On a new diminutive *Rhachotropis* species from the North Sea, with a key to European *Rhachotropis* (Crustacea, Amphipoda, Eusiridae)

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ABSTRACT

A new species of Rhachotropis, R. northriana *n. sp, is described after 4 specimens from the area of the oilfield Statfjord (61°26'N 001°55'E to 001°58'E, 270-283 m depth) in the North Sea. It is by far the smallest of* Rhachotropis *species from the North Sea and the only North-European species with an entire telson. It is close to* Rhachotropis integricauda *Cărăuşu, 1948 from the Mediterranean Sea and the Bay of Biscay, but the rostrum of both species is different: in* R. integricauda *it points anteriorly, whilst in* R. northriana *n. sp. it is directed downwards. Illustrations of the holotype of* R. integricauda *are given for the first time. A new identification key to North-European* Rhachotropis *species is given.*

Key-words: Rhachotropis, *Amphipoda, Europe, North Sea, new species, taxonomy, identification key, checklist.*

RIASSUNTO

Una nuova specie di *Rhachotropis*, *R. northriana* n. sp., viene descritta a partire da 4 esemplari provenienti dall'area della piattaforma petrolifera di Statfjord (61°26'N 001°55'E to 001°58'E, 270-283 m di profondità) nel Mare del Nord. Si tratta di gran lunga della più piccola specie del Mare del Nord e dell'unica specie nordeuropea con telson intero. La specie descritta è affine a *Rhachotropis integricauda* Cărăuşu, 1948 del Mar Mediterraneo e del Golfo di Biscaglia, ma il rostro è diverso nelle due specie: in *R. integricauda* è diretto anteriormente, mentre in *R. northriana* n. sp. è diretto posteriormente. Per la prima volta sono date le illustrazioni dell'olotipo di *R. integricauda*. È data infine una chiave di identificazione per le specie nordeuropee di *Rhachotropis*.

Parole chiave: *Rhachotropis*, Amphipoda, Europa, Mare del Nord, nuova specie, tassonomia, chiave dicotomica, checklist.

INTRODUCTION

The amphipod genus *Rhachotropis* includes about 20 species in European waters, where they are present at all latitudes and from the infralittoral to the abysses. The size of the different species of the area ranges from 5 to 50 mm. Some species like *R. macropus* G.O. Sars, 1893 are locally very abundant. The quality of the description of the different species is variable and some taxonomical problems remain unsolved, but the species occurring at less than 500 m depth are usually assumed to be well known. However, when sorting samples of crustaceans from the neighbouring of the Statfjord oilfield (northern North Sea) at about 300 m depth, the third author found a minute *Rhachotropis* (5 mm long) which she was unable to identify. The largest specimen is an ovigerous female, indicating that at least that specimen is adult. Afterwards the material was submitted for expertise to the two first authors, who both concluded that it was a new species, close to *R. integricauda* Cărăuşu, 1948. The new species is described in the present paper and illustrations of the holotype of *R. integricauda* are published for the first time, after pencil drawings made long ago by the late S. Cărăuşu. In addition, we have tried to draw a synthesis of our current understanding of the taxonomy of the genus *Rhachotropis* in Europe, in proposing an identification key and a brief checklist.

Since very few specimens were available for study and since *Rhachotropis* are very brittle animals (irreparable damages could too easily happen), most figures have been made from the animal in toto. Only the mouthparts of the holotype have been fully dissected.

Abbreviations used: A1, first antenna; A2, second antenna; Coxae 1-7, coxal plates of the first to seventh pereiopods; Ep1-Ep3, first to third epimeral plates; Md, mandible; Mx1, first maxilla; Mx2, second maxilla; Mxp, maxilliped; Gn1, first gnathopod; Gn2, second gnathopod; P3-P7, third to seventh pereiopods; PL1-3, first to third pleopod; U1-U3, first to third uropods; TL, total length; TMU, Tromsø Museum University; TSZCr, Tromsø Samlinger Zoologi Crustacea; IOPAN, Instytut Oceanologii Polskiej Akademii Nauk.

In the description, the term "tooth" is used for non-articulated, pointed structures, the term "spine" for stout, inflexible articulated structures, and the term "seta" for slender, flexible articulated structures

TAXONOMY

Phylum Crustacea
Class Malacostraca
Order Amphipoda
Family Eusiridae
Genus *Rhachotropis* S.I. Smith, 1883

Rhachotropis northriana n. sp.
(Figs 1-6)

Material examined

STATFJORD NORD, station F2-1, 61°26.425'N 001°57.623'E, 283 m depth, very fine sand (10% pelite, 69% very fine sand, 19% fine sand), 10/VI/2005, 3 specimens: 1 ovigerous holotype female (mouthparts and some other parts dissected and mounted on 9 slides, TMU, TSZCr 14556; rest of body in alcohol, TMU, TSZCr 14555), 2 paratypes (sex indet.), 4.5 mm and 3 mm], TMU, TSZCr 14557.

STATFJORD NORD, station D3-2, 61°26.358'N 001°55.303'E, 270 m depth, finer sand (26% very fine sand, 67% fine sand, the rest of the sediment has not been analysed but is presumably clay or silt), 09/VI/2005: 1 paratype specimen, IOPAN.

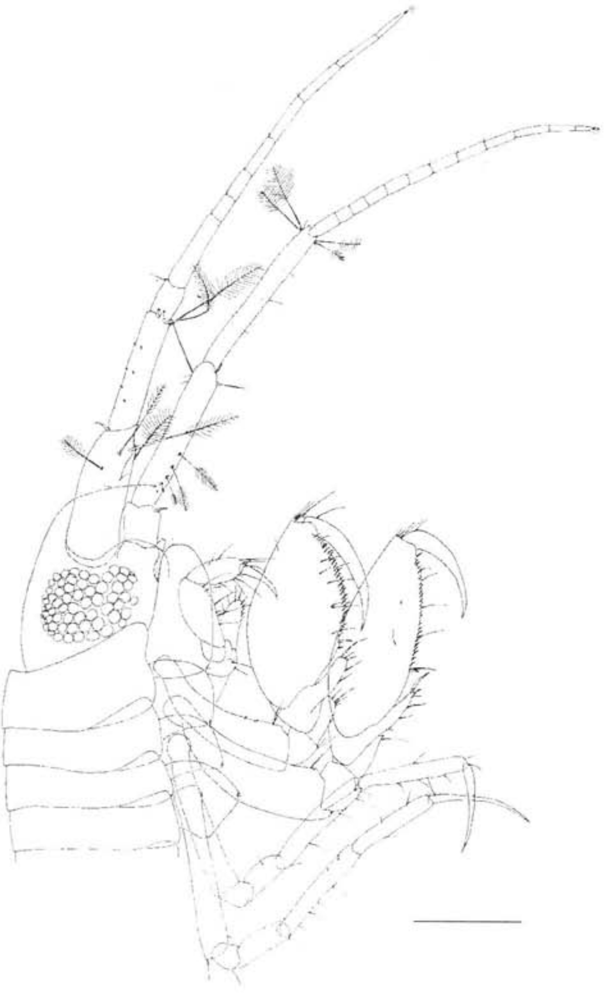

Fig. 1 - *Rhachotropis northriana* n. sp., station F2-1. Larger paratype, anterior part. Scale bar: 0.21 mm.

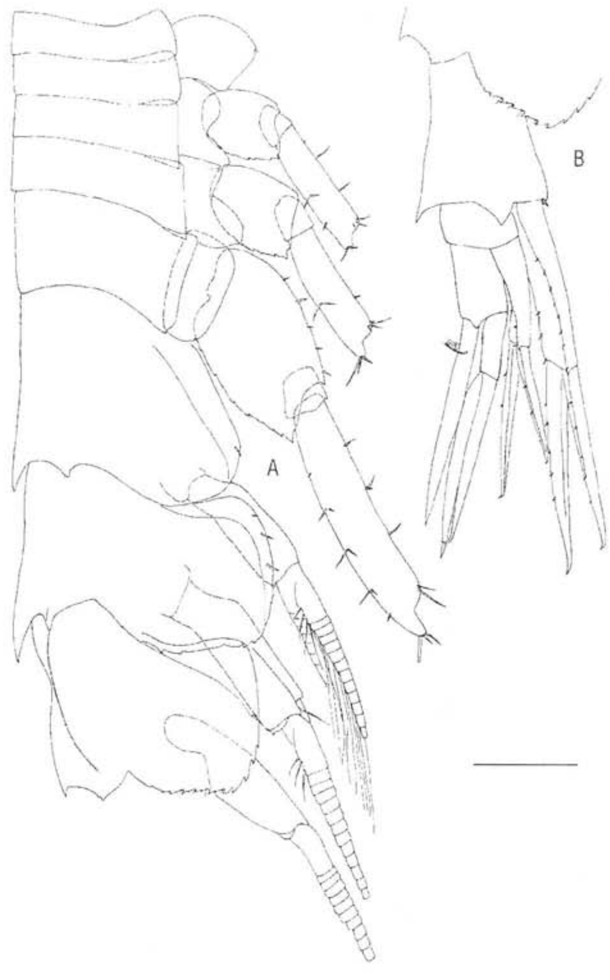

Fig. 2 - *Rhachotropis northriana* n. sp., station F2-1. Larger paratype. A, median part (basis of P7 slightly tilted); B, posterior part. Scale bar: A, B, 0.21 mm.

