

NEBALIA DEBORAHAE, A NEW SPECIES OF LEPTOSTRACA
(PHYLLOCARIDA) FROM SOUTH WEST AFRICA

BY

RALF BOCHERT^{1,2}) and MICHAEL L. ZETTLER¹)

¹) Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Dept. Biological Oceanography,
Seestr. 15, D-18119 Rostock, Germany

ABSTRACT

Nebalia deborahae new species is described from samples collected in coastal shelf zones off Namibia and Angola, in 2004 and 2008. The genus *Nebalia* is now represented in West and South Africa by three species. The new species differs from other African species in the length/width ratio of the rostrum, in the armature of the fourth segment of the antennule, in the dentation on the dorsal side of pleonites 6 and 7, and in the shape of the posterolateral corner of the epimeron of the fourth pleonite.

ZUSAMMENFASSUNG

Nebalia deborahae eine neue Art wird von Proben der Küstenschelfzone von Namibia und Angola beschrieben, die in den Jahren 2004 und 2008 gesammelt wurden. Die Gattung *Nebalia* wird nun in West- und Südafrika von drei Arten repräsentiert. Die neue Art unterscheidet sich von anderen afrikanischen Arten im Verhältnis von Länge zu Breite des Rostrums, in der Beborstung des vierten Gliedes der Antenne 1, in der dorsalen Bezahnung der Pleonite 6 und 7 und in der Form der hinteren seitlichen Ecke der vierten Pleonplatte.

INTRODUCTION

The genus *Nebalia* Leach, 1814 is one of four nominal genera of the family Nebaliidae Samouelle, 1819 and currently contains more than 30 distinct species all over the world (Mees, 2011). Leptostracans have been found from shallow waters to more than 2000 m depth, but they have been recorded mostly in less than 200 m depth (Walker & Poore, 2001). The specimens are predominately benthic, and associated with algal mats or organic detritus (Haney & Martin, 2004). A new classification of the Leptostraca based on a phylogenetic analysis is given

²) Fax: +49-381-5197-221; e-mail: ralf.bochert@io-warnemuende.de

by Walker & Poore (2001). Numerous new species were described in the genus *Nebalia* during the last two decades (Escobar-Briones & Villalobos-Hiriart, 1995; Martin et al., 1996; Vetter, 1996; Olesen, 1999; Haney & Martin, 2000, 2005; Haney et al., 2001; Moreira et al., 2003, 2007). These new species were found especially in the United States (California region) and southern Europe, including the Mediterranean Sea and the Red Sea. A general summary with an overview of all known species is lacking to date, although a revision of the European shelf species, including five species of the genus *Nebalia*, was given by Dahl (1985) and a further review of *Nebalia* from the southern hemisphere lists eight species (Dahl, 1990). Subsequently, Olesen (1999) described *Nebalia brucei* Olesen, 1999 from Tanzania (East Africa). Only two species are known from the Southwest African coast: *Nebalia capensis* Barnard, 1914 and *Nebalia iltheoensis* Kensley, 1976 (cf. Barnard, 1914; Kensley, 1976). In geographical relation to this oceanic area, the records of *Nebalia straussi* Risso, 1826 are of interest. This species was found, inter alia, on St. Helena, a small island in the South Atlantic more than 1000 km west of Angola, and on the Canary Islands off Northeast Africa (Dahl, 1985).

During two benthic investigations in the coastal shelf zones off Angola and Namibia, a small collection of 11 leptostracan specimens, all belonging to the genus *Nebalia*, was acquired. The specimens differed, however, from any known species of the genus, in some morphological features. We thus describe these herein as a new species.

MATERIAL AND METHODS

Benthic organisms were collected with a grab from 30 to 42 m depth during the cruises of the R/V "Alexander von Humboldt" in 2004 and the R/V "Maria S. Merian" in 2008. Samples were fixed in 4% buffered formaldehyde-seawater solution and later sorted under a stereomicroscope. The animals were then preserved in 70% ethanol and later examined using a light microscope with up to 800× magnification. Digital microphotographs were made using an AxioCam ICC3 (Carl Zeiss MicroImaging GmbH, Jena) and the software AxioVision release 4.8.1 (Carl Zeiss Imaging Solutions GmbH, Jena). The resulting file was imported into Adobe Illustrator CS5 release 15.0 (Adobe Systems Incorporated) and digital line drawings were made using a WACOM Intuous digitiser board. Scanning electron microscopic (SEM) studies were performed with a Cam Scan 44WEX.

The type material of the new species and further material of *N. deborahae* is deposited in the Collection "Systematische Zoologie am Museum für Naturkunde (ZMB)" in Berlin. [See also endnote.]

SYSTEMATIC PART

Order LEPTOSTRACA Claus, 1880

Family NEBALIIDAE Samouelle, 1819

Genus *Nebalia* Leach, 1814***Nebalia deborahae* sp. nov.**

(figs. 1-5)

Material examined. — Holotype: female, body length 6.2 mm (ZMB 27924) (Kunene, BE30; South-East Atlantic, shelf coast off Namibia; water depth 29.6 m, grab sampling; 17°14'03''S 11°26'10''E; salinity at bottom 35.7 PSU, temperature at bottom 17.5°C, oxygen at bottom 1.19 ml/l); collected M. L. Zettler, 5 March 2008.

Paratype: 1 male 6.0 mm, same data as holotype [ZMB 27924].

