Marine Biology Research
June 2008, Volume 4, Issue 3, Pages 180 - 192
http://dx.doi.org/10.1080/17451000801898576

The original publication is available at http://www.tandf.co.uk/journals/

A new deep-sea genus of Nannastacidae (Crustacea, Cumacea) from the Lucky Strike hydrothermal vent field (Azores Triple Junction, Mid-Atlantic Ridge)

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Abstract:

A new cumacean genus and species, *Thalycrocuma sarradini* gen. et sp. nov., belonging to the family Nannastacidae is described from several sites of the Lucky Strike hydrothermal vent field (Mid-Atlantic Ridge, 37°N, 1700 m depth). The new genus differs from others in the family by males lacking exopods on the pereopods 3 and 4 and having an antenna with a five-articulate peduncle and a short flagellum. This is the first cumacean species that could be considered, at the moment, as endemic from hydrothermal vent areas. Data on the accompanying fauna including other cumacean species (*Cyclaspis longicaudata*, *Bathycuma brevirostre*, *Procampylaspis* sp. and *Makrokylindrus* sp.) and some ecological remarks are included. A key for the currently known genera of the family Nannastacidae is provided and the taxonomic position of some genera is discussed.

Keywords: Cumacea; deep sea; hydrothermal vents; Mid-Atlantic Ridge; morphology; systematics

Introduction

Since the discovery in 1977 of hydrothermal vents as a new deep-sea ecosystem and its associated fauna (Weiss et al. 1977; Lonsdale 1977), more than 700 species are recorded living in this environment (Wolff 2005; Desbruyères et al. 2006). Although, this is not a high number, most species are endemic from this habitat (71%) while only a few (5%) are shared with other reduced marine environments, i.e. cold seeps and whale falls (Wolff 2005). Mollusca and Crustacea are the taxa showing the highest diversity. Among crustaceans, copepods and decapods are the most speciose (Heptner and Ivanenko 2002; Martin and Haney 2005).

Among the peracarid crustaceans, the amphipods are the best represented (24 species; Bellan-Santini 2006), while tanaids and isopods are less frequently identified (Cunha 2006; Cunha and Wilson 2006; Larsen et al. 2006).

Similarly, very little is known on the cumacean fauna of chemosynthetic-based marine ecosystems. Only two cumacean species, *Atlantocuma bidentatum* Ledoyer 1988 and *Bathycuma brevirostre* (Norman 1879), have been recorded from hydrothermal vent vicinity (Corbera 2006) while four other (*Diastylopsis dawsoni* Smith 1880, *Eudorella pacifica* Hart 1930, *Campylaspis* sp. and ?*Hemilamprops* sp.) were found in north Californian methane seeps (Levin et al. 2000, 2003). This is perhaps due to a lack of sampling, but probably also to a poor representation of this group in these environments.

The family Nannastacidae currently comprises 28 genera. Few of them had been assigned to distinct families by some authors. Genus *Picrocuma* was described firstly in the family Bodotriidae (Hale 1936) but, because of the lack of pleopods in the male and the shape of the mandible, the same author (Hale 1945) transferred it to the Nannastacidae when these characteristics were described for the male of the type species. Several years later, Bacescu (1988) considered it again as a member of the Bodotriidae, a criterion also followed by Tafe and Greenwood (1996) and Mühlenhardt-Siegel (2003). A similar trajectory has followed the genus *Atlantocuma*. First described within the Bodotriidae (Bacescu and Muradian 1974), it was assigned to this family by Bacescu (1988) and Corbera (2006) but to the family Nannastacidae by Jones (1984) and Ledoyer (1988, 1993). A phylogenetic analysis made by Haye (2002) on 86 parsimony-informative morphological characters grouped *Atlantocuma* and *Picrocuma* external to all bodotriid genera. Although these genera have a doubtful position, they are here provisionally included in the family Nannastacidae. Further studies on the genera and families of Cumacea with pleotelson are needed to solve the position of genera in question.

On the other hand, genera *Schizocuma* Bacescu 1972 and *Styloptocuma* Bacescu and Muradian 1974 were not recognized by Jones (1984), while Watling (1991) accepted *Schizocuma* but considered *Styloptocuma* a subgenus of *Cumella* Sars 1865. Later on, a detailed morphological study led Petrescu (2000a) to consider again *Styloptocuma* as valid genus.

Material collected in the Lucky Strike hydrothermal vent field belongs to a new species that cannot be included in any of the currently known genera. The new species is described in this paper and data on the ecological parameters of its habitat are provided.

Material and methods

The specimens were collected on the Mid-Atlantic Ridge (MAR) in the Lucky Strike hydrothermal vent field, at different sites and by different means. At the Eiffel Tower site, cumaceans were collected by two in situ colonization experiment gears called SMAC, B and C (**S**mall **M**odule **A**utonome de **C**olonisation). Each of the arrays consisted of four trays containing artificial sediment (dust-size glass beads) and different organic materials and concentrations to attract opportunistic animals. These arrays were moored during MARVEL cruise (N/O *L'Atalante*, submersible *Nautile*, dives 1194 and 1195, 20-21.08.1997), at the base of the chimney, which is covered with the mytilid bivalves *Bathymodiolus azoricus* Cosel and Comtet in Cosel, Comtet and Krylova 1999. The SMACs were recovered 320 days later during the PICO cruise (N/O *Nadir*, submersible *Nautile*, dives 1268 and 1269, 05-06.07.1998). At the vent site Sintra, specimens were collected by a sediment trap, moored during the ATOS cruise (N/O *L'Atalante*) and deployed by the ROV *Victor 6000*, between two active chimneys, 30 m apart. The sediment trap provides information about the export and the distribution of hydrothermal particle material to the surrounding deep ocean. It allows also a sequential collection – each two weeks – of a diversified fauna composed of invertebrate larvae and other small animals (see Khripounoff et al. 2001 for its mode of use). The mouth of the trap is situated 2.5 m above the bottom. Trap was recovered a year later (3.07.2002) by the R/V *Arquipélago* (IMAR, Portugal). Further samples were collected during the cruises TTR10 (August 2000) and TTR12 (August 2002) onboard the RV *Prof. Logatchev* (Training Through Research programme, IOC-UNESCO). The location of samples inside the vent field was predetermined and based on data (ROV *Jason* images) obtained during the cruise LUSTRE-1996. A TV-guided grab was used to locate different types of rocks allowing a minimally destructive sampling procedure. Macroinvertebrates were picked from the surface of the rocks or sorted from sieved sediments and rock washings. Samples were preserved in 70% ethanol. Data on the stations yielding cumaceans are presented in Table 1.