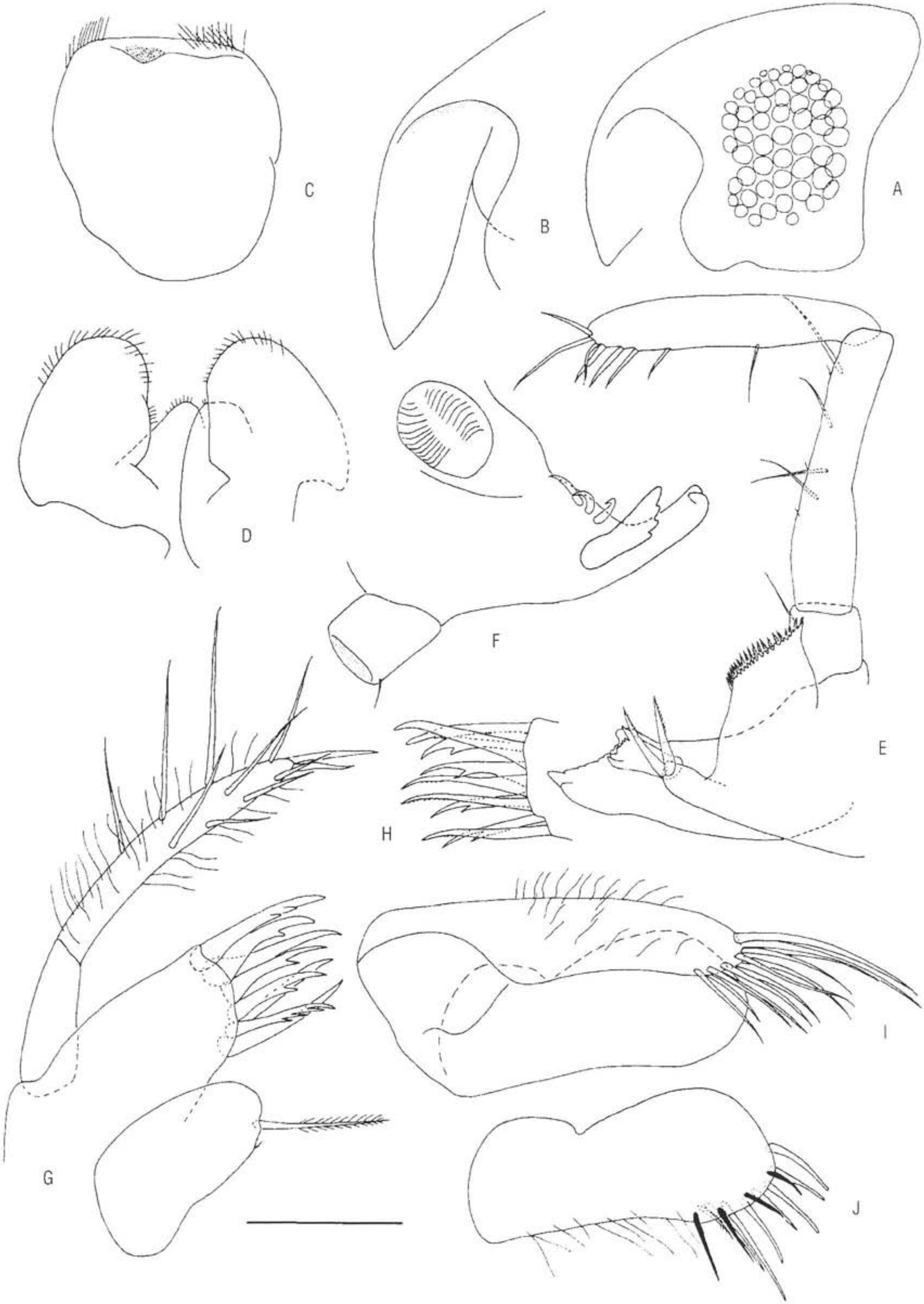

Fig. 3 - *Rhachotropis northriana* n. sp., station F2-1. A, smaller paratype; B-J, holotype. A, head; B, rostrum; C, upper lip; D, lower lip; E, right Md; F, left Md; G, right Mx1 (palp seen on the edge); H, outer plate of left Mx1; I, right Mx2 (spines of inner plate not shown); J, inner plate of right Mx2 (spines of upper row in black). Scale bar: B, 0.21 mm; A, C, D, 0.14 mm; E, F, 0.10 mm; G, H, I, J, 0.071 mm.

Fig. 4 - *Rhachotropis northriana* n. sp., station F2-1. Holotype. A, Mxp in dorsal view; B, inner plates of Mxp in ventral view; C, right Gn1 in outer view; D, Gn2 in outer view; E, Gn2 in medio-oblique view. Scale bar: C, D, E, 0.21 mm; A, B, 0.10 mm.

