

MONODICARIS GEN. N. (COPEPODA, HARPACTICOIDA,
PARASTENOCARIDIDAE) FROM WEST AFRICA

BY

HORST KURT SCHMINKE¹⁾

Institut für Biologie und Umweltwissenschaften, Fakultät V, Universität Oldenburg, Postfach 2503,
D-26111 Oldenburg, Germany

ABSTRACT

A new genus of Parastenocarididae, *Monodicaris* gen. n., is described from West Africa. It has many characters in common with the genus *Kinnecaris* Jakobi, 1972 but lacks the most distinctive feature of this genus, the grossly prehensile male antennule. Its own main distinctive features are the endopod of leg 2 male being short and stub-like, with a short terminal seta, and the spinules on the basis of leg 4 male above the insertion of the endopod being different in size, becoming smaller from internal to external. The new genus contains a new species from the Ivory Coast, *Monodicaris larsi* gen. n., sp. n. and 3 known species, viz. *M. cataractae* (Cottarelli, 1982) comb. n. from Sierra Leone, *M. christiani* (Dumont, 1981) comb. n. from Guinea, and *M. monodi* (Chappuis, 1959) comb. n. from Mali.

ZUSAMMENFASSUNG

Eine neue Gattung der Parastenocarididae, *Monodicaris* gen. n., wird aus Westafrika beschrieben. Sie stimmt in vielen Merkmalen mit der Gattung *Kinnecaris* Jakobi, 1972 überein, lässt aber deren kennzeichnendes Merkmal, die stark prähensile Antennula der Männchen, vermissen. Eigene kennzeichnende Merkmale sind der kleine stumpfartige Endopodit des zweiten Beinpaars der Männchen mit kurzer Terminalborste und die unterschiedliche Größe der Stacheln auf der Basis des vierten Beinpaars der Männchen oberhalb des Endopoditen, die von innen nach außen kleiner werden. Die neue Gattung umfasst eine neue Art von der Elfenbeinküste, *Monodicaris larsi* gen. n., sp. n. und 3 schon bekannte Arten: *M. cataractae* (Cottarelli, 1982) comb. n. aus Sierra Leone, *M. christiani* (Dumont, 1981) comb. n. aus Guinea und *M. monodi* (Chappuis, 1959) comb. n. aus Mali.

INTRODUCTION

With some 260 species, Parastenocarididae is one of the species-rich families within Harpacticoida. Most of these species are known from groundwater in

¹⁾ e-mail: schminke@uni-oldenburg.de

Europe (43%), followed by South America with 29% and Africa (without the Canary Islands and Madagascar) with 11%. Most of the 28 African species have been reported from East Africa, while only 7 are known from West Africa. All of these except one belong to the genus *Parastenocaris* Kessler, 1913. None of them has been taken into account by Jakobi (1972) when proposing 24 new genera of Parastenocarididae. Most of the West African species, it is true, date from later than 1972 (viz., *Parastenocaris cataractae* Cottarelli, 1982, *P. christiani* Dumont, 1981, *P. jeanninei* Dumont, 1981, *P. kimi* Dumont, 1981) but two species should have been considered by Jakobi (1972), viz., *Parastenocaris monodi* Chappuis, 1959 and *P. nigerianus* Chappuis, 1959, but seem to have been overlooked by him.

Kinnecaris Jakobi, 1972 has recently been redefined by Schminke (2008) and is represented in West Africa by one species, *Kinnecaris lyncaea* (Cottarelli & Bruno, 1994) from Sierra Leone. The relationships of the other 6 species from West Africa are rather obscure. When describing *P. monodi* and *P. nigerianus* from the river Niger in Mali, Chappuis (1959) made no comments in this respect. Dumont (1981) had not much more to say when describing *Parastenocaris christiani*, *P. jeanninei*, and *P. kimi* from Senegal and Guinea except that he found one resemblance between *P. christiani* and *Kinnecaris muscicola* (Chappuis, 1936) from East Africa. Cottarelli (1982) in his description of *P. cataractae* from Sierra Leone is more explicit. He mentions resemblances of his new species to *Parastenocaris gracilis* Chappuis, 1954, *P. macaco* Chappuis, 1952, and *P. trisaetosa* Chappuis, 1955 from Madagascar, and to *Kinnecaris cornuta* (Chappuis, 1955) from the sandy shores of Lake Tanganyika.