For morphological observations, the cumaceans were dissected in lactic acid and stained with chlorazol black. Material preserved as permanent glass slides was mounted in Fauré medium and sealed with nail varnish. Drawings were prepared after dissection in lactic acid (except for the whole animal and the uropod) using a camera lucida on an Olympus microscope. A few specimens were examined with a Hitachi H-2300 Scanning Electron Microscope; they were prepared by dehydration through graded ethanol, critical point dried, mounted on stubs and sputter-coated with gold. Material was deposited in the *Muséum National d'Histoire Naturelle*, Paris (MNHN), in the Biological Research Collection of the Department of Biology, University of Aveiro (DBUA) and in the Cumacean collection of the *Institut de Ciències del Mar*, Barcelona (ICMU).

Systematics

Order Cumacea Kröyer 1846
Family Nannastacidae Bate 1866
Genus *Thalycrocuma* gen. nov.

Diagnosis. Carapace anterolateral angle acute but not projecting, eyelobe single, branchial siphons slightly separated in males and preadult females, meeting in front of eyelobe in adult females. Mandible molar process truncate. Antennula article 2 without process, article 3 of males with two sets of sensory setae. Antenna of male developed with a short flagellum not exceeding carapace length. Maxilliped 3 and pereopods 1 and 2 with exopods in both sexes. Uropod peduncle longer than pleonite 6; uropod exopod longer than its terminal seta, basal article short; endopod 1-articulate.

Etymology. From the Greek *thalykros* meaning hot, referring to the increase in water temperature due to vent activity in the environment where type species was collected.

Type species. *Thalycrocuma sarradini* sp. nov.

Remarks. Although in most of the genera of the family Nannastacidae males have five pairs of exopods (on maxilliped 3 and pereopods 1-4) there are few with a lower number. Males of *Picrocuma* Hale 1936, *Cubanocuma* Bacescu and Muradian 1977 and *Claudicuma* Roccatagliata 1981 have no exopod on pereopod 4, while those of *Almyracuma* Jones and Burbanck 1959 have not exopods beyond pereopod 2. *Thalycrocuma* gen. nov. resembles *Almyracuma* by the number of exopods and *Picrocuma* by the shape and length of antenna of male but neither has the combination of both characters. Moreover males and preadult females of *Thalycrocuma* have the branchial siphons slightly separated. The monotypic genus *Elassocumella* Watling 1991 is only known by a single adult female that has not exopods. It is possible that males of this genus could also have a reduced number of exopods, but *Elassocumella* also differs from the genus described above by the shortness of its uropods.

Finally, the presence of sensory setae on the peduncle of antennula is a case unique between the nannastacid males. Although males of some genera of other cumacean families have sensory setae on the antennula, they are located in most of the cases on the main flagellum.

Thalycrocuma sarradini sp. nov. (Figures 1-6)

Type material. North Atlantic Ocean, Mid-Atlantic Ridge, Azores Triple Junction, Lucky Strike vent area. Holotype: ATOS cruise, sediment trap ML3-19 (2.5 m above the bottom), site Sintra, 37°17.539´N, 32°16.404´W, 1630 m, 3.07.2002, adult female (MNHN Cu-1103). Allotype: TTR10 cruise, stn AT271Gr, TV-grab, 37°17.461’N, 32°16.924’W, 1712 m, 4.08.2000, adult male dissected in one slide (MNHN Cu-1104). Paratypes: same station as holotype, one preadult female dissected in two slides (MNHN Cu-1105); stn ML3-18, one manca (MNHN Cu-1106); PICO cruise, sample number SMAC C-6, 37°17.357´N, 32°16.479´W, 1705 m, 6.07.1998, two juveniles (MNHN Cu-1107); SMAC B-9, 37°17.358´N, 32°16.511´W, 1690 m, 5.07.1998, one juvenile (MNHN Cu-1108); same station as allotype, four adult females, 15 preadult females, 13 males (DBUA-00874.05) three additional males were used for SEM study;

TTR12 cruise, stn AT436Gr, TV-grab, 37°17.300’N, 32°16.563’W, 1709 m, 29.08.2002, three adult females, three preadult females, 6 males (ICMU 60/2007) and 6 males (MNHN Cu-1109).

Other material. Location close to the holotype. TTR10 cruise, stn AT250Gr, TV-grab, 37°17.275’N, 32°16.525’W, 1704 m, 1.08.2000, two adult females, two preadult females, two males (DBUA-00874.01); TTR10, stn AT251Gr, TV-grab, 37°17.356’N, 32°16.657’W, 1685 m, 1.08.2000, one preadult female (DBUA-00874.02); TTR10, stn AT255Gr, TV-grab, 37°17.503’N, 32°16.610’W, 1680 m, 2.08.2000, one male (DBUA-00874.03); TTR10, stn AT279Gr, TV-grab, 37°17.400’N, 32°16.625’W, 1703 m, 5.08.2000, two adult females (one of them used for SEM study), one male (DBUA-00874.04); TTR12, stn AT428Gr, 37°17.289’N, 32°16.522’W, 1716 m, 26.08.2002, one adult female, one male (DBUA-00875.01).

Etymology. The species is named in honour of Pierre-Marie Sarradin (Ifremer, Brest) for his valuable accomplishments in the study of the environmental conditions of hydrothermal vent communities.

Diagnosis. Carapace covered by small spines and with 2-3 teeth on mid-dorsal line. Eyelobe rounded, not reaching the end of pseudorostrum. Antero-lateral angle acute, lower margin serrate. Pleonites 3-5 with five longitudinal rows of spines, pleonite 6 with three. Uropod peduncle longer than endopod, with serrate outer margin and a dorsal row of spines.

Description. Adult female 2.43 mm total length. Carapace (Figure 1A) more than 1/3 of total length fully covered by small spines directed forwardly (Figure 4A) (sometimes difficult to see when it is covered by sediment) and two teeth on mid-dorsal line; eyelobe rounded not reaching the tip of pseudorostrum, without optical lenses; pseudorostral lobes meeting in front eyelobe (slightly separated in preadult females); anterolateral angle acute, lower margin serrate. Pleonites 3-5 with longitudinal rows of spines (Figure 4B); pleonite 6 with three rows (spines were not visible on free pereonites and proximal pleonites because the thin sediment layer covering the animal). Antennula (Figure 1B), peduncle 3-articulate; article 1 longer than article 3; article 2 shorter than article 3; main flagellum 2-articulate, with two aesthetascs and two long simple setae; accessory flagellum rudimentary. Left mandible (Figure 1C) with three teeth on the pars incisiva, five setae between pars incisiva and truncated pars molaris (six setae on right mandible; Figure 1D). Maxillula (Figure 1E) palp with two unequal filaments, inner endite with four setae, two simple, one trifid and one serrulate. Maxilla endites exceeding the protopod, with simple and serrulate setae.