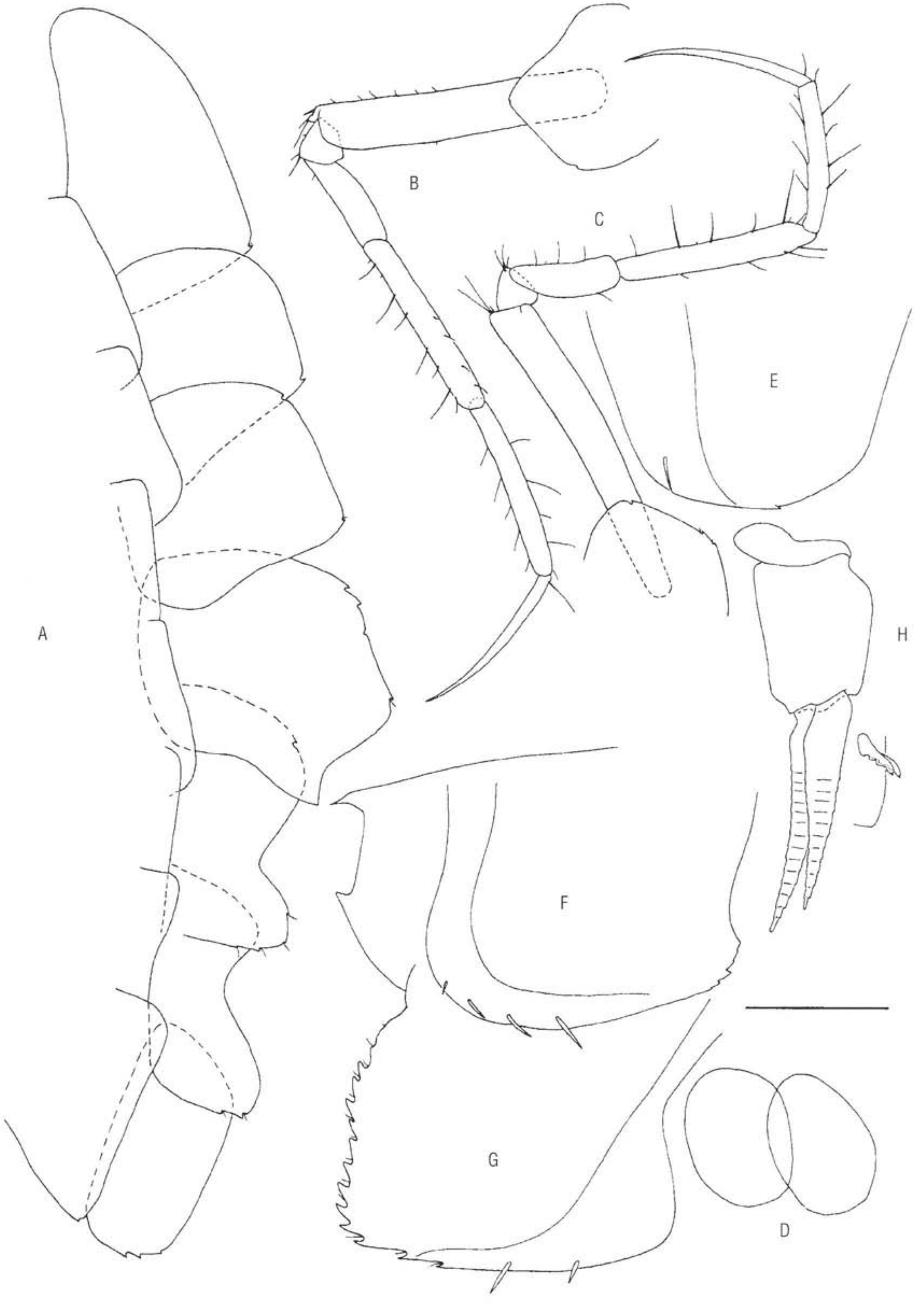

Fig. 5 - *Rhachotropis northriana* n. sp., station F2-1. Holotype. A, coxae 1-7; B, right P3; C, left P4; D, eggs; E, left Ep1; F, left Ep2 (posteriorly damaged or distorted; refer to fig. 2a for a correct depiction of the posterior border of Ep2); G, right Pleosomite 3; H, left PL1; I, coupling hooks of left PL1. Scale bar: D, H, 0.42 mm; B, C, 0.30 mm; A, E, F, G, 0.21 mm; I, 0.10 mm.

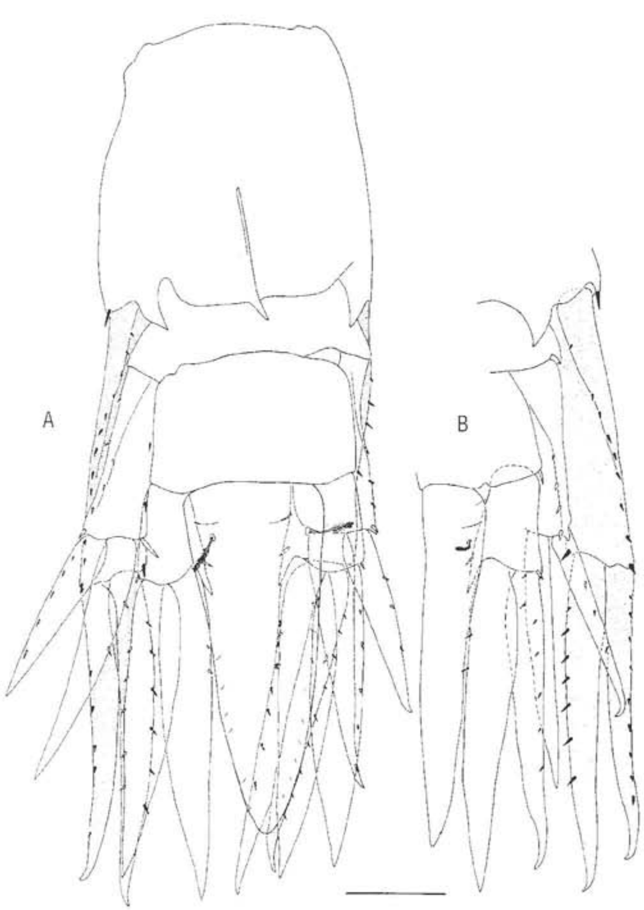

Fig. 6 - *Rhachotropis northriana* n. sp., station F2-1. Holotype. A, posterior part of body in dorsal view; B, right posterior part of body in oblique view. Spines of U1 and urosomite 1 in black. Parts of U1 not overlapped by other appendages shadowed with dots. Scale bar: A, B, 0.21 mm.

Etymology

The adjective *northrianus* derives from Norðri, a dwarf of the Norse mythology associated with the North cardinal point (Vøluspå 11). The letter "ð" has been transliterated in "th" because the International Code of Zoological Nomenclature (Art. 11.2) only admits the 26 classical letters of the Latin alphabet. The name (literally 'relative to the dwarf of the North') alludes to the northern distribution of this small species. Its affinities are mostly, as far as we can see, to dwarf species with a somewhat more southern distribution.

Description

Head: rostrum long, acute, pointing downwards; anteroventral process short, semi-circular.

Eyes: present, very large, dark in alcohol, with very distinct ommatidia.

A1: First article of peduncle distoventrally pointed; second article with distal outer tooth; accessory flagellum not seen (but this may result from its very small size); major flagellum with 8-9 articles.

A2: flagellum with 8-12 articles.

Md: laciniae mobilis and incisor processes asymmetrical; palp quite long and slender.

Mx1: second article of palp with capillary setae, and on its distal third long to very long spiniform setae; outer plate with 8 or 9 spines on two rows (bifid or multifid spines on ventral side, entire spines on dorsal side); inner plate with one strong seta and an accessory tiny setule.

Mx2: outer plate with long strong setae restricted to its tip and with capillary setae on its surface; inner plate with two marginal rows of spiniform setae on distoventral area (rows consisting of few setae).

Mxp: palp with rather slender setae which are irregularly disposed (not forming rows); inner plates with all spines pointing forward, hence without interlocking spines.

P1: coxa anteriorly elongate, with small posteroventral tooth; carpal process long; cutting edge of propodus with 2 rows or regular-sized curved spinules.

P2: coxa subquadrate, with small posteroventral tooth; carpal process long; cutting edge of propodus with 2 rows or regular-sized curved spinules.

P3: coxa subquadrate, with small posteroventral tooth, with or without small anterior notch.

P4: coxa with 1-4 notches or denticles (number probably increasing with size).

P5 slightly shorter than P6, which is considerably shorter than P7. Carpus, propodus and dactylus of P5-P7 missing in all specimens.

P5: coxa with 0-5 notches or denticles (number probably increasing with size); basis broad, with posterior border denticulate and posterodistal area forming a right angle; merus with spiniform setae on both sides.

P6: coxa with 1-2 notches or denticles (number probably increasing with size); basis broad, with posterior border denticulate and posterodistal area forming a right angle; merus with spiniform setae on both sides.

P7: coxa with 3 posterior denticles; basis broad, with posterior border denticulate and posterodistal area forming a large triangular point directed downwards; anterior border of basis with spinules; merus with spiniform setae on both sides.

Pleosomite 1: one mediodorsal posterior tooth flanked on each side by a dorsolateral tooth; pleuron regularly rounded with minute ventral tooth, with posterior border smooth, with 1 ventrolateral spine.

Pleosomite 2: one mediodorsal posterior tooth flanked on each side by a dorsolateral tooth; pleuron with weak posterior and posteroventral crenulations or denticulations, with 3-4 ventrolateral spines.

Pleosomite 3: one mediodorsal posterior tooth flanked on each side by a dorsolateral tooth; pleuron with strong denticulations on all posterior border and extending to posterior part of ventral border, with 1-2 ventrolateral spines.

Urosomite 1: one strong mediodorsal posterior tooth, with large triangular lateral tooth just above insertion of U1, with one ventrolateral distal spine.

U1: peduncle with 8-14 short outer dorsal spinules, with about 3 short medial dorsal spinules; outer ramus with 5-9 spinules all along its outer border; inner border with 5-7 spinules all along its medial border.

U2: peduncle with 3-4 short outer dorsal spinules; outer ramus with 2-5 spinules all along its outer border; inner border with 2 spinules on proximal half.

U3: peduncle with large and sharp tooth on distomedial corner, with 1 distal outer spine and 1 subdistal medial spine; outer ramus with about 5 spinules along its outer border; inner border with about 2 spinules on its proximal third.

Telson: entire, apically blunt; pair of rather short proximal plumose setae

Length. Up to 5 mm (ovigerous female).

Ecology

Apparently an upper bathyal species; found between 270 and 283 m.

Distribution

Northern North Sea. Its biogeographical affinities remain unknown but its closest relative *R. integricauda* has southern affinities.

Remarks

The discovery of a new and very characteristic *Rhachotropis* species in the North Sea is a surprise, since the fauna of this sea is supposed to be well known. It is likely that the species has been previously collected but not properly examined and assumed to be juveniles of other larger *Rhachotropis* species. Furthermore the species is brittle and presumably not common, which renders the probability of capture rather small. *R. northriana* n. sp. has an entire telson, just like the South-European species *R. caeca* Ledoyer, 1977 and *R. integricauda* Cărăuşu, 1948. The differential characters between these species are given in the key hereafter which also includes all other European *Rhachotropis* species known so far.