The following description of a new species from the Ivory Coast allows to shed some light on the relationships of 3 of the 6 West African species just mentioned.

MATERIAL AND METHODS

The sample was collected by digging a pit on the bank of the Sassandra River (Ivory Coast). The water accumulating on the bottom of the pit was filtered through a plankton net (mesh 70 μm) and the residue fixed in 5% formaldehyde. Specimens were later transferred to a drop of the medium W15 (Zeiss) and mounted on slides. Microscopic investigation was carried out with a WILD M20 phase contrast microscope. Drawings were made with the aid of a WILD drawing tube according to Treffenberg.

DESCRIPTIVE PART

Monodicaris larsi gen. n., sp. n. (figs. 1-4)

Etymology. — This species is dedicated to my son Lars Schminke. The species name consequently is a noun in the genitive singular.

Type locality and material examined. — *Monodicaris larsi* gen. n., sp. n. is described from the hyporheic zone of the Sassandra River (Ivory Coast). The sample was taken on 22 April, 1977 on the bank of the river at the road Worofla-Touba. The depth of the pit was 1.50 m. Leg. Dr. Bernhard Statzner.

Holotype male (dissected on 4 slides, catalogue no. SMF 32258), allotype female (dissected on 4 slides, catalogue no. SMF 32259), one paratype male (undissected on 1 slide, catalogue no. SMF 32260), 2 paratype females (undissected on one slide, catalogue no. SMF 32261) are kept in the collection of the Deutsches Zentrum für Marine Biodiversitätsforschung (DZMB) at Wilhelmshaven (Germany), being a department of the Senckenberg Museum und Forschungsinstitut, Frankfurt (SMF).

Description of adult male (holotype). — Total body length of holotype, measured from rostrum to margin of anal operculum 520 μm . Length of furcal rami 45.8 μm . Body slender, 7 times as long as wide. Cuticle perforated by numerous pits (fig. 1C). Cephalothorax with integumental double-window. Urosomal somites 4 and 5 with paired lateral elliptical integumental windows, which are slightly smaller on urosomal somite 4 than those on somite 5 (the latter in lateral view also a little more ventral than those of somite 4) (fig. 1C). Urosomal somites 2 and 3 also with lateral windows which are located dorso-laterally and are round and much smaller than those of urosomal somites 4 and 5 (fig. 1C). Anal operculum slightly convex at its free border, not reaching beyond end of anal somite (fig. 1A).

Furcal rami (fig. 1A, B) symmetrical, slightly divergent, reaching 85% of the length of the anal somite. Each ramus 3.7 times as long as maximum width; at mid-length with lateral group of 3 setae that are unequal in length; dorsal seta located opposite to these lateral setae and biarticulate at base, posterolateral seta longer than inner terminal one; proximally on inner side with row of fine spinules.

Rostrum with pair of dorsolateral sensilla.

Antennule (fig. 2A) 8-segmented; segment 1 with row of spinules. Segment 2 longest. Segment 4 a small sclerite; segment 5 moderately dilated, with proximally a small protrusion; segment 7 sickle-shaped, terminally with a notch. Setation formula: 0/6/4/2/4 + aes/0/1/9 + aes. Aesthetasc on segment 5 slender and reaching beyond end of antennule; aesthetasc on segment 8 also slender, but shorter.