Maxilliped 1 (Figure 1F) basis with four plumo-serrate and two simple setae on inner margin, distally produced reaching carpus; carpus with four flattened hand-like-side setae on the inner margin; propodus with three setae on distal inner corner. Maxilliped 2 (Figure 2A) basis shorter than rest of appendage, with a long plumose seta on distal inner corner; merus with a long plumose seta on distal inner corner; carpus shorter than merus with simple seta on inner margin; propodus shorter than carpus, with simple seta on inner margin and two plumose setae distally. Maxilliped 3 (Figure 2B) with well developed exopod, basis as long as rest of appendage, not expanded distally, with three long plumose setae on distal outer corner and two pappose setae on inner margin; merus with a plumose seta on inner margin; carpus longer than merus, with a plumose and a simple setae on inner margin and a long plumose seta on distal outer corner; propodus longer than carpus with two setae on inner margin; dactylus half length of propodus. Pereopod 1 (Figure 2C) with well developed exopod, basis shorter than the rest of appendage, with two simple and one plumose setae distally; merus longer than ischium; carpus twice as long as merus with simple setae on both margins; propodus shorter than carpus and longer than dactylus. Pereopod 2 (Figure 2D) with well developed exopod, basis shorter than rest of appendage, with a small plumose seta on distal lower corner, upper margin serrate with a plumose seta near the distal margin; ischium very short with a plumose seta on distal lower corner; merus shorter than carpus; carpus with two cuspidate setae on distal lower corner; propodus half length of merus with a seta on distal corner; dactylus more than two times as long as propodus, with a simple seta on lower margin, one on upper margin and four terminally (the longest longer than article). Pereopod 3 (Figure 3A) basis longer than rest of appendage, anterior margin serrate, with simple setae on anterior margin and a plumose seta on distal corner; ischium with two simple setae on distal corner; merus with two simple seta on the margin; carpus twice as long as merus, with a long simple setae on distal corner; propodus shorter than half length of carpus, with a long simple seta on distal corner. Pereopod 4 (Figure 3B) basis as long as rest of appendage with simple and articulate setae; merus with a simple seta on distal corner; carpus three times as long as merus, with a simple seta on distal corner; propodus shorter than half length of carpus, with a long simple seta on distal corner. Pereopod 5 (Figure 3C), basis shorter than rest of appendage; carpus three times as long as propodus with a long simple seta on distal corner; propodus shorter than merus, with a long simple seta on distal corner.

Uropod peduncle (Figure 3D) longer than pleonite 5 and 1.5 times as long as endopod, outer margin serrate and with a dorsal row of spines; endopod 1-articulate with outer margin serrate on its proximal 2/3, 6 acuminate setae on inner margin and 4 terminally; exopod 2-articulate, shorter than endopod, with two long simple setae terminally.

Adult male 2.05 mm total length, carapace fully covered by small directed forwardly spines (Figure 4C, D) branchial siphons longer than in adult female and slightly separate (Figure 5A). Antennula (Figures 4E, F, 5B), peduncle 3-articulate; article 1 slightly longer than article 3; article 2 nearly as long as article 3; article 3 with two sets of sensory setae on ventral face and several more on distal margin; main flagellum 2-articulate, with two aesthetascs and two long simple setae; accessory flagellum rudimentary. Antenna (Figure 5C) not exceeding length of carapace; peduncle 5-articulate, article 5 the longest with three long sensory setae near the distal margin; flagellum 6-articulate shorter than peduncle. Mouth appendages as in female.

Maxilliped 3 and pereopods 1 (Figure 5D) and 2 (Figure 6A) with well developed exopods. Pereopods 3-5 (Figures 6B-D) and uropods of the same proportions and ornamentation than in female.

Remarks. Although male of *Thalycrocuma sarradini* sp. nov. is easily identifiable by the number of exopods and the shape of antenna (see remarks on the genus above), female resembles *Cumella hystrix* Gamô 1997, and *Cumella spinifera* Petrescu and Heard 2004b by having the carapace covered with small spines. *Cumella hystrix* is twice larger than *T. sarradini* (4.6 vs 2.4 mm of total length, measured in adult females) and its uropod peduncles are not strongly serrate. Moreover, it actually has an elongate eyelobe, a character that places it within the genus *Styloptocuma*, thus we hereby formally transfer *Cumella hystrix* Gamô 1997 to *Styloptocuma* Bacescu and Muradian 1974 to become *Styloptocuma hystrix* (Gamô 1997), new combination.

Cumella spinifera, a shallow-water species, also has its carapace covered by small spines, but the pleon somites have no spines and its uropod peduncle is smooth.

Key to the genera of the family Nannastacidae

Based in part on the key published by Bacescu and Muradian (1977) a new one is here proposed including the new genera described since then:

1 – Molar process of the mandible truncate 2
– Molar process of the mandible styliform 19

2 – Ocular elements separate in two groups 3
– Ocular elements fused in a single median lobe or absent 5

3 – Branchial siphons separate .... *Schizotrema* Calman 1911
– Branchial siphons united medially 4

4 – Anteroventral corner large, acute and strongly projecting, pseudorostral lobes short, directed slightly upward .... *Nannastacus* Bate 1865
– Anteroventral corner in female acute or subacute, not projecting, pseudorostral lobes elongate, united in front of head .... *Scherocumella* Watling 1991

5 – Female without exopods 6
– Female with at least 2 pairs of exopods 7

6 – Eyelobe rounded not reaching the tip of pseudorostrum, peduncle of uropods shorter than pleonite 6 .... *Elassocumella* Watling 1991
– Eyelobe narrow, elongate, reaching the tip of pseudorostrum, peduncle of uropods longer than pleonite 6 .... *Styloptocumoides* Petrescu 2006

7 – Antenna rudimentary in males as in females 8
– Antenna of males with a flagellum more or less long 9

8 – Three pairs of exopods in both sexes...... *Almyracuma* Jones and Burbanck 1959
– Male with four pairs of exopods........................ *Claudicuma* Roccatagliata 1981

9 – Antenna of male with a short flagellum not exceeding posterior margin of carapace

.... 10

– Antenna of male with a long flagellum exceeding the posterior margin of carapace 14

10 – Antenna of male with flagellum shorter than peduncle 11

– Antenna of male with flagellum shorter than peduncle 12

11 – Both sexes with four pairs of exopods............................... *Picrocuma* Hale 1936

– Both sexes with three pairs of exopods.......................... *Thalycrocuma* gen. nov.