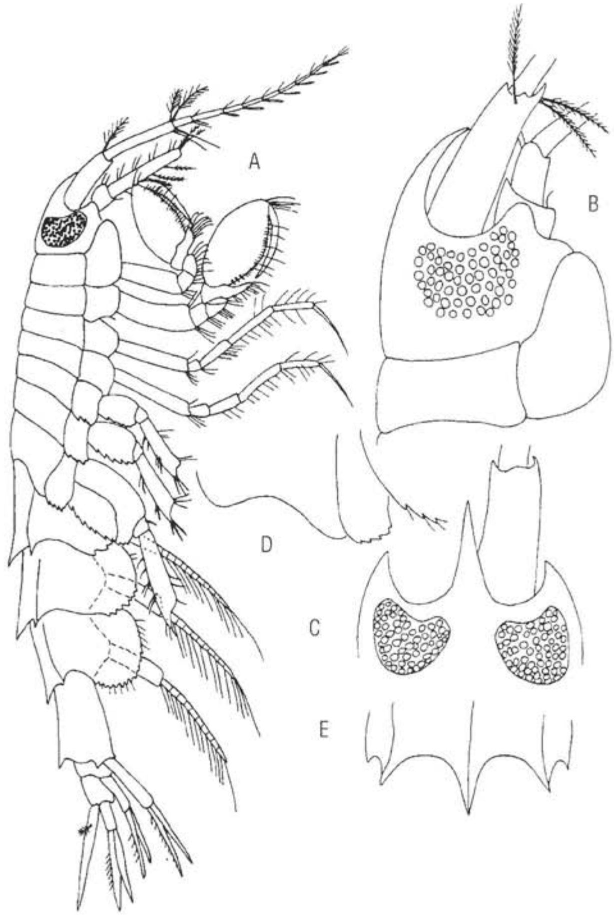

Fig. 7 - *Rhachotropis integricauda* Cărăuşu, 1948, ovigerous female, holotype, Monaco. A, habitus in lateral view; B, head in lateral view; C, head in dorsal view; D, posterior border of last thoracic segment, coxa 7 and basis 7; E, third pleonite in dorsal view. Pencil drawing by Cărăuşu inked by C. d'Udekem d'Acoz; scale unavailable.

Rhachotropis integricauda Cărăuşu, 1948 (Figs 7-10)

Rhachotropis integricauda Cărăuşu, 1948: 460; Ledoyer, 1977: 363, fig. 16; Ledoyer, 1982a: 242 fig. 164; Froglia et al., 2003: 19.

Material

Marseille area, Planier canyon, locality 16, series FVP [= 'faune vagile profonde', i.e. mobile deepwater fauna], Ledoyer, 300-320 m, 07.iii.1975: 10 specimens in very poor condition, including ovigerous females (material dried out and rehydrated), leg. M. Ledoyer, TMU, TSZCr 12059

Unpublished diagnosis, extended description and pencil drawings of the holotype by Cărăuşu. An English translation of Cărăuşu account (in French) is given here-

Fig. 8 - *Rhachotropis integricauda* Cărăuşu, 1948, ovigerous female, holotype, Monaco. A, first right antenna; B, second right antenna; C, upper lip; D, lower lip; E, left Md, F, tip of left Md; G, tip of right Md; H, Mx1; I, spines of outer plate; J, Mx2; K, detail of Mx2; L, right Mxp; M, inner plate of right Mxp. Pencil drawing by Cărăuşu inked by C. d'Udekem d'Acoz; scale unavailable.

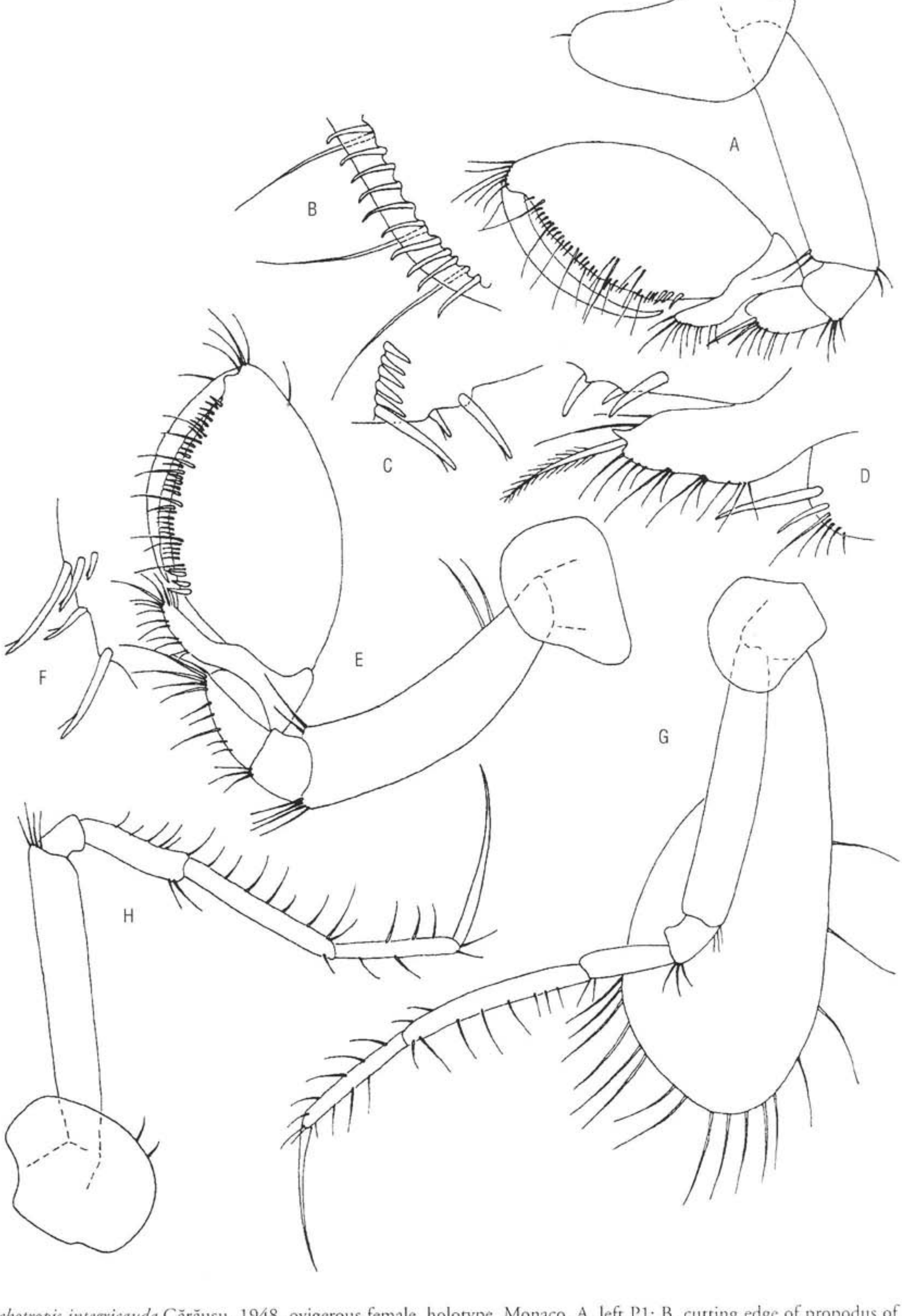

Fig. 9 - *Rhachotropis integricauda* Cărăuşu, 1948, ovigerous female, holotype, Monaco. A, left P1; B, cutting edge of propodus of left P1; C, propodus of left P1 in medial view (at the level where the tip of the dactylus does fold); D, anterior part of carpus of left P1; E left P2; F, propodus of left P2 in medial view (at the level where the tip of the dactylus does fold); G, left P3; H, left P4. Pencil drawing by Cărăuşu inked by C. d'Udekem d'Acoz; scale unavailable.

