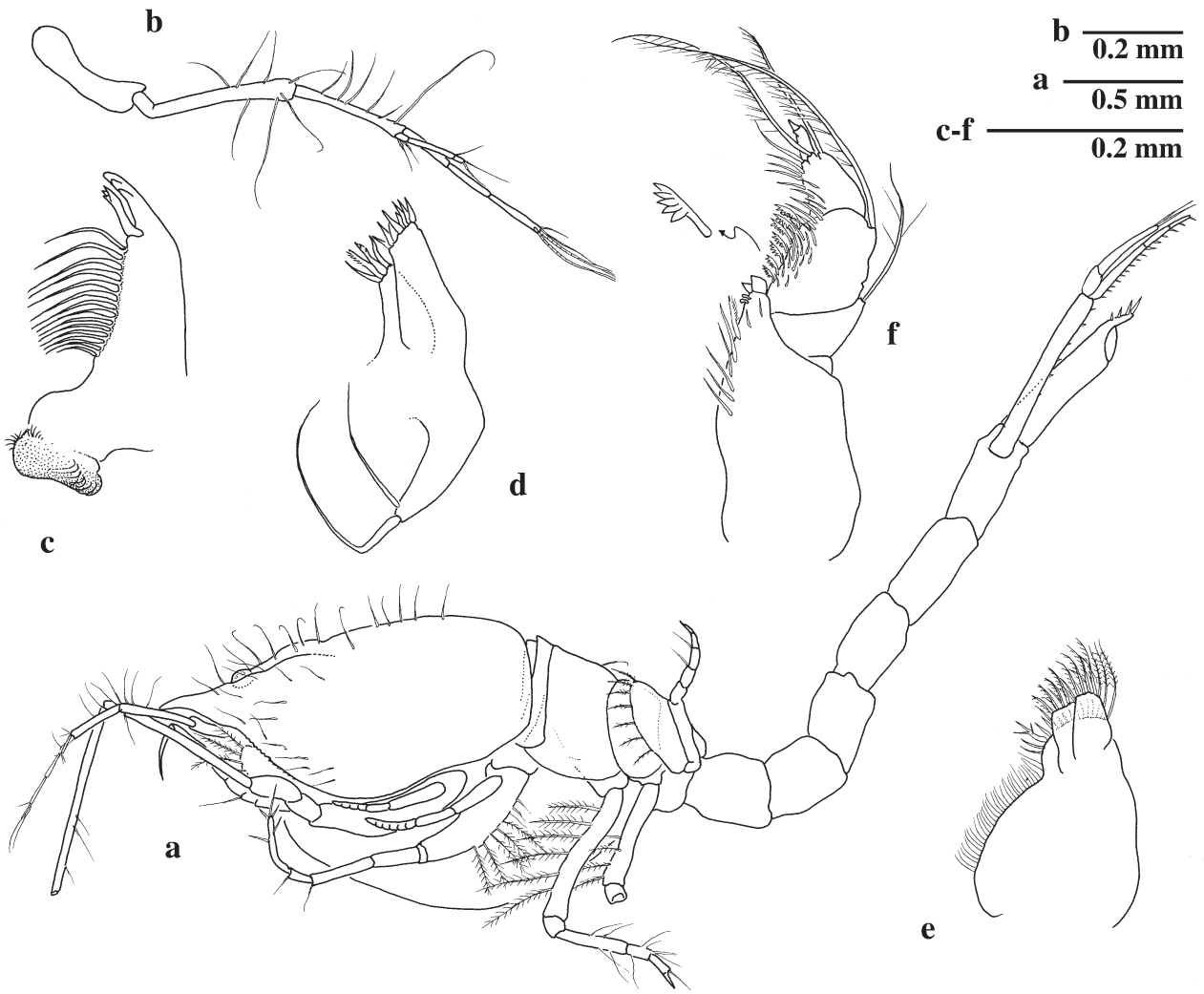

FIG. 4. – *Paradiastylis capillata* sp. nov., adult female Holotype (ICM: CUM-0037): **a**, whole animal in lateral view; **b**, first antenna; **c**, left mandible; **d**, first maxilla; **e**, second maxilla; **f**, first maxilliped.