Non-type material:

One male, two females, 1 female with brood 6.4 mm (AHAB8, BE2; South-East Atlantic, shelf coast off Namibia; water depth 32.3 m, grab and dredge sampling; coordinates: 18°06'14''S 11°30'17''E; salinity at the bottom 35.4 PSU, temperature at bottom 14.3°C, oxygen at bottom 1.46 ml/l); collected M. L. Zettler, 12 May 2004.

One specimen (AHAB8, BE1; South-East Atlantic, shelf coast off Namibia; water depth 42 m, dredge sampling; 18°13'05''S 11°33'10''E; salinity at bottom 35.3 PSU, temperature at bottom 13.4°C, oxygen at the bottom 0.12 ml/l); collected M. L. Zettler, 12 May 2004.

One female, 1 juvenile 3.1 mm (AHAB8, BE12; South-East Atlantic, shelf coast off Angola; water depth 37.6 m, grab sampling; 15°06'30''S 12°02'57''E; salinity at bottom 35.6 PSU, temperature at bottom 16.2°C, oxygen at bottom 0.88 ml/l); collected M. L. Zettler, 17 May 2004.

Two females 5.6-6.4 mm (same data as holotype).

Diagnosis. — Lateral carapace length up to 2.74 mm, with average of females 2.68 mm ($n = 4$) and males ($n = 1$) 2.23 mm; rostrum approximately 2.5 times as long as wide; eyestalk with pigmentation at least in distal half; supraorbital plate covering proximal half of eye dorsally; fourth article of antennule with conspicuous row of 6 to 7 short pennate setae along anterior margin and with one robust short spine terminally; posterior borders of all pleonites dentate, with teeth rounded and blunt; fourth pleonite epimeron with curved anterior lateral margin and forming an acute point; caudal furca approximately two times length of telson.

Description of adult female. — Carapace: elliptical in lateral aspect, dorsal length approximately 1.74 mm, lateral length 2.71 mm, height 1.83 mm.

Rostrum: long, 0.55 times carapace length; extending behind eyestalk, about 2.5 times as long as wide, expanding slightly near base and then tapering evenly to a rounded apex; ventral keel more or less rectangular, protruding posteriorly.

Compound eye: large, elongate-oval, slightly downturned distally, eyestalk margins relatively even, without eye papilla; pigmentation extensive, ommatidial area covering approximately half the length of the eyestalk with small space to eyestalk margin, dark pigments present and surrounded, with exception of posterior part, by row of round ommatidial structures; supraorbital plate extending to approximately half length of eye.