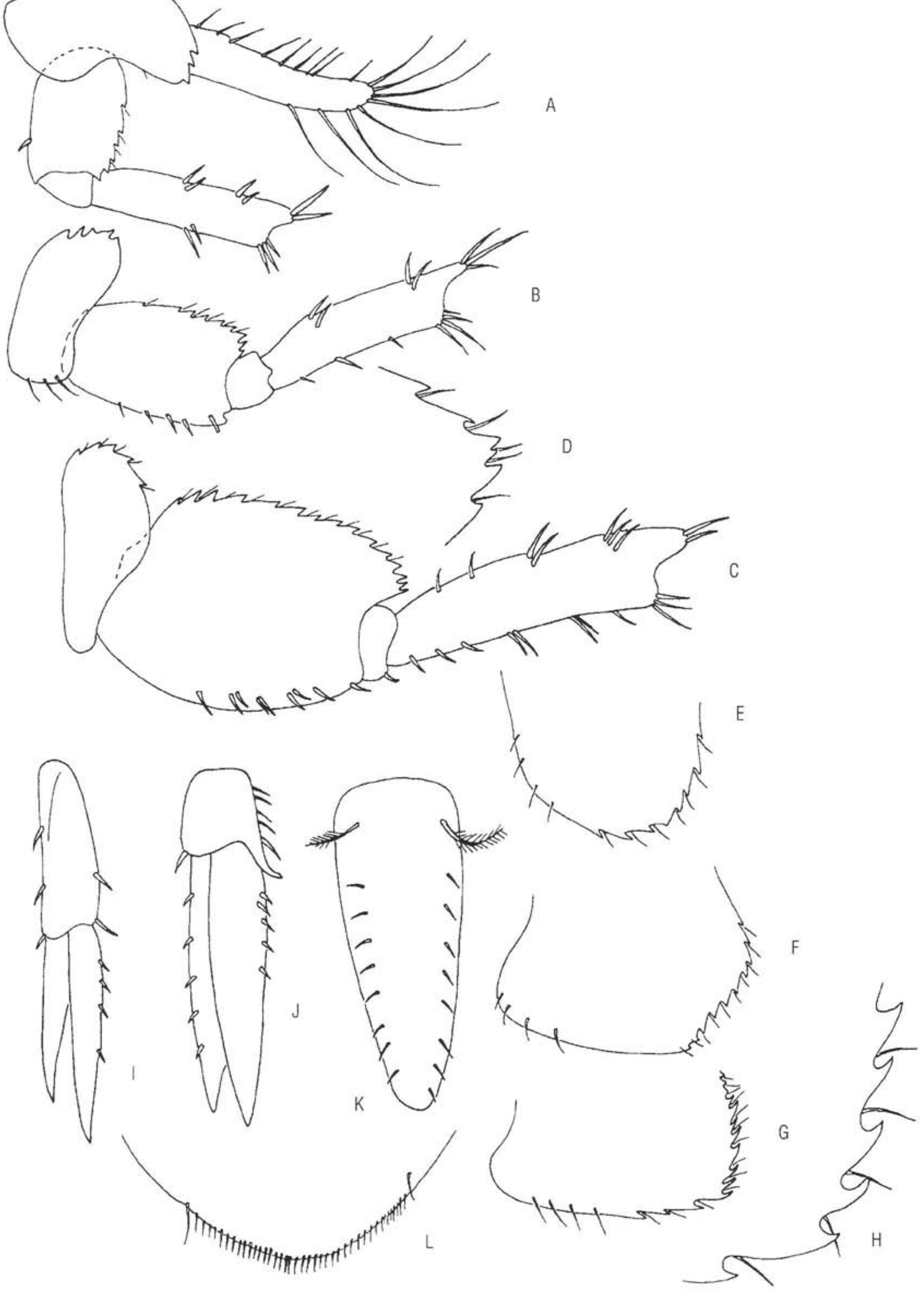

Fig. 10 - *Rhachotropis integricauda* Cărăuşu, 1948, ovigerous female, holotype, Monaco. A, left P5; B, left P6; C, left P7; D, posterior border of basis of left P7; E, left Ep1; F, left Ep2; G, left Ep3; H, posterior border of left Ep3; I, left U2; J, left U3; K, telson; L, tip of telson. Pencil drawing by Cărăuşu inked by C. d'Udekem d'Acoz; scale unavailable.

after, in italics. When relevant, additional information or remarks have been added and put between brackets. The pencil Cărăuşu drawings, which were quite small, have been enlarged twice and inked in trying to respect the original. However, although inking has been done as carefully as possible, a few mistakes may well have been introduced where the original pencil drawings were ambiguous or too small. The figure of the first uropod made by Cărăuşu has been lost. The original pencil drawings were not accompanied by scale bars.

Station: Monaco, Stn. LIII 07712 - 15 VI 1939, in front of the Museum, 220 m depth, mud, 1 ovigerous female.

Our single specimen is somewhat damaged. However, in examining the characteristic structures of this ovigerous female, it has been possible to study it adequately, and we have concluded that it is a new species of the genus [Rhachotropis].

Diagnosis - ovigerous female

Size = 5.1 mm. The three segments of the metasome have a strong dorsal carina and two lateral carinae, of which the tip is produced into an acute tooth. First segment of urosome also with a dorsal carina followed [posteriorly] *by an acute tooth. Rostrum well developed, eyes present. Accessory flagellum absent. All the 3 epimeral plates crenulated along their posterior border. Peduncle of first uropod not longer than rami. Telson almost reaching tip of third uropods and with no trace of slit, the distal border being devoid of interruption.*

Description

- **Body**. *Mesosome stout; its segments without carina, without tooth. Metasome and urosome very developed. Head + mesosome shorter than pleon + first urosomal segment. Last segment of mesosome posteriorly produced into a pointed lobe reaching the posterior border of the 7th coxal plate. The 3 segments of the metasome are carinated; there are a stronger median carina and 2 lateral carinae* [actually one lateral carina on each side]. *On each segment these carinae are terminated by a long and acute tooth which is directed backwards. The first segment of the urosome exhibits a narrow carina which is terminated in a point; on each side of this median tooth, there is a smaller lateral tooth.*
- **Head** *as long as length of the four first segments of the mesosome together; with strong rostrum, curving downwards, overreaching half of first article of peduncle of first antenna; seen from above, this rostrum looks acute. The lateral lobes, which are somewhat curved on their lower part, are terminated in an obtuse point* [Cărăuşu uses the term "pointe obtuse", which should be translated as "obtuse point"; actually "obtuse lobe" would be more adequate to describe the situation as illustrated].
- **First antenna** *equal to half of body length (excluding telson), reaching the level of the first segment of pleon. First article of peduncle robust and terminated by two distal teeth; long ciliate setae present, especially along posterior border; second article of peduncle longer but much narrower than first article and terminated by two small tooth-shaped processes; third article small, almost 4 x shorter than second article. Flagellum equal to peduncle, with 8 articles; all these articles except the last one have each a hyaline rod. No calceoli. Accessory flagellum totally absent.*
- **Second antenna** *incomplete, only the first four article present; these article present the typical structure* [for the genus *Rhachotropis*]*; penultimate article of peduncle with pairs of short setae on anterior border and pairs of ciliated setae on posterior border. Again, no calceoli.*
- **Mouth parts**
- **Anterior lip** *rounded and without marginal notch.*
- **Posterior lip** *with internal lobes small-sized and finely ciliated on tip; outer lobes similarly ciliated.*
- **Mandibles**. *Cutting edge, lacinia mobilis and molar process well developed on both mandibles; cutting edge with two* [well developed] *teeth on tip and minute ones along the margin; lacinia mobilis with 5 denticles, slightly different on each mandible. Palp tri-articulate, "le dernier article plus long que l'ensemble des soies courtes du bord interne"* [a word for word translation would be "last article longer than the short setae of inner border all together", which makes no sense in the present context]*; moreover the last article has 3 apical setae.*
- **First maxillae**. *Inner plate well developed, with a single upper plumose seta; outer plate with bi- or trifurcate spines and with serrate spines. Palp biarticulate, the last article with a regular row of small spiny setae on its internal and terminal border; outer border also with setae (these setae are less numerous but longer).*
- **Second maxillae**. *The two lobes have the same size; external border of outer and inner plate adorned with very narrow setae; at the tip of lobes, these setae become stouter and longer.*
- **Maxillipeds**. *Inner plates with 3 spines and a few apical setae; outer plates reaching half of second article of palp and with ordinary setae. Palp well developed and robust; second article broad and with pairs of long setae on internal border; penultimate article broadened and with long setae; dactylus powerful, slightly shorter than penultimate article.*
- **First gnathopods**. *Coxal plate short* [in vertical axis]

but strongly produced forwards, reaching tip of lower angles of head; anterior border rounded, with only one seta. Basis rather slender, with only two pairs of setae on anterior border and one group of short setae on posterodistal angle; ischium and merus short. Carpus with an elongated lobe, with a long and stout apical seta and some groups of shorter setae along the posterior border. Tip of carpal process terminated in an acute tooth. Propodus large and oval, 2 x as long as broad; its length is equal to that of basis; palm very oblique; outer border of palm with regular row of short setae which are slightly curved at their tip; medial border of palm with another row of longer setae which are not ciliated. The palm is terminated by 2 triangular teeth and by 3 strong spines where the tip of dactylus is folded; on the medial side of this area of the propodus, the proximal spine is followed by a row of 5 short, stout and equal-sized spines. The dactylus is narrow and curved, and is equal to the border of the palm.