12 – Females with two pairs of exopods .... *Atlantocuma* Bacescu and Muradian 1974

– Females with three pairs of exopods 13

13 – Gut spirally coiled .... *Platycuma* Calman 1905

– Gut not coiled .... *Cumellopsis* Calman 1905

14 – Eyelobe narrow, elongate, reaching the end of pseudorostral lobes ....*Styloptocuma* Bacescu and Muradian 1974

– Eyelobe rounded with or without lenses 15

15 – Branchial siphons separate .... *Schizocuma* Bacescu 1972

– Branchial siphons united medially 16

16 – Pars incisiva of mandible with four teeth, peduncle of antennula article 2 with a tubercle... *Vemacumella* Petrescu 2001

– Pars incisiva of mandible with three teeth, peduncle of antennula without tubercle 17

17 – Peduncle of uropod shorter than pleonite 6 18

– Peduncle of uropod as long as or longer than pleonite 6 ....*Cumella* Sars 1865

18 – Pereopod 2 without ischium......................*Humesiana* Watling and Gerken 2001
– Pereopod 2 with iscium.. *Bacescella* Petrescu 2000b

19 – Females without exopods........................ *Normjonesia* Petrescu and Heard 2001
– Females with at least three pairs of exopods (on maxilliped 3 and pereopods 1 and 2).. 20

20 – Females with rudimentary exopods on pereopods 3 and 4.............................. 21
– Females with only three pairs of exopods 22

21 – Basis of maxilliped 2 with a peculiar club-shaped organ.....................................
.... *Floridocuma* Bacescu and Muradian 1974
– Basis of maxilliped 2 without this organ, dactyl of pereopod 2 club-shaped ....
....*Bathycampylaspis* Mühlenhardt-Siegel 1996

22 – Dactylus of maxilliped 2 with long spines or teeth 23
– Dactylus of maxilliped 2 short, ending in two or more spines......................... 24

23 – Dactylus of maxilliped 2 in from of a trident ....*Campylaspides* Fage 1929
– Dactylus of maxilliped 2 shaped like a rake ....*Procampylaspis* Bonnier 1896

24 – Males with four pairs of exopods.........*Cubanocuma* Bacesu and Muradian 1977
– Males with five pairs of exopods.. 25

25 – Male with a very large and well developed penis on last pereonite......................
....*Campylaspenis* Bacesu and Muradian 1974
– Male without a well developed penis 26

26 – Pseudorostral lobes not meeting in front of head *Pavlovskeola* Lomakina 1955
– Pseudorostral lobes meeting in front of head.. 27

27 – Carpus of maxilliped 3 expanded laterally, anterolateral angle well produced
.... *Paracampylaspis* Jones 1984
– Carpus of maxilliped 3 not expanded .... *Campylaspis* Sars 1865

Taxonomical affinities

As commented above, the new genus described here shows its higher affinities with *Almyracuma*, *Claudicuma* and *Picrocuma.* All the species of these three nannastacid genera live in shallow-water. The two known species of the genus *Almyracuma* inhabit brackish and freshwater habitats of the south coast of the United States and some specimens were collected 100 km upstream (Petrescu and Heard 2004a). *Claudicuma*, a monotypic genus, has been recorded on the Argentine shore of Rio de la Plata, from Buenos Aires to Punta Indio, about 150 km downstream, where salinity range from 0.5 to 7 (Roccatagliata 1991). Finally, the three species of *Picrocuma* are known from Australian coasts where are common in sandy bottoms and rocky reef up to 4 m depth (Tafe and Greenwood 1996; Mühlenhardt-Siegel 2003). It is difficult to understand how the deep-water genus described above have such morphological affinities with littoral genera. However, similar affinities with shallow-water fauna have been pointed out for deep-sea hydrothermal vents and cold-water seeps bathymodiolid mussels (Craddock et al. 1995; Distel et al. 2000) and polychaete worms in the genera *Ophryotrocha* and *Amphisamytha* (Van Dover 2000). It seems to be clear that reduction in the number of exopods is a character that could have evolved independently by different ways (it may be observed also in other cumacean families) and within the Nannastacidae it could be associated to the life in stressed environments.

Ecological remarks

The SMACs, where part of the material studied were collected, had been placed on a mussel bed close to an active chimney. In such mussel assemblages, the temperature ranges generally between 5 and 15°C but can even reach 25°C (Sarradin et al. 1999). Alvinocaridid shrimps, bythograeid crabs and galatheid crabs live on this mussel bed (Desbruyères et al. 2001). The trays of SMACs containing cumaceans were composed of artificial sediment not enriched by organic matter. It contained 323 invertebrates including (in order of decreasing abundance): Polychaeta, Copepoda (4 families of which Tisbidae having species known for their strong preference for the hydrothermal conditions; V. Ivanenko, unpublished data), vent gastropods *Lurifax vitreus* Warén and Bouchet 2001 and *Protolira thorvaldssoni* Warén 1996 (A. Warén, unpublished data), post-larvae of mytilid bivalves and Ostracoda.

The holotype and two paratypes were collected in a sediment trap with a male of *Bathycuma brevirostre*, a moult of *Makrokylindrus* sp. and the vent gastropods *Protolira thorvaldssoni*. These hydrothermal vent gastropods, as well as the cumaceans, are benthic. It is thus surprising to find them in trap whose opening is located at 2.5 m of the bottom. As noticied by Khripounoff et al. (in press) it is suggested that the hydrodynamic turbulence occurring around the active black smokers, could cause re-suspension of the hydrothermal sediment and the small-sized animals.