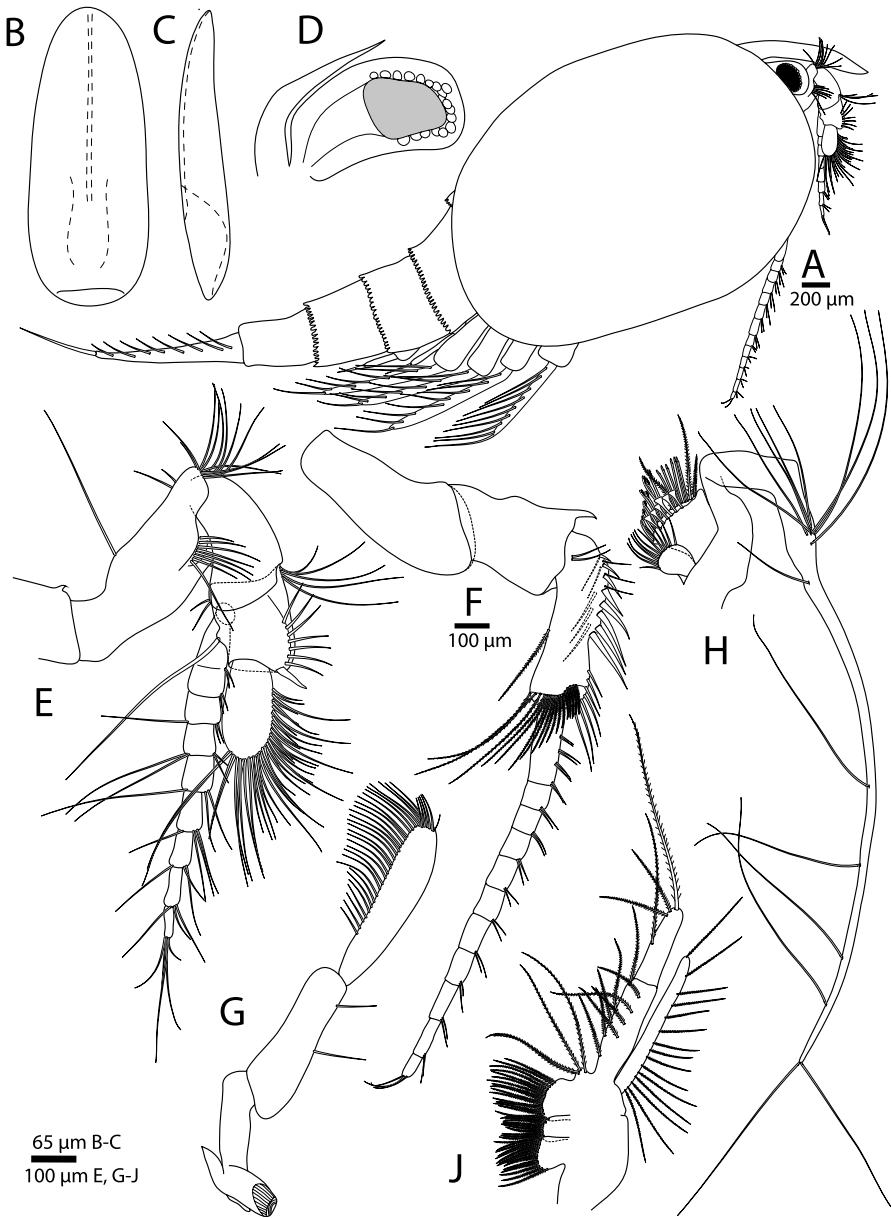


Fig. 1. *Nebalia deborahae* sp. nov. holotype female. A, habitus; B, rostrum dorsal; C, rostrum lateral; D, compound eye; E, antennule; F, antenna; G, mandible with mandibular palp; H, first maxilla; J, second maxilla.

Antennule: anteriorly directed; peduncle consisting of 4 articles; first article short; second longest, approximately 1.5 times length of third article, about 2.5 times as long as wide; with long plumose seta arising proximally on anterior

margin, with subterminal row of about 8 simple setae on posterior margin, with cluster of many simple setae on anterodistal margin; third article 0.3 mm in length, distally widened, distally with few short setae on posterior margin and with cluster of few long setae anteriorly; fourth article about three-quarter length of third, with one long setae arising medially on posterior margin, with conspicuous row of seven short pennate setae along anterior margin and with one robust short spine terminally; antennular scale elongate and nearly oval, approximately 220 μm long and 120 μm wide, anterior margin slightly convex, with rows of distinct setal types, including long and short simple setae, pinnate setae, and serrate setae; flagellum well developed, shorter than peduncle, composed of eight to ten articles, first article longest and showing evidence of fusion of multiple articles, each article bears short setae on anterodistal margin and long setae on posterior margin.

Antenna: peduncle consisting of three articles; first article elongate; second article about 1.4 times as long as wide, about two-thirds length of first, with acute distal process on anterior margin; third peduncular article elongate, more than 3 times as long as wide, with small depression at midlength on anterior margin: this and arrangement of setulation gives indication of fusion of two articles, article bears multiple groupings of setae, with one long plumose seta on mid-posterior margin, with row of different setae on proximal half of anterior margin, one row of stronger simple setae increasing in length towards distally, each associated with one thinner simple seta that is oriented at an angle, lateral with two short setae proximally and four setae at midlength, with a row of seven robust simple setae distally on anterior margin, increasing in length from proximal to distal, with a terminal row of about 17 plumose setae of different length; flagellum slightly shorter than articles of peduncle combined, composed of 11 to 14 articles, first article longest and showing evidence of fusion of multiple articles, each article with anterodistal group of four setae of different length.

Mandible: molar process 2.0 times as long as wide, slightly shorter than first article of palp, mandibular palp 3-articulate; second article bearing two simple setae on anterior margin, one at midlength and one subterminally; third article subequal to second, straight, slightly expanded subdistally, posterior margin with row of plumose setae from proximal one-fourth length to terminus, increasing in length from proximal to distal, with row of about five setae on distal margin.

First maxilla: protopod with two endites, proximal endite small, with row of about 12 simple setae; distal endite 1.5 times as long as proximal one, with a row of setae of different types, ten stout tridentate setae and six unidentate setae framed by three plumose setae, with a row of six distally broadened, spatulate setae; maxillar palp very long, slender, bearing proximal cluster of approximately eight long setae and approximately seven long setae, relatively evenly spaced along its length.

Second maxilla: protopod subdivided into four endites, endites 1 and 3 approximately equal in size, endite 2 slightly smaller, endite 1 with about 16 plumose setae, endite 2 with approximately 14 and endite 3 with approximately 22 plumose setae arising in double rows, endite 4 very small, rounded, with four long plumose setae; endopod composed of two articles, distal article only slightly shorter than proximal, distal article with four long, robust plumose setae, proximal article with approximately 9 plumose setae comprised in two rows; exopod approximately 0.78 times as long as endopod and 1.55 times as long as proximal article of endopod, with approximately 16 plumose setae on lateral margin and two setae distally.

Thoracopods: whole margins bordered by short capillary setae; endopod always exceeding length of exopod, the length ratios decrease towards caudal end from thoracopod 1 with endopod 1.7 times as long as exopod, thoracopod 2 length ratio 1.5 to thoracopod 8 length ratio 1.1, endopod weakly segmented in the last third, distal segment of each thoracopod slightly enlarged, turned at angle from main axis, bearing numerous long, plumose setae; exopod with up to 15 short and two long plumose setae on lateral margin and distally, exopod of thoracopod 1 oval, exopod of thoracopod 2 elongated oval, weakly bilobed, broad distally, exopod of thoracopod 8 elongated, broadest proximally, distally with rounded apex; epipod bilobed, with 1-3 short plumose setae on outer margin.

Pleonites: posterior borders of all pleonites dentate, with teeth evenly spaced, rounded and blunt, pleonite 4 epimeron with curved anterior lateral margin and posterolateral margin forming an acute point, pleonites 5 and 6 longer than other pleonites.