- **Second gnathopods**. *Coxal plate with the same height as coxa 1, but narrowing towards* [ventral] *tip. Basis longer than that of Gn1, but not significantly broader. The propodus exhibits the same shape as in Gn1, but it is slightly broader and has the same length as the basis; on the medial side of the* [proximal] *extremity of the palm there are also 3 spines, but near the proximal spine there are 2 spines instead of 5, as it is the case in Gn1.*
- **Third pereiopods** [in the French text Cărăuşu uses the terms "péréiopodes 1-5" for the pereiopods 3 to 7]. *The coxal plate is smaller than any other; its anterodistal angle is rounded. Basis much narrower than in Gn2, but almost of the same length; it is completely devoid of setae on anterior and posterior border and there are only 3-4 short setae at the anterodistal border. Merus narrower than ischium and twice longer. Carpus 2 x as long as merus and with setae along its posterior border. Propodus considerably shorter than carpus, with setae on the two borders; dactylus slender, nearly straight, longer than propodus. Oostegites as long as half body length.*
- **Fourth pereiopods** *subequal to third pereiopods, but their coxal plates are broader and have a posterior concavity* [échancrure].
- **Fifth pereiopods**. *Coxal plate rather broad, bilobed and with posterior border crenulated; basis 1.5 x as long as broad, with anterior border convex, with a single small spine; the posterior border, which is also slightly convex, is crenulated, especially in its distal part; a very narrow seta is inserted at the basis of each crenulation; merus rather stout, adorned with groups of 2 to 3 short spines along the anterior and posterior border; merus 1.5 x as long as basis; postero-distal angle produced into a narrow lobe; such a lobe is also present in the sixth and the seventh pereiopods, in which it is significantly more developed.*
- **Sixth pereiopods**. *Coxal plate and basis morphologically similar to those of the fifth pereiopods, but basis larger and with spines more numerous on anterior border; carpus proportionately shorter than in the fifth pereiopod.*
- **Seventh pereiopod**. *Coxal plate higher in its posterior half, which has its border crenulated; basis much broader than in sixth pereiopod and presenting a membranous lobe at its posterodistal angle; anterior border adorned with short spines, posterior border crenulated on all its length; carpus stout, not much longer than basis; considering the size of the merus it can be assumed that the last 3 pereiopods are very elongated, as in most species of* Rhachotropis.
- **First epimeral plate** *with borders nearly parallel, with crenulations along the posterior border.*
- **Second epimeral plate** *posteriorly produced, and also denticulated.*
- **Third epimeral plate** *not much produced posteriorly, presenting up to 15 denticles pointing backwards and upwards, distributed all along the posterior border and on a part of the ventral* [Cărăuşu uses "distal" for ventral] *border; a seta is inserted at the basis of each denticle.*
- **First uropod** [drawing lost]. *Peduncle slightly shorter than inner ramus and adorned with small spines along its two borders; inner ramus with a row of short spines along its medial border; outer ramus narrower, a bit shorter than inner ramus, devoid of spines.*
- **Second uropod**. *Peduncle barely as long as outer ramus; outer ramus significantly shorter than inner ramus; ornamentation slightly different to that of first pereiopod* [no more detail given].
- **Third uropod**. *Peduncle 3 x shorter than inner ramus and presenting a curved and acute distomedial tooth; outer ramus slightly shorter than inner ramus; outer ramus adorned with outer marginal spines; inner ramus adorned with medial marginal spines.*
- **Telson** *triangular, less than 3 x as long as wide; its tip reaches the extremity of the outer ramus of the third uropod. It presents a pair of plumose setae near its basis, and a row of very narrow setae along each border* [depicted much too broad on the drawing]. *There is absolutely no trace of incision at the tip of the telson, even when examined under a high magnification; the tip of the telson only presents very narrow* [and extremely short] *setae. The name of the species derives from the morphological characteristics of the telson.*

Remarks [by Cărăuşu].

The new species markedly differs from other species of *the genus* [known in 1948] *by its non-cleft telson. In other respects, it appears that it is close to* Rh. Grimaldii *(Chevreux). Both species have the same number of teeth at the tip of the carinae of the metasome, a carina on the first segment of the urosome, crenulations on the last 3 coxal plates. However, our species can be distinguished from* Rh. Grimaldii *by the absence of accessory flagellum, the shorter first antenna, by the teeth of the carina* [of what?] *not erected, by the basis of the third pereiopods which is considerably broader and devoid of crenulations* [confusion between basis and coxa?], *by the absence of some spines on the 4 first coxal plates, and finally by its size which is twice smaller. On the other hand,* Rh. kergueleni *Stebb. exhibits many similarities with our species: spines of palm of Gn1, posterior border of the last 3 coxal plates... "a little serrate" (Stebbing, "Challenger"), many details in the structure of mouthparts, occurrence of a carina on the last segment of the urosome, very small incision of telson, not to speak about its ornamentation identical to that of our species. The main difference in the species of the Indian Ocean is the absence of eyes, the great length of the flagellum of the first antenna which considerably overreaches the peduncle and presents 34 articles, the greater relative length of the merus if compared with basis in the last 5 pereiopods, and finally the size which is almost 3 x longer than that of our specimen. This prevents us to conclude that the two species are identical.*

Morphological notes on the specimens from Marseille

The very poor condition of these specimens prevents us to present a detailed morphological account of them. Just let's say that their rostrum is curved but pointing forward; the eyes are well developed; their coxae 1-3 have a very indistinct posterior notch or at most a faint trace of tooth; their first epimeral plate is somewhat variable being weakly to indistinctly crenulated; the peduncle of their first uropod has 11 to 13 outer dorsal teeth.

Ecology

Muddy bottoms, at 200-500 m depth in the Mediterranean, and 100-350 m in the Bay of Biscay.

Distribution

Mediterranean, including Adriatic Sea, Bay of Biscay.

Remarks

There is no doubt that Ledoyer's (1977, 1982a) specimens are correctly identified. Dr. Jean-Claude Sorbe *(in litt.)* has confirmed that the *Rhachotropis* from the Bay of Biscay identified as *R. integricauda* and available to him really belongs to that species, since they have an elongated rostrum.

IDENTIFICATION KEY TO EUROPEAN *RHACHOTROPIS* SPECIES

The West Atlantic *R. lobata* Shoemaker, 1934 has been included in the key, as it still may be discovered in the East Atlantic.

1. Telson entire 2
– Telson cleft or notched....................................... 6
2. Pleosomites 1-2 with pair of small posterolateral dorsal teeth about 0.1 x as long as segment..........3
– Pleosomites 1-2 with pair of huge posterolateral dorsal teeth about 1.0 x as long as segment .... *Rhachothropis flamina* Bellan-Santini, 2006
3. Eyes present 4
– Eyes absent 5
4. Rostrum directed anteriorly. Ep1 posterior border more or less crenulated .... *R. integricauda* Cărăuşu, 1948
– Rostrum directed downwards. Ep1 posterior border not crenulated, with only one minute tooth..... .... *R. northriana* n. sp.
5. Rostrum short. Ep3 posterior border smooth. Basis of P7 posterodistally with rectangular lobe............ .... *R. caeca* Ledoyer, 1977
– Rostrum long. Ep3 posterior border crenulated. Basis of P7 posterodistally with acute lobe .... *R. gloriosae* Ledoyer, 1982 (Material from Madagascar)
6. Telson cleft 10% or less....................................... 7
– Telson cleft 20% or more................................. 14
7. P7 basis with mid-posterior bulge or spur 8
– P7 basis lacks mid-posterior bulge or spur........... 9
8. Eyes absent. Dorsal teeth on metasome and urosome segment 1 long, acute and well-developed. P7 with long posterior spur..... *R. palporum* Stebbing, 1908
– Eyes well-developed. Dorsal teeth on metasome and urosome segment 1 short. P7 with basis posteriorly with rounded bulge .... *R. lobata* Shoemaker, 1934 (W.Atlantic)
9. Ep3 with small or large serrations 10
– Ep3 posteriorly smooth (small setae may be present) 12
10. Ep3 posteriorly coarsely serrate. Urosome segment 1 with well-developed, acute dorsal tooth .... *R.* aff. *kergueleni* Stebbing, 1888, sensu Stephensen, 1944
– Ep3 posteriorly finely serrulate, only in distal half 11
11. Metasome segment 1 with small median tooth only .... *R. faeroensis* Stephensen, 1944
– Metasome segment 1 with median tooth and a pair of lateral teeth .... *R. proxima* Chevreux, 1911