The material obtained during the TTR cruises was collected inside the vent field, mostly in the SE area, close to Tour Eiffel, Y3 and Chimiste vents (see Desbruyères et al. 2001) but also from the NW area (close to Nuno vent), and from different geological settings: sulphides from areas of active diffuse venting (AT271Gr), sulphides and sulphide rubble from more peripheral areas (AT251Gr, AT255Gr) where a specimen of *Procampylaspis* sp. was also collected (AT248Gr), hydrothermal slabs near active venting (AT428Gr and AT436Gr), and volcanic basalts (AT250Gr, AT279Gr). Higher abundances were recorded in the vicinity of active areas (AT271Gr, 40 individuals; AT436Gr, 21 individuals) together with more than 30 other species of macroinvertebrates, including typical vent polychaetes (*Amathys lutzi* Desbruyères and Laubier 1996 and other Ampharetidae, Polynoidae and several other families) and molluscs but mainly small peracarid crustaceans such as several species of tanaids (Larsen et al. 2006), the abundant *Bonnierella compar* (Myers and Cunha 2004) and other amphipods, and different isopod species. *Thalycrocuma sarradini* appears to be a common and rather abundant species in Lucky Strike; it was retrieved from eight out of 29 grab samples collected inside the vent field but in none of the five grab samples collected in the Lucky Strike segment outside the vent field. The ochre colour of the studied cumaceans is caused by oxide-sulphide deposits, which indicate a hydrothermal way of life. Thus we believe that *Thalycrocuma sarradini* is the first species of Cumacea endemic of the hydrothermal areas. An effort of macrofauna sampling of the hydrothermal sediments will be needed to confirm this idea.

Sets of sensory setae on the male antennula are a rare feature within the Nannastacidae. Similar receptors were described from the antennae of the vent shrimps *Rimicaris* and their chemical sensitivity was demonstrated (Renninger et al. 1995). These shrimps have a positive response to sulphides. However, the presence of this kind of sensory receptors only in adult males could be associated alternatively to the search of the female for reproductive purpose. Physiological studies, which are very scarce in the cumacean literature, will be useful to know the function of such sensory structures.

Acknowledgements

We thanks the Chief scientists Pierre-Marie Sarradin (ATOS, Ifremer), Daniel Desbruyères (PICO, Ifremer), Ana Colaço (Arquipélago, IMAR, Portugal) and Mikhail Ivanov (TTR10 and TTR12, Moscow State University, Russia) and José Hipólito Monteiro, (TTR10 and TTR12, INETI, Portugal); Alexis Khripounoff (Ifremer), responsible of the sediment trap; as well as the Captains and crew of the R/Vs *L'Atalante, Nadir, Arquipélago* and *Prof. Logatchev,* and the pilots of the submersibles *Nautile* and ROV *Victor 6000*. This work was partly funded through the MAST 3, AMORES (MAS3-CT95-0040) and VENTOX European projects (EVK3-1999-00003). R. Fontarnau and collaborators are also thanked for their assistance during SEM sessions in the Serveis Cientificotècnics (University of Barcelona).

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Table 1. Station data for the samples yielding Cumacea. The active chimneys or vent sites closest to each sampling location are referred in brackets using the names given during French and American cruises (see Desbruyères et al. 2001).

Cruise	Station /sample	Date	Latitude	Longitude	Depth (m)	Lithology	Location	Species
PICO	SMAC-B9	5.07.1998	37°17.358'N	32°16.511'W	1690		SE area (Tour Eiffel) near active chimneys	*Thalycrocuma sarradini*
PICO	SMAC-C6	6.07.1998	37°17.357'N	32°16.479'W	1705		SE area (Tour Eiffel) near active chimneys	*Thalycrocuma sarradini*
TTR10	AT248Gr	1.08.2000	37°17.425'N	32°16.509'W	1665	Sulphide	SE area	*Procampylaspis* sp.
TTR10	AT250Gr	1.08.2000	37°17.275'N	32°16.525'W	1704	Volcanic: hyaloclastic rocks	SE area (Tour Eiffel) near active chimneys	*Thalycrocuma sarradini*
TTR10	AT251Gr	1.08.2000	37°17.356'N	32°16.657'W	1685	Sulphide	SE area	*Thalycrocuma sarradini*
TTR10	AT255Gr	2.08.2000	37°17.503'N	32°16.610'W	1680	Hydrothermal slab	SE area	*Thalycrocuma sarradini*
TTR10	AT271Gr	4.08.2000	37°17.461'N	32°16.924'W	1712	Sulphide: low temperature, active	NW area (Nuno), diffuse venting	*Thalycrocuma sarradini*
TTR10	AT279Gr	5.08.2000	37°17.400'N	32°16.625'W	1703	Volcanic: high vesicularity lava	SE area (Y3)	*Thalycrocuma sarradini*
ATOS	ML3-7	3.07.2002	37°17.539'N	32°16.404'W	1630		NE area (Sintra) between two active chimneys	*Bathycuma brevirostre*
ATOS	ML3-12	3.07.2002	37°17.539'N	32°16.404´W	1630		NE area (Sintra) between two active chimneys	*Makrokylindrus* sp.
ATOS	ML3-18	3.07.2002	37°17.539'N	32°16.404'W	1630		NE area (Sintra) between two active chimneys	*Thalycrocuma sarradini*
ATOS	ML3-19	3.07.2002	37°17.539'N	32°16.404'W	1630		NE area (Sintra) between two active chimneys	*Thalycrocuma sarradini*
TTR12	AT425Gr	26.08.2002	37°20.465'N	32°16.437'W	2072	Volcanic: massive lava	Outside the vent field	*Cyclaspis longicaudata*
TTR12	AT428Gr	26.08.2002	37°17.289'N	32°16.522'W	1716	Hydrothermal slab	SE area (Chimiste) near active chimney	*Thalycrocuma sarradini*
TTR12	AT436Gr	29.08.2002	37°17.300'N	32°16.563'W	1709	Hydrothermal slab	SE area (Chimiste) near active chimney	*Thalycrocuma sarradini*

Figure 1. *Thalycrocuma sarradini* gen. et sp. nov. female: A, habitus in lateral view; B, antenna 1; C, right mandible; D, left mandible; E, maxilula; F, maxiliped 1.