Antenna (fig. 2B) with small coxa with a few inner spinules; allobasis 3 times as long as maximum width, with 2 transverse rows of spinules on inner margin. Exopod 1-segmented, about 3 times as long as wide, cylindrical, with apical bipinnate seta. Endopod about half as long as allobasis, with 2 spines and two rows of spinules on inner margin; distal end with 5 setae, two of which are geniculate, and outer apical seta with unipinnate inner margin.

Mouthparts as described for *Parastenocaris inferna* Schminke, 1971 in Schminke (1971, fig. 1).

Leg 1 (fig. 3A) with a row of spinules at outer distal corner of coxa. Basis with outer and inner seta and with spinule rows on outer and inner margins as well as at

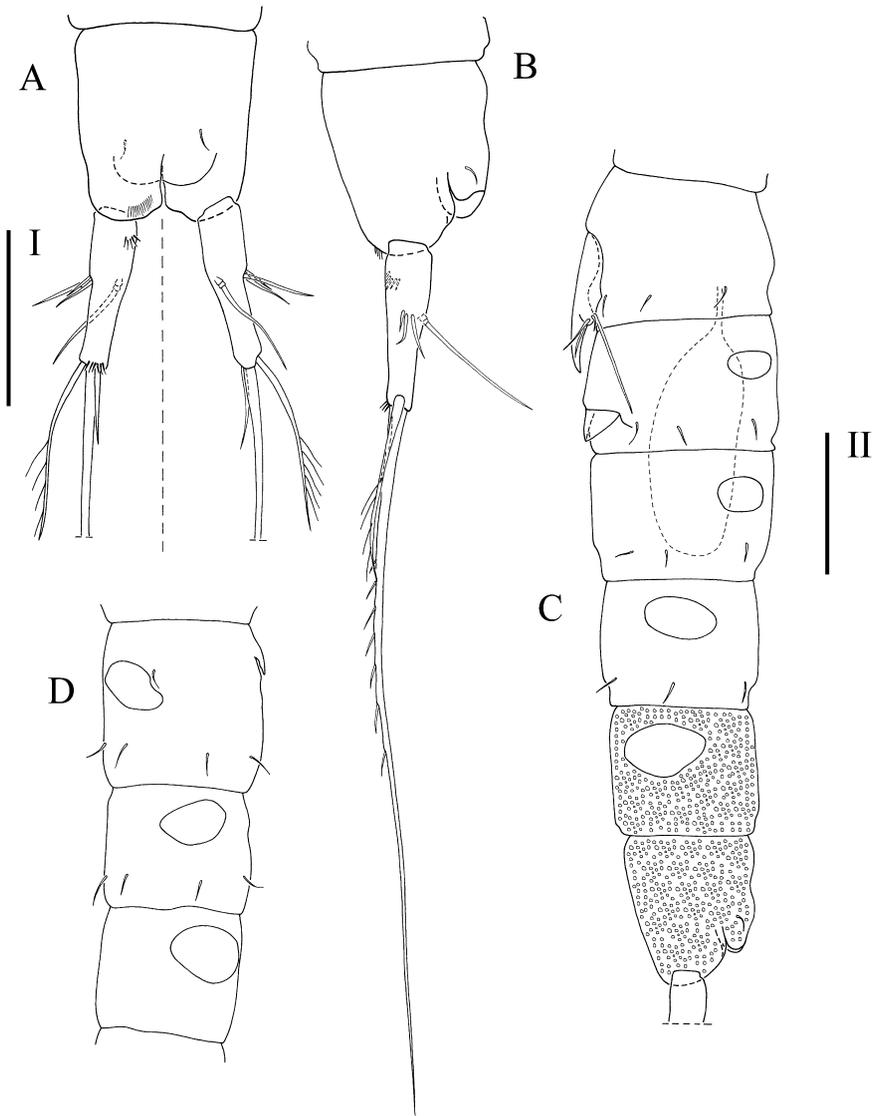


Fig. 1. *Monodicaris larsi* gen. n., sp. n. A, anal segment and furcal rami, right: dorsal view, left: ventral view; B, anal segment and furcal rami, lateral view; C, urosome, lateral view, last two somites with indication of pitted cuticle (A–C, all male holotype); D, urosomal somites 2/3 (top)–5 (bottom), lateral view, ventral to the right (female paratype). Scale bars, 50 μ m.