Pleopods 1-4: stenopodous, consisting of protopod, endopod, and exopod, first pleopod protopod with three simple setae arising proximally, medially and subterminally, posterior terminal spine strong, slightly shorter than exopod, anterior terminal spine two-thirds length of exopod, endopod about same length as protopod, small, with acute process at apex, with long, robust terminal spine, both lateral margins with 14-15 plumose setae, appendix interna bearing three short, stout retinacula distally, exopod approximately two-thirds as long as endopod, with four spines of alternating length distolaterally, with approximately 15 plumose setae on inner margin, with a row of approximately 18 short spines shifting from proximally inserting dorsally to distalmost inserting laterally; pleopod 2 protopod with two long and two short simple setae proximally, with two long simple setae medially, with two short plumose setae distally, endopod and retinaculum as pleopod 1, with 19-21 plumose setae on both lateral margins, exopod approximately 0.8 times as long as endopod, distally with three strong spines increasing in size towards apex, with approximately 19 plumose setae on inner margin, with row of five pairs of robust spines on inner margin, each consisting of a long and a short spine; pleopod 4 protopod approximately 0.8 times as long as endopod, lateral inner margin

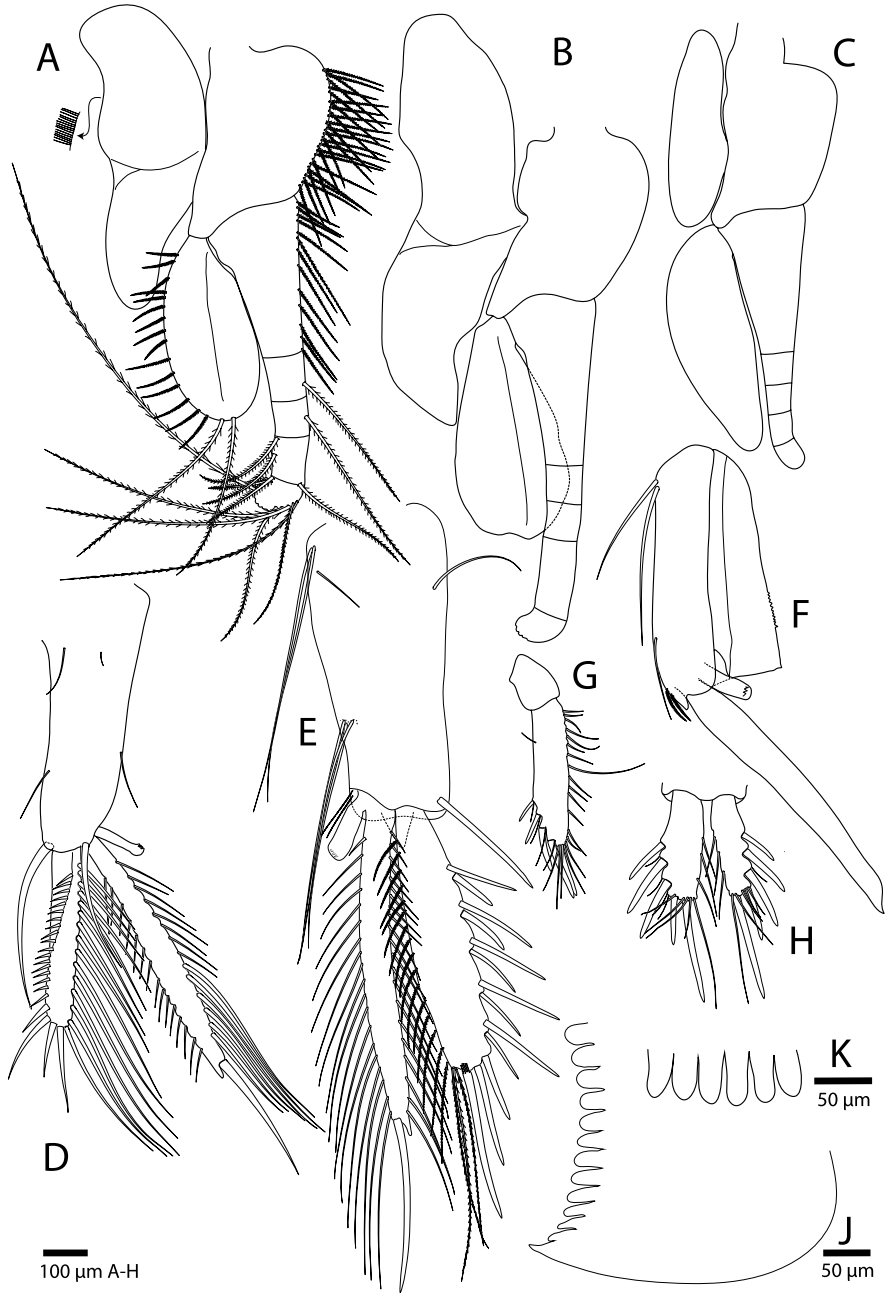


Fig. 2. *Nebalia deborahae* sp. nov. holotype female. A, thoracopod 1; B, thoracopod 2 (setae omitted); C, thoracopod 8 (setae omitted); D, pleopod 1; E, pleopod 2; F, pleopod 4 lateral view (endopodal setae omitted); G, pleopod 5; H, pleopod 6; J, pleon 4 lateral; K, pleon 7 dorsal posterior margin.

twice as high as outer margin, extended rectangular, anterior margin with minute serrations and one very small tooth, with proximal region bearing two long, simple setae, with one shorter simple seta medially and one short plumose seta subdistally, exopod with single robust spine proximally and a row of five pairs of robust spines on inner margin, consisting of a long and a short spine, and each pair accompanied by one short simple seta, otherwise similar to second pleopod.