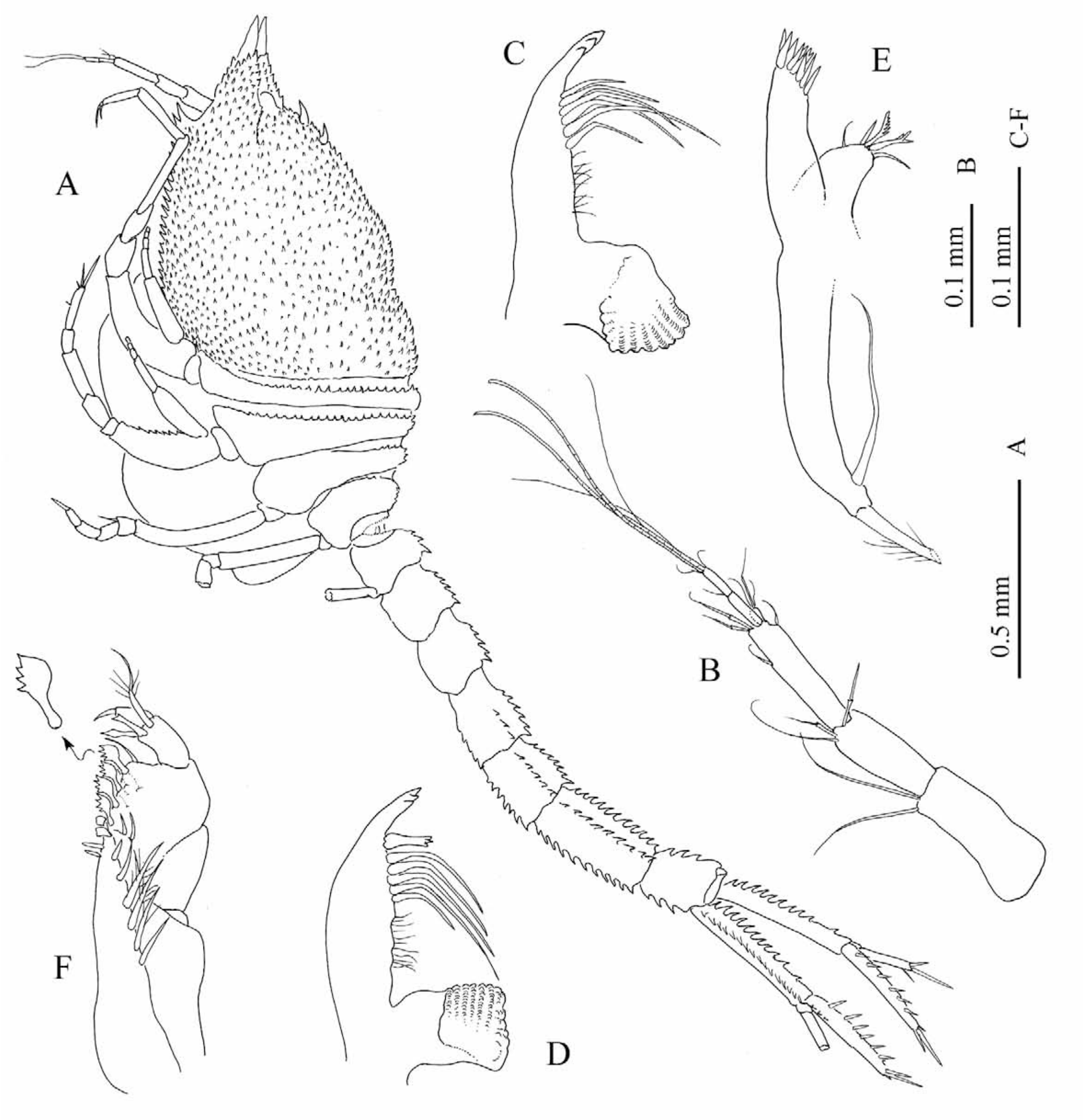

Figure 2. *Thalycrocuma sarradini* gen. et sp. nov. female: A, maxilliped 2; B, maxilliped 3; C, pereopod 1; D, pereopod 2.

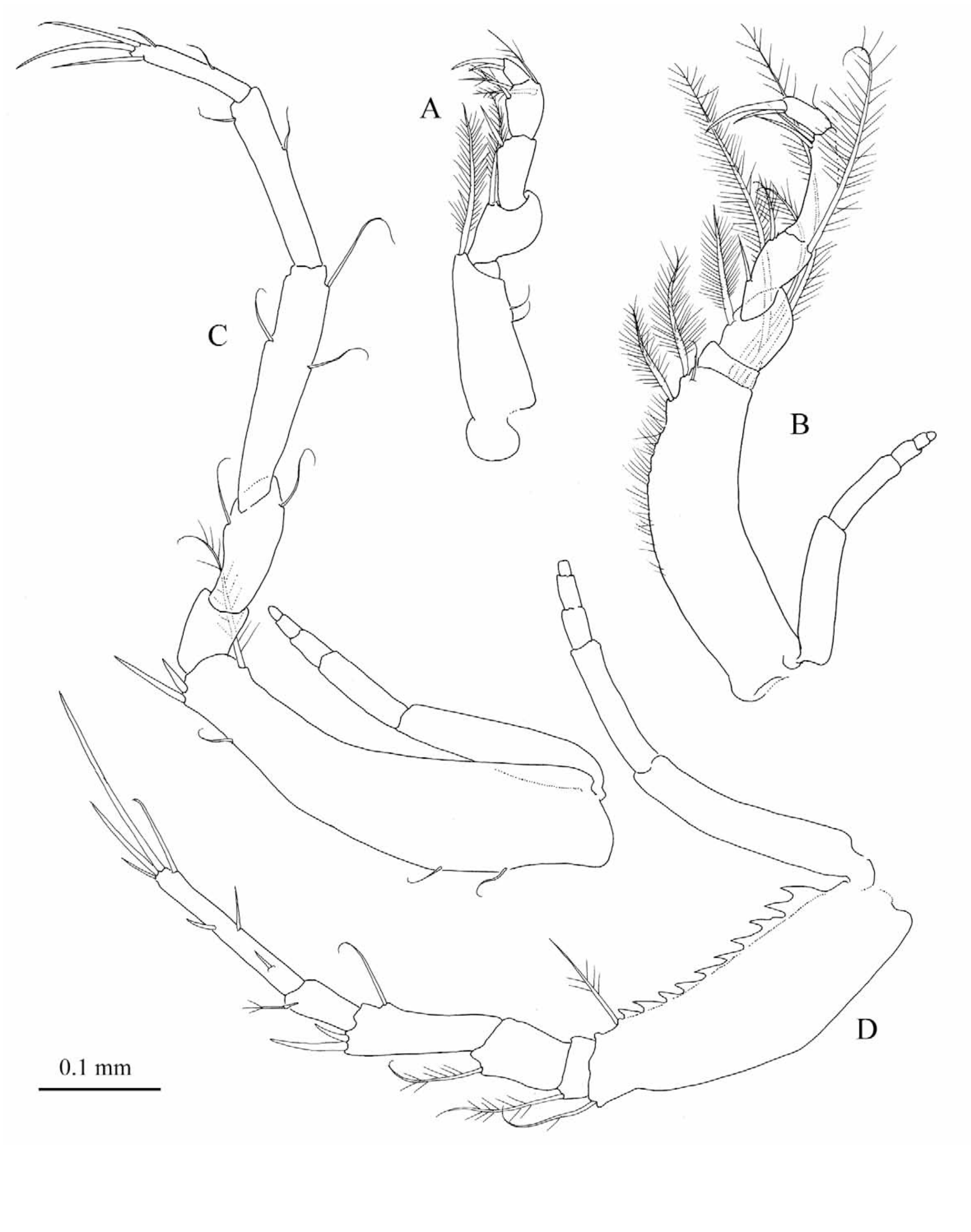

Figure 3. *Thalycrocuma sarradini* gen. et sp. nov. female: A, pereopod 3; B, pereopod 4; C, pereopod 5; D, uropod.