base of endopod. Exopod 3-segmented and as long as endopod; first segment with 1 outer spine and 3 spinule rows on outer margin; second and third segments together as long as first segment; no outer spine on second segment but with distal spinule row on outer margin; third segment with 2 unipinnate outer spines, 2 geniculate and unipinnate, apical setae, and with a distal spinule row on outer margin. Endopod

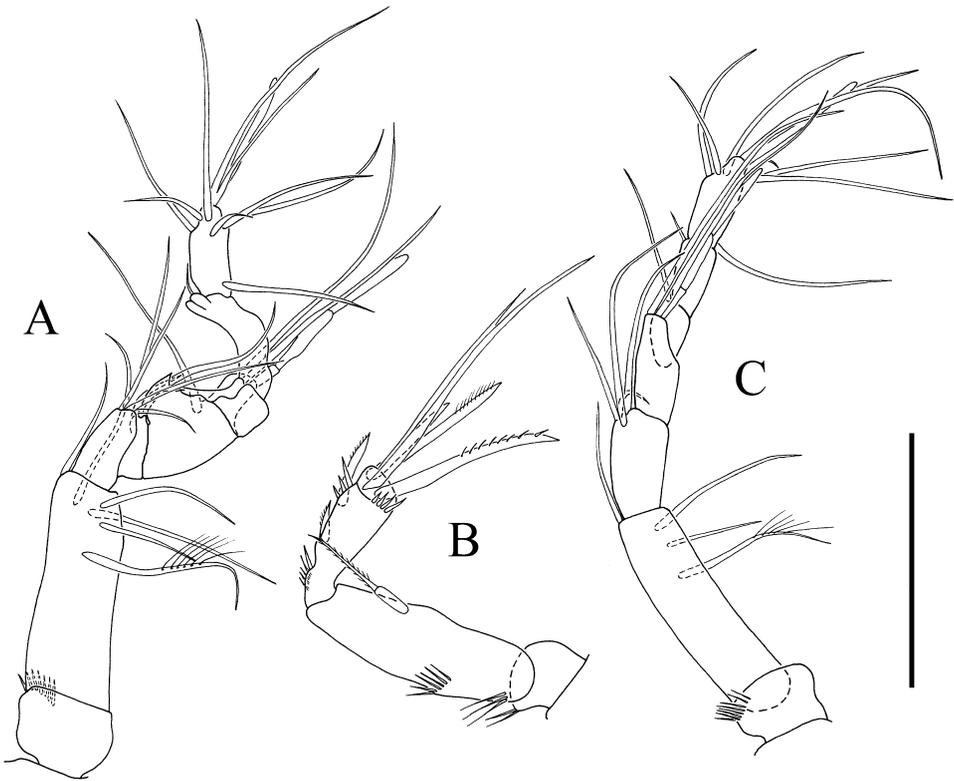


Fig. 2. *Monodicaris larsi* gen. n., sp. n. A, male antennule, dorsal view; B, antenna (A–B, both male holotype); C, female antennule, ventral view (female allotype). Scale bar, 50 μ m.

2-segmented; first segment as long as first two segments of exopod together, with 2 spinule rows on outer margin and 1 row of hair-like spinules on inner margin; second segment half as long as first one, with 1 unipinnate outer spine, 1 unipinnate geniculate terminal seta, and with 1 spinule row on outer margin and 1 transverse row on inner margin.