Pleopods 5-6: pleopod 5 uniramous, 2-segmented, distal article approximately 320 μm in length, with about 17 setae on inner margin, with five robust spines subterminal and distal on outer margin each accompanied by one simple seta increasing in length towards apex; pleopod 6 uniramous, 1-segmented, ramous approximately 240 μm in length, with about three setae on inner margin, with five setae terminal, with three robust spines on outer margin and two robust spines distal, spines partially accompanied by one fine simple seta.

Anal somite, anal plates and furca: telson (anal somite) short, approximately as long as wide, rectangular, margins slightly diverging posteriorly, anal plates triangular, tapering to acute point, producing Y-shaped medial invagination, caudal rami (furca) elongate, approximately 1.0 mm in length, with 12-13 robust setae on outer margin increasing in length towards apex, with 13-14 long setae on inner margin arising from one-third to apex and 10-13 shorter, simple setae on whole inner margin, with two long robust spines of approximately same length distally.

Description of adult male. — Body length 6.0 mm, lateral carapace length 2.23 mm, dorsal carapace length 1.7 mm, carapace height 1.53 mm; rostrum 0.84 mm in length. Similar to female with the following exceptions: compound eye a little larger than in female with ommatidial area completely covering approximately two-thirds of the length of the eyestalk; antennular scale elongate, approximately 250 μm long and 110 μm wide; flagellum of the antennulae well developed, shorter than peduncle, composed of nine articles, first article longest and showing evidence of fusion of multiple articles, articles 1-4 broader than long, article 1 broadest, 145 μm wide distally, each article bears approximately 5 short setae on anterodistal margin, these setae of articles 5 and 6 longer, articles 3-8 bear one long seta distally on posterior margin; flagellum of antenna multiarticulate, with up to 40 very short articles, last few articles clearly longer, penultimate and antepenultimate articles longest.

Distribution. — To date, *Nebalia deborahae* sp. nov. is only known from shallow waters off the northern coast of Namibia and off the southern coast of Angola, South West Africa.

Etymology. — The new species is named after Deborah A. Bochert, daughter of the first author. The name thus is a noun in the genitive singular.

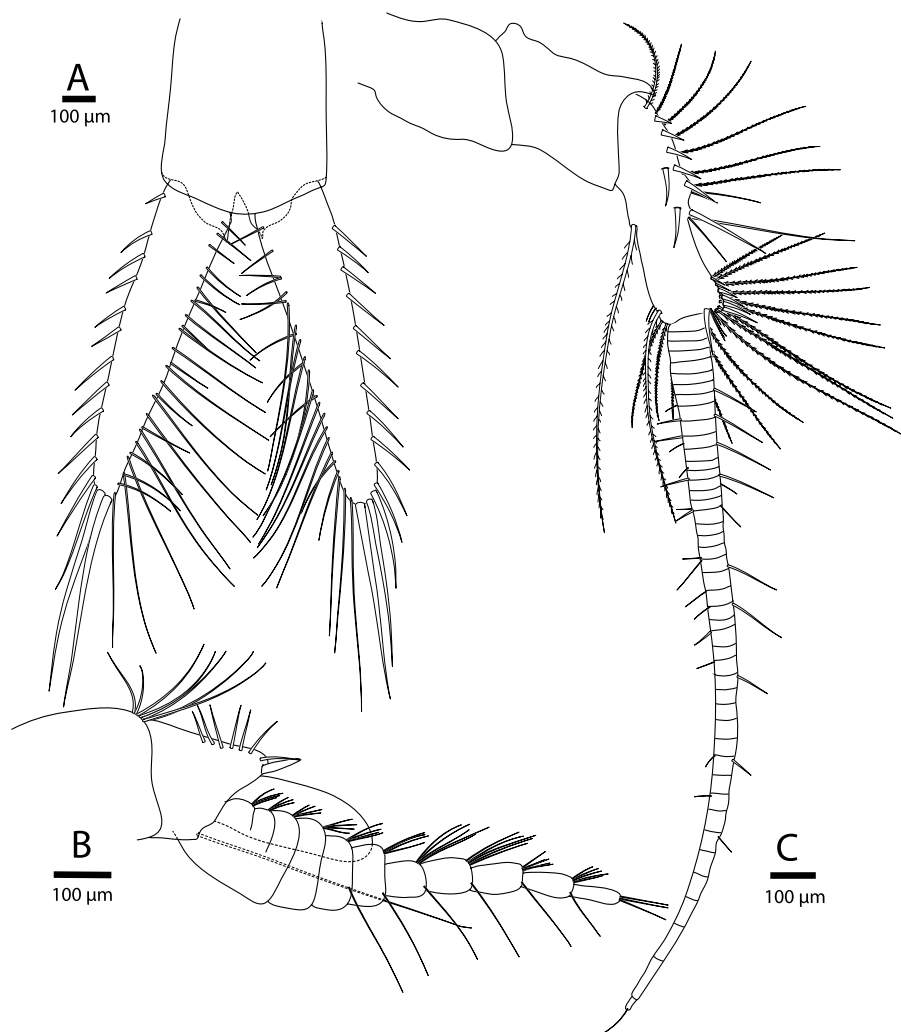


Fig. 3. *Nebalia deborahae* sp. nov. holotype female: A, telson and furca dorsal view. *Nebalia deborahae* sp. nov. paratype male: B, distal articles and flagellum of antennule (antennular scale setae omitted); C, antenna.