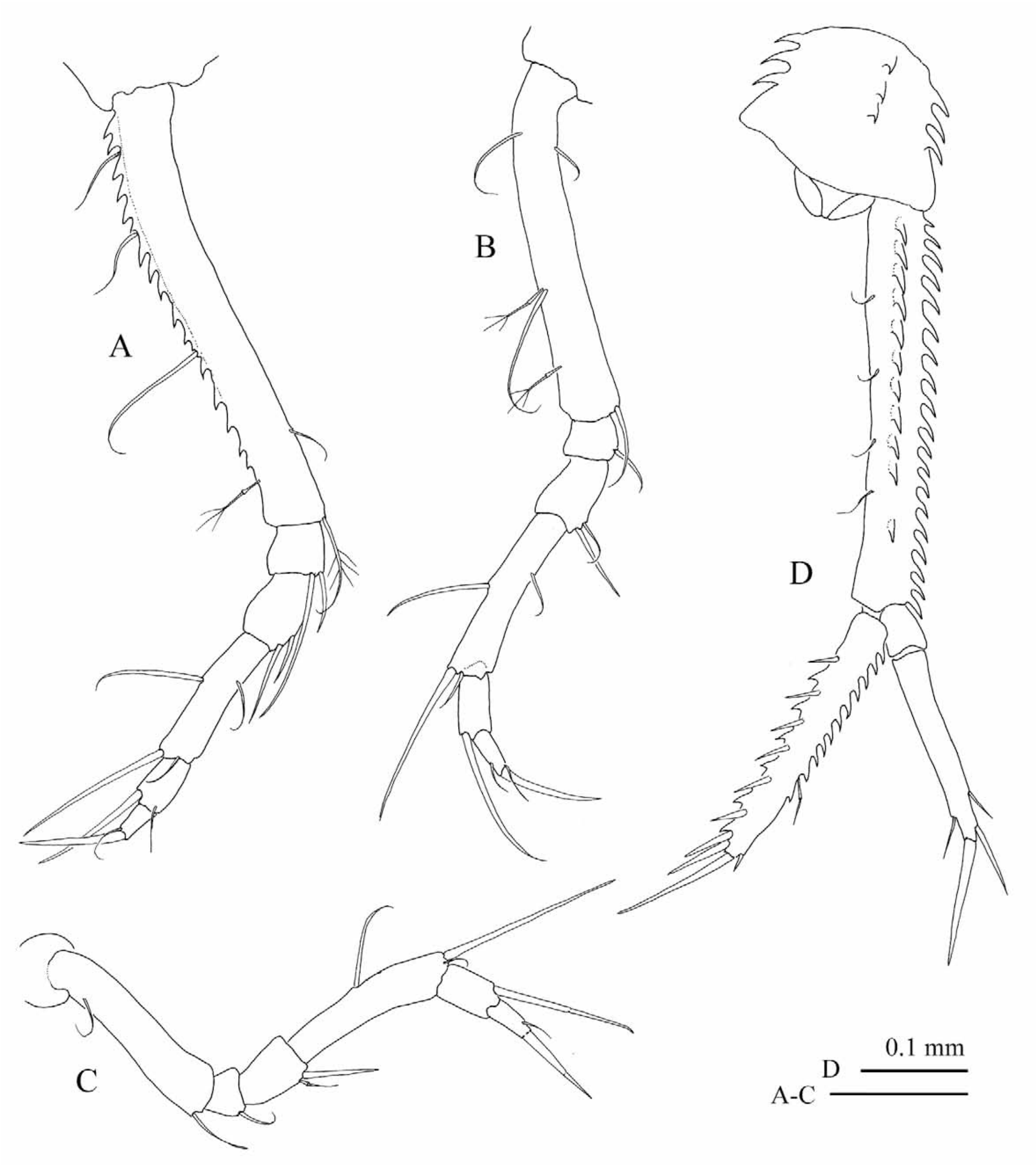

Figure 4. *Thalycrocuma sarradini* gen. et sp. nov. SEM photographs. Adult female: A, carapace cuticle showing the forwarded spines; B, pleonites 2 and 3 showing the longitudinal rows of spines. Adult male: C, cephalothorax in lateral view; D, carapace cuticle showing the forwarded spines; E, antennules between the first pair of pereopods; F, sensory setae attached on the ventral face of the article 3 of the peduncle of antennula.