Basis of the second maxilliped as long as the rest of appendage, with three plumose setae on the inner margin; carpus longer than ischium and merus combined; propodus with a long plumose seta on the distal outer corner. Third maxilliped without exopod; basis longer than the rest of appendage, produced distally reaching the end of merus, with simple setae on inner margin and plumose setae on the process; carpus shorter than propodus; dactylus shorter than its claws. Exopods on pereopods first and second. Basis of first pereopod shorter than the three following segments combined, with long plumose setae on the inner margin; merus twice ischium; carpus long and slender, shorter than propodus; dactylus broken. Basis of second pereopod less than half length of the appendage with plumose setae on outer and inner margins; merus shorter than carpus; carpus with a simple and four acuminate setae distally; dactylus slightly shorter than carpus. Basis of third pereopod with long plumose setae on anterior margin.

Telson one and a half times as long as the last abdominal somite; pre-anal part cyclindrical, post-anal part one sixth of the whole length, with three pairs of lateral acuminate setae and a pair of distal ones. Peduncle of uropod slightly longer than telson, with nine acuminate setae on inner margin; endopod longer than exopod, three-segmented, ten acuminate setae on the first segment, three on the second and two on the third; second segment of exopod with simple setae on outer and inner margin and two long spine-like setae distally.

Adult male, third segment of first antenna with a dense brush of sensory setae. With exopods on third maxilliped and first to fourth pereopods; basis of four first pereopods expanded. Two pairs of pleopods.