Remarks. — To date, only four species belonging to the genus *Nebalia* have been recorded from African coasts. *Nebalia capensis* from South Africa, *N. ilheoensis* from South West Africa (Namibia), *N. brucei* from East Africa (Tanzania) and *N. straussi* from Algeria and the Canary Islands (Dahl, 1985, 1990; Kensley, 1976; Olesen, 1999).

Nebalia deborahae sp. nov. differs from the other known species of *Nebalia* in the following unique combination of characters: rostrum approximately 2.5 times as long as wide; eyestalk with pigmentation present at least in distal half;

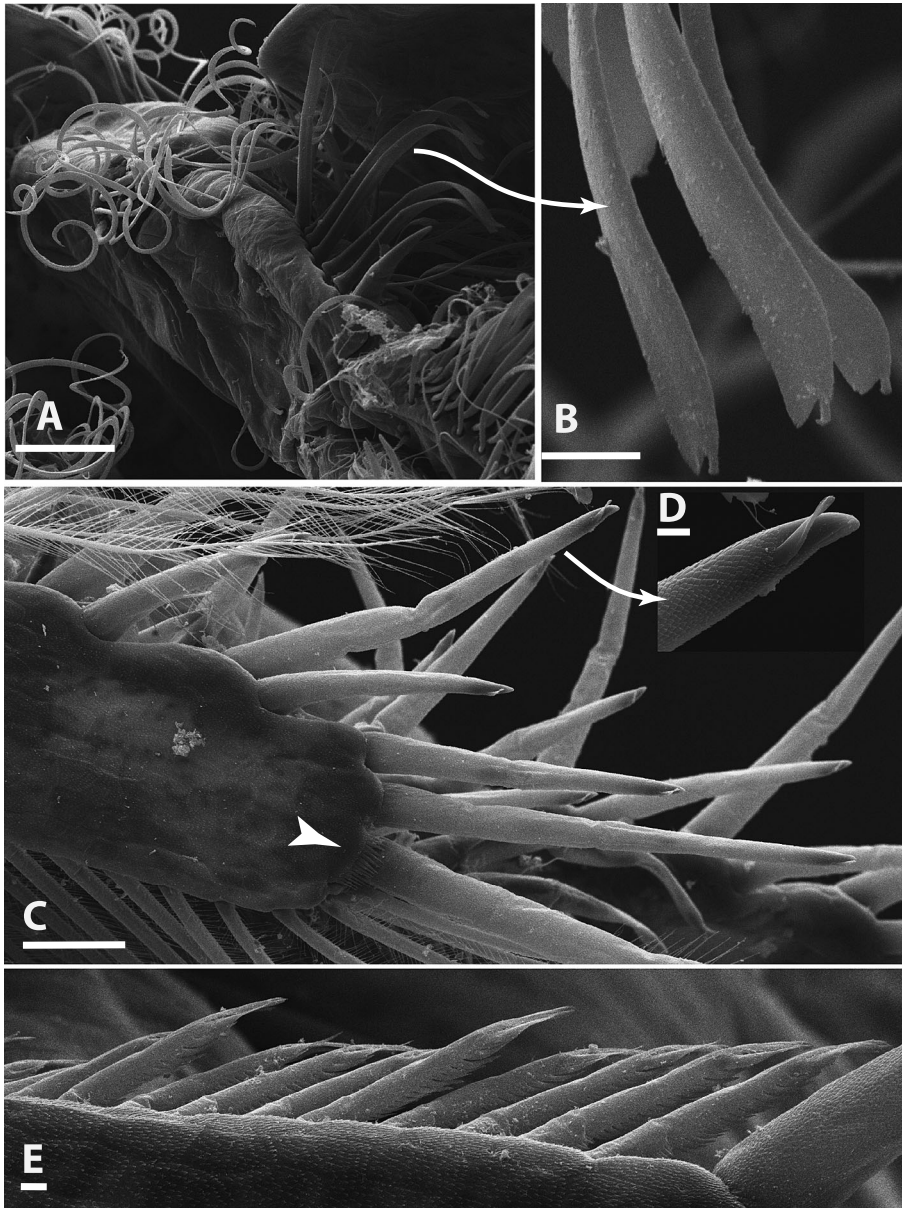
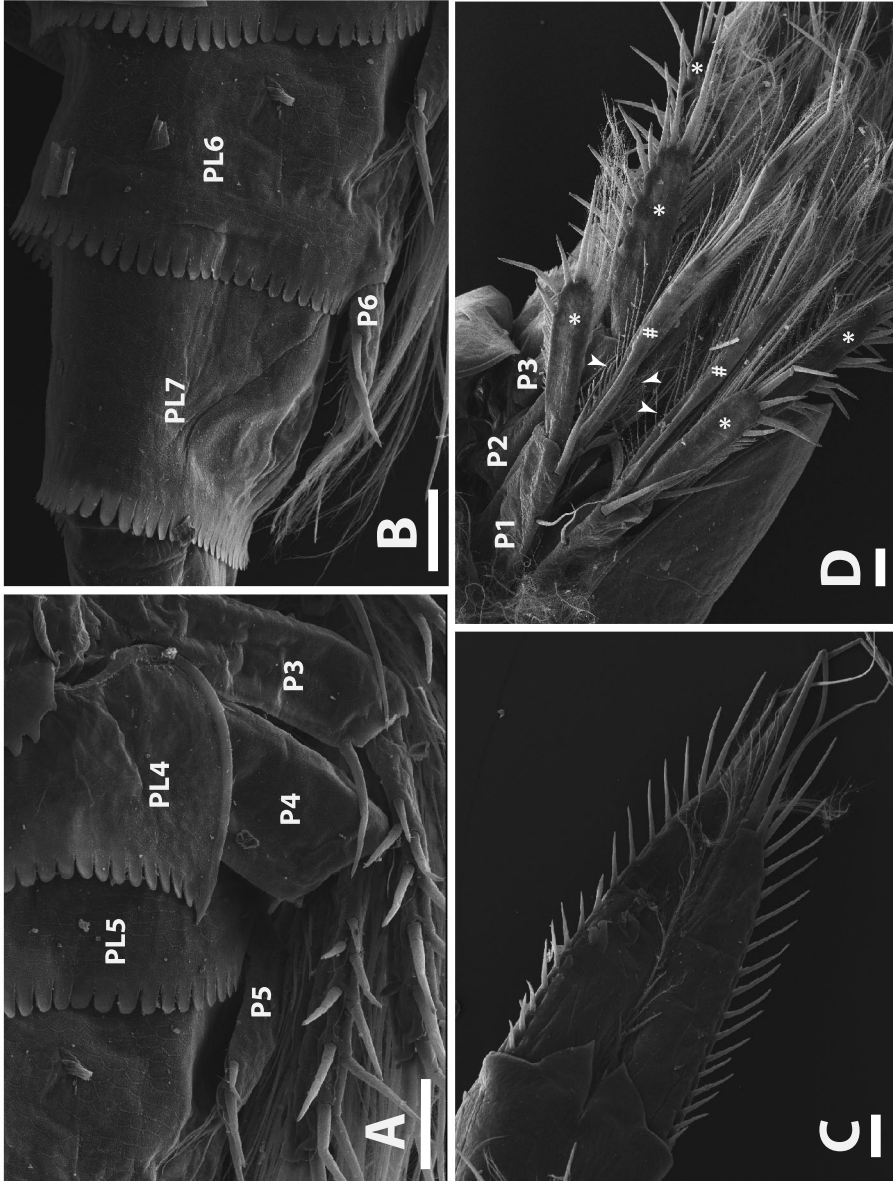