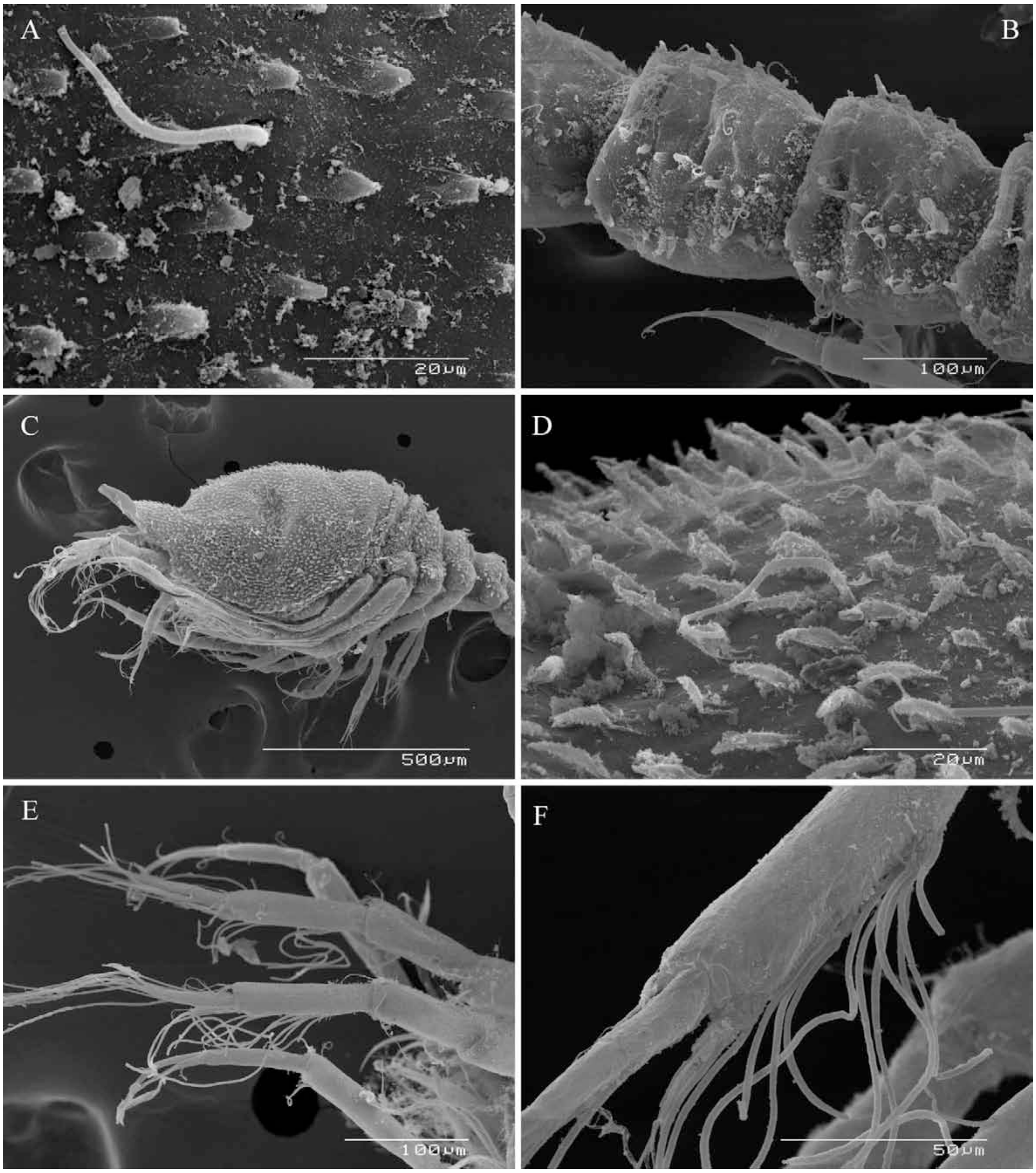

Figure 5. *Thalycrocuma sarradini* gen. et sp. nov. adult male: A, dorsal view of frontal lobe and pseudorostrum; B, antennula; C, antenna; D, pereopod 1.

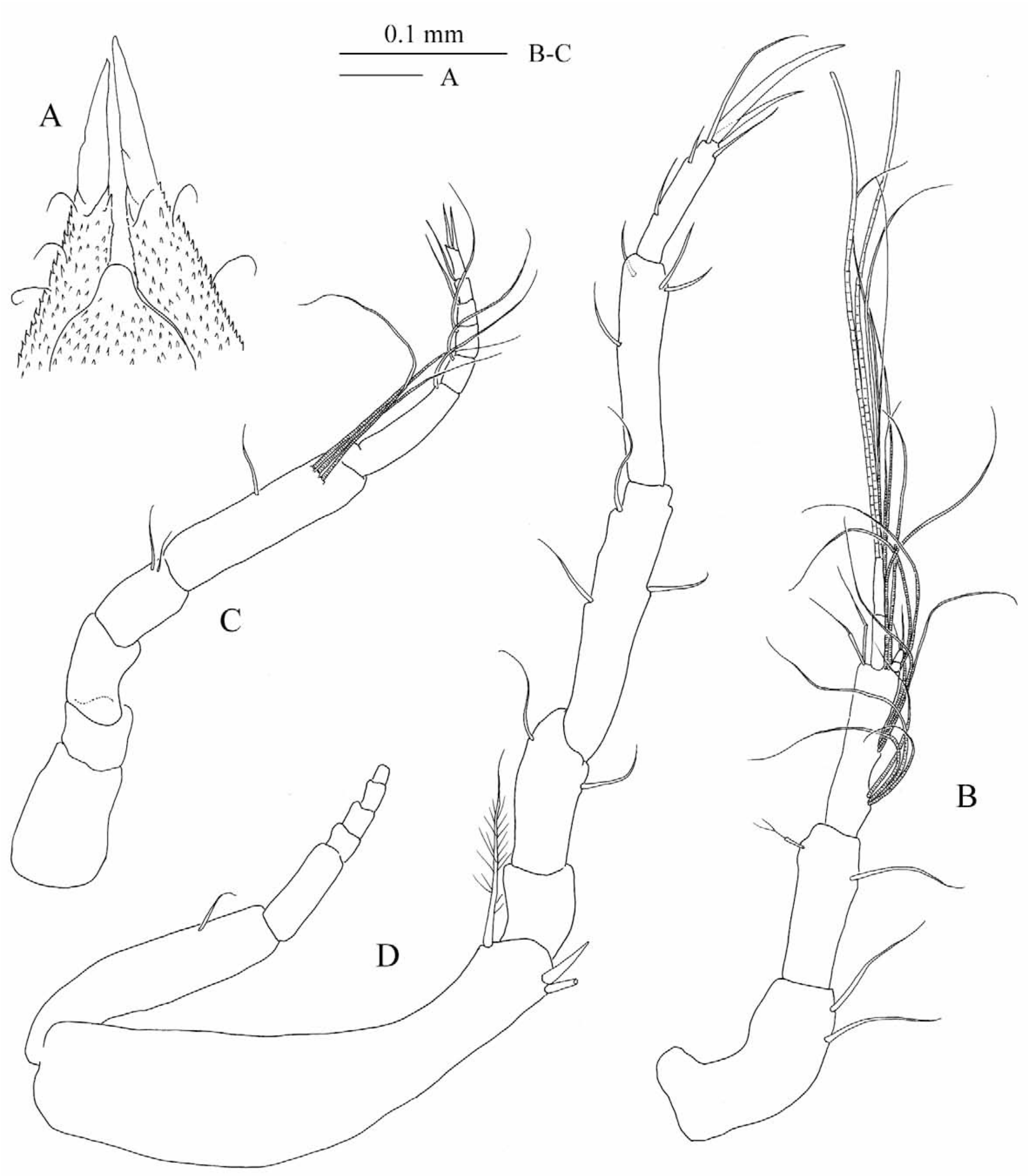

Figure 6. *Thalycrocuma sarradini* gen. et sp. nov. adult male: A, pereopod 2; B, pereopod 3; C, pereopod 4; D, pereopod 5.