12. Metasome segments 1 and 2 with both median and lateral dorsal teeth ... *R. thorkelli* Thurston, 1980
– Metasome segments 1 and 2 with median dorsal tooth only 13
13. Rostrum long and acute. Eyes well-developed .... *R. glabra* Ledoyer, 1977
– Rostrum short and blunt. Eyes absent .... *R. gracilis* Bonnier, 1896 and *R. arii* Thurston, 1980 (NB: these species are very close; for differences, see Thurston 1980, p. 63)
14. Article 1 of first antenna without long curved spine at the inferodistal corner 15
– Article 1 of first antenna with long curved spine (about as long as article 1) at the inferodistal corner .... *R. licornia* Bellan-Santini, 2006
15. Rostrum long, acute 16
– Rostrum short 19
16. Small species, up to 4.5mm. Ep3 weakly denticulate posteriorly. [Eyes present, not well developed] .... *R. inermis* Ledoyer, 1977
– Larger species, 8-30 mm. Ep3 regularly serrate posteriorly 17
17. Smaller southern species, 8-10 mm. Eyes absent. P7 basis without acute posterodistal lobe 18
– Large northern species, up to 30 mm. Eyes large, dark. P7 basis with acute posterodistal lobe .... *R. aculeata* (Lepechin, 1788)
18. Pleonites 1-2 with posteromedian dorsal tooth .... *R. rostrata* Bonnier, 1896
– Pleonites 1-2 without posteromedian dorsal tooth .... *R. pilosa* Bellan-Santini, 2006
19. Blind deepwater (850 m and deeper) species. [Metasome segment 3 with single middorsal tooth] 20
– Eyed species (eyes may fade in alcohol in some species) of shallow to moderate depths (usually less than 1000 m except *R. lomonosovi* which is often found deeper) 21
20. Coxa 1 strongly produced anteriorly. Dorsal teeth on metasome strong, acute ... *R. gislii* Thurston, 1980
– Coxa 1 weakly produced. Dorsal teeth on metasome low, blunt ...... *R. thordisae* Thurston, 1980
21. Metasome segment 3 and urosome segment 1 lack clear middorsal tooth (may have carina) 22
– Metasome segment 3 and urosome segment 1 with clear middorsal tooth or teeth 23
22. Mesosome segment 7 with small middorsal tooth .... *R. oculata* (Hansen, 1887)
– Mesosome segment 7 lacks middorsal tooth.......... .... *R. inflata* G. O. Sars, 1883
23. Urosome segment 1 lacks middorsal tooth............ .... *R. grimaldii* (Chevreux, 1887)
– Urosome segment 1 with middorsal tooth......... 24
24. Lateral cephalic lobe long and narrow. Eyes small, white in life, turning dark in alcohol..................... .... *R. lomonosovi* Gurjanova, 1934
– Lateral cephalic lobes broadly triangular. Eyes large (may occasionally fade in alcohol) 25
25. Eyes white, often fading in alcohol........................ .... *R. leucophthalma* G. O. Sars, 1893
– Eyes with dark pigment, remaining distinct in alcohol 26
26. P7 longer than body length. Metasome segment 3: mediodorsal tooth acute, similar to those on segments 1 and 2........ *R. macropus* G. O. Sars, 1893
– P7 shorter than body length. Metasome segment 3: mediodorsal tooth blunt, different from those on segments 1 and 2 .... *R. helleri* (Boeck, 1871)

Synopsis of European *Rhachotropis* species

Where no further references are given, these distribution data are based on the papers by Stephensen (1940, 1944a,b), Thurston (1980), Ledoyer (1982a), Bousfield & Hendrycks (1995), Brandt et al. (1996), Bellan-Santini & Ruffo (1998), Brunel et al. (1998), Weisshappel (2000), Tzvetkova & Golikov (2001), Dauvin & Bellan-Santini (2002), Galil (2004), and Palerud et al. (2004). The situation in Iceland waters is unclear: Weisshappel (2000), who studied the material of the BioIce campaigns, indicated the presence of a number of undescribed species among the 23 species of *Rhachotropis* that she recorded in the area, but no descriptions have yet been published. The experience of Thurston, who recorded five *Rhachotropis* species, among them four previously undescribed ones, from only five hauls in deep water in the East Iceland basin, makes clear that the *Rhachotropis* fauna of the deep Norwegian Sea is as yet very incompletely known.

R. aculeata (Lepechin, 1780)
(Figured by G. O. Sars, 1893)

This species, which is considered by Bousfield & Hendrycks (1995) as the most plesiomorphic in the genus, has an almost circumpolar distribution. In the Atlantic it occurs south to northernmost N. Norway (Vader et al. 1997); in the Pacific it has been reported south to the Japan Sea (Gurjanova 1951). It is a large and often common species in shallow or moderately deep Arctic waters.

R. arii Thurston, 1980
(Figured by Thurston 1980)

Only known from the type locality, at 2700 m in the East Iceland basin (Thurston 1980).

R. caeca Ledoyer, 1977
(Figured by Ledoyer 1977, 1982a)

Found in the Mediterranean and the Bay of Biscay, on muddy bottoms. In the western Mediterranean it is common on the Upper (400-500 m), Middle (550-600 m) and Lower (1250-1350 m) Slopes, as well as in the deep canyons (1850 m) (Cartes & Sorbe 1999); elsewhere in the Mediterranean it has been found down to 2720 m. In the Bay of Biscay records are from 346 to 790 m, most common at the shallower depths (Dauvin & Sorbe 1995)

R. faeroensis Stephensen, 1944
(Figured by Stephensen 1944a)

Described after specimens from the northern Norwegian Sea collected at 800-900 m (Stephensen 1944a). It also occurs in the Bay of Biscay where it has been found sparingly at depths from 430 to 920 m (Dauvin & Sorbe 1995). Not recorded off Iceland (not present in the BioIce material).

R. flamina Bellan-Santini, 2006
(Figured by Bellan-Santini, 2006)

Described from 2250 m from the Azores Triple Junction zone (Bellan-Santini, 2006).

R. gislii Thurston 1980
(Figured by Thurston 1980)

Described from c 2700 m in the East Iceland basin (Thurston 1980); apparently also present in the BioIce material (Weisshappel 2000), at roughly similar depths.

R. glabra Ledoyer, 1977
(Figured by Ledoyer 1977, 1982a)

In the Mediterranean found from 90 down to 2720 m, but on the Catalan Sea slope most characteristic for the Middle Slope (550-600 m) where it was the most numerous amphipod collected (Cartes & Sorbe 1999). Also found in the Bay of Biscay, where it occurred in small numbers at depths of 350 to 600 m (Dauvin & Sorbe 1995).

R. gloriosae Ledoyer, 1982
(Figured by Ledoyer 1982b)

This species, described from deep water off Madagascar (615-625 m), was reported from Icelandic waters by Weisshappel (2000); 4 specimens as *R.* cf *gloriosae* in North Atlantic Deep Water at depths from 2050 to 2300 m, 5 specimens as *R.* nr *gloriosae* from the warmer North Atlantic Water at depths of 1020 to 1200 m. Further research will show the real identity of these specimens.

R. gracilis Bonnier, 1896
(Figured by Shoemaker 1930)
(Probable synonym *R. distincta* (Holmes, 1908))

Shoemaker (1930) synonymized these two species, both somewhat insufficiently described, *gracilis* from the Bay of Biscay at 900 m, *distincta* from Californian specimens; Shoemaker's material was from the western North Atlantic. The synonymy has been accepted, now and then somewhat reluctantly, by most authors, but Bousfield & Hendrycks (1995) do not mention *gracilis* at all in their discussion of *R. distincta.* Thurston (1980, p.63) announced a redescription of *R. gracilis*, but this has not yet appeared. The species has a very wide distribution, from the Bay of Biscay to the NE coast of Canada and New England in the N. Atlantic (Weisshappel (2000) mentions it from Icelandic waters sub nom. *R. distincta* from nine stations at depths from 500 to 2300 m), and from British Columbia and S. California in the NE Pacific. The Atlantic and Pacific populations may on further research well turn out to be not conspecific. In addition, Cartes & Sorbe (1999, p. 1141) are of the opinion that 14 specimens caught in deep water (1250-1850 m) on the Catalan Sea slope may well constitute a new species different from *R. gracilis.*

R. grimaldii (Chevreux, 1887)
(Figured by Ledoyer 1977, 1982a)
(Probable synonym *R. elegans* Bonnier, 1896)

These two nominal species are usually put into synonymy, although *R. elegans* was described as blind, while *R. grimaldii* has well-developed eyes; both were described from the Bay of Biscay. *R. grimaldii* occurs in the Mediterranean, at moderate depths (cf e.g. Cartes & Sorbe 1999) and in the Bay of Biscay in moderate numbers at all depths from 350 to 1030 m (Dauvin & Sorbe 1995). Stephensen (1944a) recorded the species from two localities in the Norwegian Sea, at 900 and 1900-2150 m depth, respectively, but it is not recorded by either Thurston (1980) or Weisshappel (2000).There is a record from off Mauritania (Chevreux 1927). *R. grimaldii* has also been reported from South Africa (Barnard 1916, Griffiths 1975, 1976) and from the Okhotsk Sea (Gurjanova 1955); this latter, blind specimen is considered by Bousfield & Hendrycks (1955) to belong to a related, but different species.