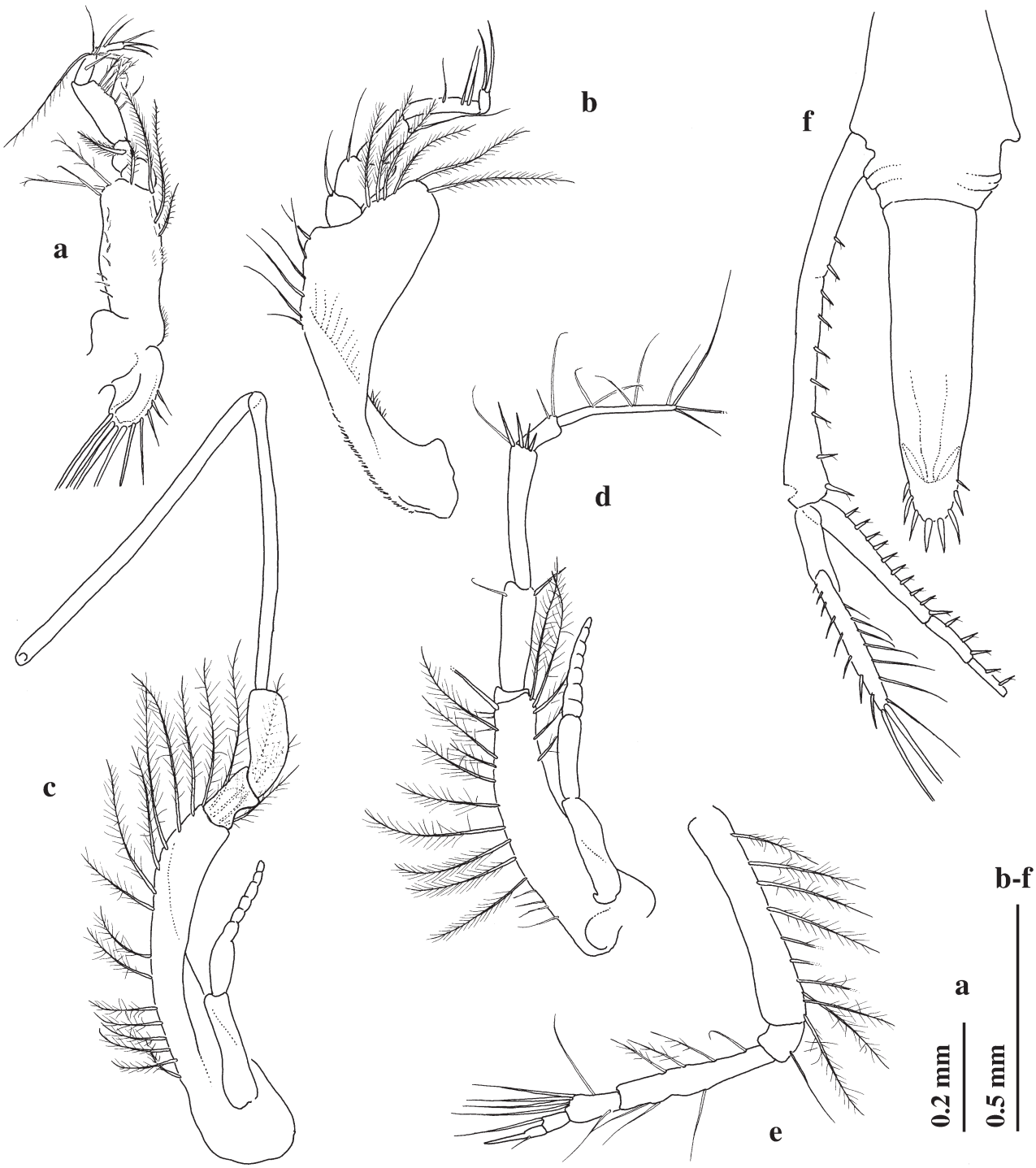

FIG. 5. – *Paradiastylis capillata* sp. nov., adult female Holotype (ICM: CUM-0037): **a**, second maxilliped; **b**, third maxilliped; **c**, first pereopod; **d**, second pereopod; **e**, third pereopod; **f**, last abdominal somite with the telson and the left uropod.

Taxonomical remarks: The genus *Paradiastylis* may be identified by a singular feature among Diastylidae: the absence of exopod on the third maxilliped of females. This is a feature shared with the members of the family Gynodiastylidae, the males of which do not have pleopods (for a discussion about differences between the two families see Day, 1980). As far as is known, the species of this genus are living in shallow waters of the Indo-West Pacific region (Petrescu, 1997), have folds on the carapace and a short telson, except for *P. bathyalis* Jones, 1969, which lives in deep water, does not

have folds on the carapace and has a long telson with a cylindrical pre-anal part like those of the genera *Makrokylindrus* or *Dic*. In spite of these differences, "with some hesitation" Jones (1969) placed this species in the genus *Paradiastylis* due to the absence of exopod on the third maxilliped of the female. Although *P. capillata* nov. sp. has been collected in shallow waters, it is more related to *P. bathyalis* than to the rest of the species in the genus due to the absence of folds on the carapace and the telson morphology. However, the two species may be differentiated by the relative lengths of the uropod endopod that is longer than the exopod in *P. capillata* and by the basis of the third maxilliped which is shorter, more compact and produced distally in *P. capillata*. The long legs and the long telson indicate a deep-water origin for the species described herein but differences in the morphology of the third maxilliped suggest that resemblances with *P. bathyalis* could be convergences.

The loss of the exopod of the third maxilliped could have happened several times and there may be several lineages within the Diastylidae in which that feature was present. Consequently, a new genus could be erected for the species here described. However, in the original description of the only two known specimens of *P. bathyalis* (Jones 1969), the mouthparts were not figured. Therefore, the fact that they cannot be examined makes it advisable at the moment to include the new species in the genus *Paradiastylis*.

Ecological remarks: The densities of *P. capillata* sp. nov. at the studied locations ranged from 3 to 7 ind. m^{-2}. The average environmental characteristics of the bottoms where the species was found are 68.6 ± 7.0 m deep, 91.7 ± 1.6% of fine sediments and 8.1 ± 1.4% of total organic matter (Table 2).

ACKNOWLEDGEMENTS

The authors wish to thank E. Dutrieux and S. Canovas, who were responsible for the field survey. The authors are also grateful to M. Canyelles for help with the preliminary macrofaunal sorting and to L. Watling and U. Mühlenhradt-Siegel for comments that improved the manuscript. The study was partly financed by a research contract between the CEAB (CSIC) and CREOCEAN.

REFERENCES

Bacescu, M. and I. Petrescu. – 1999. Ordre des Cumacés (Cumacea Krøyer 1846). In: J. Forest (ed.), *Traité de Zoologie*, Tome VII Fascicule IIIA Crustacés Péracarides. *Mem. Inst. Océanogr., Monaco* 19: 391-428.