Fig. 4. *Nebalia deborahae* sp. nov. scanning electron micrographs of female. A, antennule article 4 anterior view, showing pennate setae and one robust short spine; B, higher magnification of pennate setae of antennular article 4; C, pleopod 2 exopod, distal part, ventral view, arrowhead: row of short microsetulae; D, higher magnification of spine of pleopod 2 exopod outer margin; E, pleopod 1 exopodal spines of outer margin. Scale bars: A, C, 50 μm ; B, D, E, 5 μm .



eye without papilla, supraorbital plate covering proximal half of eye dorsally; fourth article of antennule with conspicuous row of 6 to 7 short pennate setae along anterior margin and with one robust short spine terminally; posterior borders of all pleonites dentate, with teeth rounded and blunt; fourth pleonite epimeron with curved anterior lateral margin and forming an acute point; caudal furca approximately two times length of telson.

Dahl (1985) developed a model for the description and identification of Lep-
tostraca and considered 16 features based on females. *Nebalia* species could be separated mainly on the combination of several of these morphological characters. Co-grouping of species is possible, for instance, on eye morphology. The superior margin of the eyestalk is either smooth as in *Nebalia kensleyi* Haney & Martin, 2005, having a small protuberance or papilla as in *Nebalia antarctica* Dahl, 1990, or is invaginated as in *Nebalia schizophthalma* Haney, Hessler & Martin, 2001. Other characters useful for species separation are the form of the dorsal denticles on abdominal somites 6 and 7 (rounded or acuminate) and the number of spines on segment 4 of the antennule (Escobar-Briones & Villalobos-Hiriart, 1995). The apical face of the fourth article of the antennular peduncle bears 4 to 5 spines in *Nebalia hessleri* Martin, Vetter & Cash-Clark, 1996, two spines in *Nebalia gerkenae* Haney & Martin, 2000, or one thick short spine in *Nebalia reboredae* Moreira & Urgan, 2009.

Nebalia deborahae sp. nov. can be easily differentiated from other African *Nebalia* species by several features. *N. capensis* differs from the new species in the length/width ratio of the rostrum (2.13), in having a small eye papilla, and the endopod of pleopod 1, which has setae on the outer margin only. *N. ilheensis* differs also in the smaller length/width ratio of the rostrum, the fourth article of the antennule is armed with five spines and several setae, and the posterior margins of the pleonal somites having truncate teeth. The posterolateral corner of the fourth pleon epimeron in *N. straussi* is only slightly produced, the teeth of pleon somites 6 and 7 are slender and acute, and the fourth article of the antennule is armed with two spines and several setae. *N. brucei* differs from the new species in the length/width ratio of the rostrum (1.8), the fourth article of the antennule has two lateral rows of setae, and the denticles on the dorsal side of pleonites 6 and 7 are acutely pointed.