R. helleri (Boeck, 1871)
(Figured by G. O. Sars, 1893)

A common, but often misidentified species from the NE Atlantic, from the coasts of Norway, Svalbard and Russia, east to the Chukchi Sea. Sexton (1910) reported, described and illustrated a single specimen of this species from the deep Bay of Biscay, but curiously enough *R. helleri* is not mentioned by either Dauvin & Sorbe (1995) or Dauvin & Bellan-Santini (2002) as occurring in French waters. Stephensen (1944a) mentioned two defective specimens from the northern West Atlantic, but their identification remains somewhat uncertain. The species is not recorded by Thurston (1980) or Weisshappel (2000). Old records from the NE Pacific probably in reality refer to closely related species (vide Bousfield & Hendrycks 1995). *R. helleri* usually occurs at moderate depths, e.g. at 230-360 m in the Laptev Sea in Siberia (Sirenko et al. 2004)

R. inermis Ledoyer, 1977
(Figured by Ledoyer 1977, 1982a)

Described from muddy bottoms around Marseille, Mediterranean at depths of 80-400 m, this small species seems to be a Mediterranean endemic. Nor is it generally common in Mediterranean waters; it was e.g. not recorded by Cartes & Sorbe (1999) in their extensive study of the Catalan Sea slope.

R. inflata G. O. Sars, 1883
(Figured by G. O. Sars, 1893)
(Synonym *R. tumida* G. O. Sars, 1893)

A small shallow-water species, living in the cold parts of the NE and NW Atlantic and along the entire coast of Siberia, east to the Chukchi Sea. Gurjanova (1951) listed this species also from the Bering Sea and the Sea of Japan, but this identification is somewhat uncertain, since Bousfield & Hendrycks (1995) have described several closely related species from the NE Pacific. For the same reason, records from the Canadian Pacific and the coast of Oregon are suspect (cf Bousfield & Hendrycks 1995).

R. integricauda Cărăuşu, 1948
(Figured by Ledoyer 1977, 1982a, and in present paper)

Described from the Mediterranean, on muddy bottoms at 250-370 m depth; recently also recorded from the Adriatic Sea (Froglia et al. 2003), at 220 m depth. Also in the extensive study of Cartes & Sorbe (1995) *R. integricauda* was only found on the Upper Slope, at 390-500 m. This species also occurs in the Bay of Biscay, where a few specimens have been collected at 350 m (Dauvin & Sorbe, 1995). Bachelet et al. (2003) additionally reported the species from off Arcachon, at 114-180 m depth.

R. ? kergueleni Stebbing, 1888
(Figured by Stephensen 1944a)

Stephensen (1944a) succinctly described and illustrated a *Rhachotropis* from the NE Atlantic, which he tentatively identified as the S. Atlantic species *R. kergueleni* described by Stebbing (1888) from off Kerguelen Island. His specimens were found at 64°54'N, 055°10'W at 740 m depth and at 65°16'N, 055'05'W at 682 m depth. Also Weisshappel (2000) has identified two of her specimens as *R.* nr *kergueleni*; these were collected in the North Atlantic Water at 976 m depth. All these specimens will probably turn out not to be identical with *R. kergueleni.*

R. leucophthalma G. O. Sars, 1893
(Figured by G. O. Sars, 1893)

This white-eyed species (eyes become colourless and hard to see in alcohol) is quite common in moderately deep water in South, West and North Norway, where it often occurs together with the still much more numerous *R. macropus.* It has been found neither in Russian waters, nor in Svalbard, but it seems to be common in the North Atlantic Water mass in Icelandic waters (Weisshappel 2000); a single specimen from much colder water was reported as *R. nr leucophthalma* (Weisshappel, loc.cit.). *R. leucophthalma* also occurs in deep water off E. Greenland (Brandt et al. 1996).

R. licornia Bellan-Santini, 2006
(Figured by Bellan-Santini, 2006)

Described from 1937 m from the Azores Triple Junction zone (Bellan-Santini, 2006).

[*R. lobata* Shoemaker, 1934)]
(Figured by Shoemaker 1934)

So far this deepwater species has been recorded in the West Atlantic only but its occurrence in the East Atlantic is not ruled out.

R. lomonosovi Gurjanova, 1934
(Figured by Gurjanova 1934, 1951)

Also this species has white eyes when alive, but they turn black in alcohol. It is a true Arctic species, the only *Rhachotropis* reported from the Central Arctic Basin, and it has also been recorded from the Kara, Laptev and East-Siberian Seas. This large species is quite common at depths of 1000-1500 m N. of Svalbard, at 80-81°N (authors' data).

R. macropus G. O. Sars, 1893
(Figured by G. O. Sars, 1893)

This species is often very numerous in the NE Atlantic, e.g. in the Skagerak, along the Norwegian coasts and in Svalbard, generally at moderate depths (200-700 m). It also is reported from the Barents, Kara and Laptev Seas (Tzvetkova & Golikov 2001), but the more recent paper by Sirenko et al. (2004) lists the Laptev material as *R.* aff. *macropus.* Weisshappel (2000) reports *R. macropus* from Iceland waters, at depths from 230 to 500 m, but there are no records from the NW Atlantic.

R. northriana n. sp.
(Figured in present paper)
Northern North Sea, at depths from 270 to 283 m.

R. oculata (Hansen, 1887)
(Figured by Hansen 1887, Bousfield & Hendrycks 1995)
This very large-eyed species was originally described from Greenland waters, at shallow depths. Many later records are from the same area, but the species has also been recorded from the Gulf of St Lawrence, where it is common (Shoemaker, 1930; Brunel et al. 1998), from Iceland waters, where it occurs at depths of 50 to 200 m in the warmer North Atlantic Water (Weisshappel 2000), from the Kara, Laptev, East Siberian and Chukchi Seas (Tzvetkova & Golikov 2001), and from British Columbia, again in shallow waters (Bousfield & Hendrycks 1995).

R. palporum Stebbing, 1908
(Figured by Stebbing 1908)
This species was described from a depth of 400 m in the central N. Atlantic, at 59°36'N, 007°00'W. Weisshappel (2000) reported 2 specimens from the North Atlantic Water (775-838 m) around Iceland as *R.* cf *palporum*. Griffiths (1975) reported a single specimen from S. African waters, 500-1000 m.

R. pilosa Bellan-Santini, 2006
(Figured by Bellan-Santini, 2006)
Described from 1630 m from the Azores Triple Junction zone (Bellan-Santini, 2006).

R. proxima Chevreux, 1911
(Figured by Thurston 1980)
This species was originally described from very deep water (4380 m) in the southern North Atlantic (Chevreux 1911), and was later refound by Thurston (1980) in the East Iceland basin at around 2700 m. Weisshappel (2000) reported *R. proxima* from 2 stations in the North Atlantic Deep Water at 2300-2400 m, and *R.* nr *proxima* at 8 stations in warmer water and at shallower depths, 260-1300 m; the latter is probably a different species.

R. rostrata Bonnier, 1896
(Figured by Ledoyer 1982a)
This species, originally described from the Bay of Biscay, apparently has a wide distribution in deep waters of the North Atlantic and Mediterranean (including the Adriatic Sea). Cartes & Sorbe (1999) found it on the Middle (550-600 m) and Lower (1250-1350 m) Slopes of the Catalan Sea. In the Cap Ferret area of the Bay of Biscay, *R. rostrata* was found in the deeper samples, 500-1500 m (Dauvin & Sorbe 1995).

R. thordisae Thurston, 1980
(Figured by Thurston 1980)
One of four new species, described by Thurston from deep water (2700 m) in the East Iceland basin. Weisshappel (2000) recorded both *R. thordisae* and *R.* nr *thordisae* from Icelandic waters, at depths from 850 to 2400 m.

R. thorkelli Thurston, 1980
(Figured by Thurston 1980)
Also described from the deep East Iceland basin (2700 m), and not as yet found elsewhere.

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