Calman, W.T. – 1905. The Cumacea of teh Siboga expedition. *Siboga-Expeditie,* 36: 1-23

Calman, W.T. – 1907. On new and rare Crustacea of the order Cumacea from the collection of the Copenhagen Museum. Part I. The families Bodotriidae, Vaunthompsoniidae and Leuconidae. *Trans. Zool. Soc. Lond.,* 18: 1-58.

Calman, W.T. – 1911. On new and rare Crustacea of the order Cumacea from the collection of the Copenhagen Museum. Part II. The families Nannastacidae and Diastylidae. *Trans. Zool. Soc. Lond.,* 18: 341-398.

Clarke, A. and J.A. Crame. – 1997. Diversity, latitude and time: Patterns in the shallow sea. In: R.F.G. Ormond, J.D. Gage and M.V. Angel, *Marine biodiversity: Patterns and processes,* pp. 122-147. Cambridge Univ. Press, Cambridge.

Day, J. – 1975. South African Cumacea. Part 4. Family Bodotriidae, subfamily Vaunthompsoniinae. *Ann. S. Afr. Mus.*, 66(9): 177-220.

Day, J. – 1980. South African Cumacea. Part 1. Families Gynodiastylidae and Diastylidae. *Ann. S. Afr. Mus.*, 82(6): 187-292.

Fage, L. – 1945. Les cumacés du plancton nocturne des côtes d'Annam. *Arch. Zool. Exp. Gén*., 84: 165-224.

Gray, J.S. – 2001. Marine diversity: the paradigms in patterns of species richness examined. In: J.M. Gili, J.L. Petrus and T.T. Packard, *A marine science odyssey into the 21st century. Sci. Mar.*, 65(Suppl. 2): 41-56

Jones, N.S. – 1969. The systematics and distribution of the Cumacea from depths exceeding 200 meters. *Galathea Rep.*, 10: 99-180.

Kurian, C.V. – 1954. Notes on Cumacea (Sympoda) in the Zoological Survey of India. *Rec. Ind. Mus.*, 52 (2-4): 275-312.

Mühlenhardt-Siegel, U. – 1996. Cumacea (Crustacea) from the Red Sea and the Maldives (Indian Ocean) in the collection of the Zoological Museum, Hamburg, with the description of seven new species and a new genus. *Beaufortia* 46(7): 105-134.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca and J. Kent. – 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403: 853-858.

Petrescu, I. – 1992. *Iphinoe insolita* n. sp. (Crustacea, Cumacea) fromthe littoral waters of Bunaken Island (N Sulawesi). *Patru naturalisti români în Indonezia*

Petrescu, I. – 1995. New Cumacea (Crustacea: Perecarida) from shallow waters of Indonesia. *Beaufortia*, 45(3): 27-49.

Petrescu, I. – 1997a. Cumacea. In: M. Gutu (coord), Results of the Zoological Expedition organized by "Grigore Antipa" Museum in the Indonesian Archipelago (1991). I. Peracarida (Crustacea). *Trav. Mus. nat. Hist. Nat. "Grigore Antipa"* 38: 115-175.

Petrescu, I. – 1997b. Nannastacidae (Crustacea: Cumacea) from the Malayan shallow waters (South China Sea). Beaufortia, 47(4): 109-151.

Petrescu, I. – 1998. Cumaceans (Crustacea: Cumacea) collected by the expedition of "Grigore Antipa" National Museum of Natural History from the coast of Tanzania (1973-1974). Part I. Family Bodotriidae. *Trav. Mus. nat. Hist. Nat. "Grigore Antipa"* 40: 227-310.

Stebbing, T.R.R. – 1912. The Sympoda (Part VI of S. A. Crustacea, for the marine investigations in South Africa). *Ann. S. Afr. Mus.,* 10: 129-176.

Watling, L. and S. Angsupanich. – 2002a. *Procampylaspis andamanensis* sp. nov. (Crustacea, Cumacea), first record of the genus from the Indo-Polynesian biogeographic province. *Phuket mar. biol. Cent. Spec. Publ*., 23: 33-40.

Watling, L. and S. Angsupanich. – 2002b. Cumacea of Thailand - An annotated list. *Phuket mar. biol. Cent. Spec. Publ*., 23: 41-51.

Scient. ed.: F. Sardà