Fig. 5. *Nebalia deborahae* sp. nov. scanning electron micrographs of female. A, lateral view of pleonites (PL) and pleopods (P) 3-5; B, lateral view of pleonites (PL) and pleopods (P) 6-7; C, posterior margin of telson and furca, ventral view; D, exopods (*) and endopods (#) of pleopods (P) 1-3, ventral view, arrowheads: endopod of pleopod 1, margins with setulae. Scale bars: 100 μ m.

REFERENCES

- BARNARD, K. H., 1914. Contribution to the crustacean fauna of South Africa. A new species of *Nebalia*. Ann. South African Mus., **10**: 443-446.
- CLAUS, C., 1880. Grundzüge der Zoologie (4th ed.), **1**: 1-822. (Marburg).
- DAHL, E., 1985. Crustacea Leptostraca, principles of taxonomy and a revision of European shelf species. Sarsia, **70**: 135-165.
- —, 1990. Records of *Nebalia* (Crustacea, Leptostraca) from the Southern Hemisphere — a critical review. Bull. British Mus. (Nat. Hist.), (Zool.), **56**(1): 73-91.
- ESCOBAR-BRIONES, E. & J. L. VILLOBOLOS-HIRIART, 1995. *Nebalia lagartensis* (Leptostraca) a new species from the Yucatán Peninsula, Mexico. Crustaceana, **68**: 1-11.
- HANEY, T. A., R. R. HESSLER & J. W. MARTIN, 2001. *Nebalia schizophthalma*, a new species of leptostracan (Malacostraca) from deep waters off the east coast of the United States. Journ. Crustac. Biol., **21**: 192-201.
- HANEY, T. A. & J. W. MARTIN, 2000. *Nebalia gerkenae*, a new species of leptostracan (Crustacea, Phyllocarida) from the Bennett Slough region of Monterey Bay, California. Proc. biol. Soc. Washington, **113**(4): 996-1014.
- — & — —, 2004. A new genus and species of leptostracan (Crustacea: Malacostraca: Phyllocarida) from Guana Island, British Virgin Islands, and a review of leptostracan genera. Journ. nat. Hist., London, **38**: 447-469.
- — & — —, 2005. *Nebalia kensleyi*, a new species of leptostracan (Crustacea: Phyllocarida) from Tomales Bay, California. Proc. biol. Soc. Washington, **118**: 3-20.
- KENSLEY, B., 1976. The genus *Nebalia* in South and South West Africa (Crustacea, Leptostraca). Cimbebasia, (A) **4**: 155-162.
- LEACH, W. L., 1814. The zoological miscellany, being descriptions of new and interesting animals: 1-149. (McMillan, London).
- MARTIN, J. W., E. W. VETTER & C. E. CASH-CLARK, 1996. Description, external morphology, and natural history observations of *Nebalia hessleri* new species (Phyllocarida: Leptostraca), from southern California, with a key to the extant families and genera of the Leptostraca. Journ. Crust. Biol., **16**: 347-372.
- MEES, J., 2011. *Nebalia* Leach, 1814. Accessed through: World Register of Marine Species at <http://www.marinespecies.org/>
- MOREIRA, J., E. CACABELOS & M. DOMÍNGUEZ, 2003. *Nebalia troncosoi* sp. nov., a new species of leptostracan (Crustacea: Phyllocarida: Leptostraca) from Galicia, Iberian Peninsula (north-east Atlantic). Journ. mar. biol. Ass. United Kingdom, **83**: 341-350.
- MOREIRA, J., G. DIAZ-ARGAS, M. CANDAS, M. P. SENARIS & V. URGORRI, 2009. Leptostracans (Crustacea: Phyllocarida) from the Ria de Ferrol (Galicia, NW Iberian Peninsula), with description of a new species of *Nebalia* Leach, 1814. Sci. mar., **73**(2): 269-285.
- MOREIRA, J., C. KOÇAK & T. KATAGAN, 2007. *Nebalia kocatasi* sp. nov., a new species of leptostracan (Crustacea, Phyllocarida) from Izmir Bay (Aegean Sea, eastern Mediterranean). Journ. mar. biol. Ass. United Kingdom, **87**: 1247-1254.
- OLESEN, J., 1999. A new species of *Nebalia* (Crustacea, Leptostraca) from Unguja Island (Zanzibar), Tanzania, East Africa, with a phylogenetic analysis of leptostracan genera. Journ. nat. Hist., London, **33**: 1789-1809.
- RISSE, A., 1826. Histoire naturel des principales productions de l'Europe meridionale, **5**: 1-495.
- SAMOUELLE, G., 1819. The entomologist's useful compendium: 1-496. (Thomas Boys, London).
- VETTER, E. W., 1996. *Nebalia daytoni* n. sp. a leptostracan from southern California (Phyllocarida). Crustaceana, **69**: 379-386.

WALKER-SMITH, G. K. & G. C. B. POORE, 2001. A phylogeny of the Leptostraca (Crustacea) with keys to families and genera. *Mem. Mus. Victoria*, **58**(2): 383-410.

[Note.—In the section Material examined, the indication AHAB8 in the station no. refers to: Alexander von Humboldt Angola-Benguela Frontal Zone leg 8, i.e., the research cruise of the R/V “Alexander von Humboldt”; BE refers to Benthos.]