Leg 2 (Fig. 3B) with spinule row on coxa at outer distal corner. Basis with a spinule row on outer margin and one near endopod, but without outer seta. Exopod 3-segmented; first segment 45% of total length of exopod; other two segments almost equal in length; first segment with bipinnate outer spine and 3 spinule rows on outer margin; second segment without spine, but with longitudinal row of spinules along outer margin and tuft of fine spinules at inner distal corner; third segment with 2 pinnate terminal setae and 1 pinnate outer one, and along outer margin with longitudinal row of spinules. Endopod 1-segmented, very short and stub-like, terminally with short, inwardly curved stout seta (fig. 3C).

Leg 3 (fig. 3D) with 2 short spinule rows on coxa. Basis with strongly developed outer seta, and oblique row of 11 spinules running medially from outer margin;

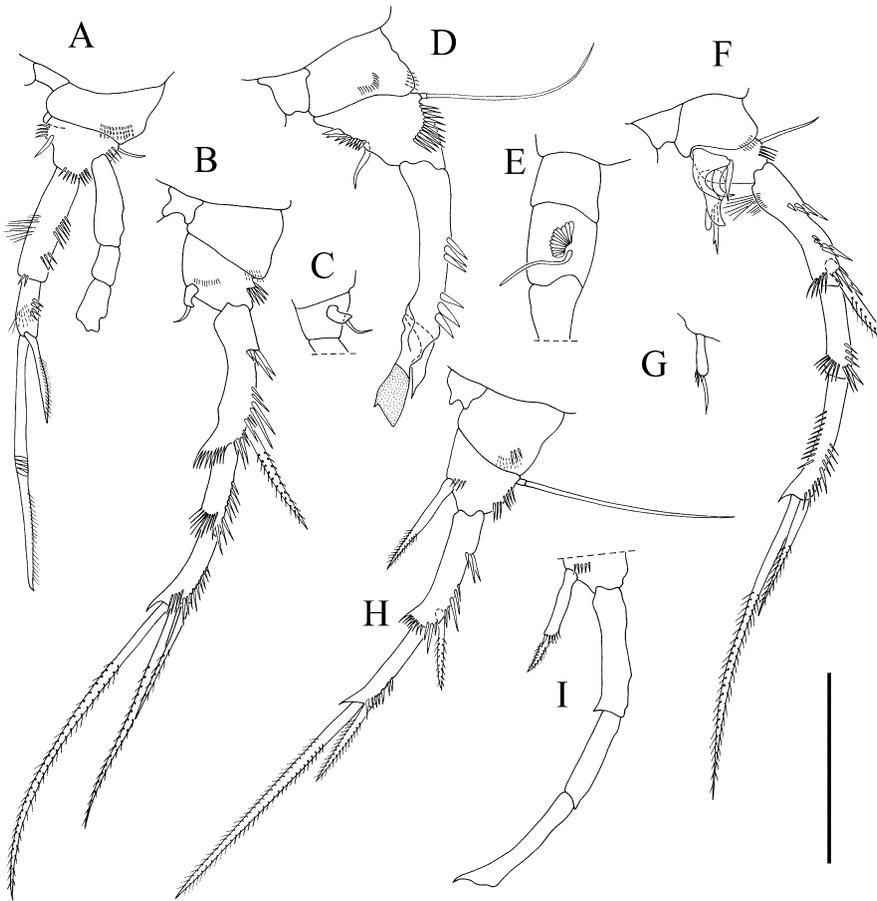


Fig. 3. *Monodicaris larsi* gen. n., sp. n. A, leg 1, armature of exopod omitted; B, leg 2 (A–B, both male holotype); C, endopod of leg 2, lateral view (male paratype); D, leg 3 (male holotype); E, basis of leg 3, internal view with denticles and endopod (male paratype); F, leg 4 (male holotype); G, endopod leg 2; H, leg 3; I, leg 4, armature of exopod omitted (G–I, all female allotype). Scale bar, 50 μ m.

half circle of denticles at inner margin around a short seta representing endopod (fig. 3E). Exopod 1-segmented, slightly incurved, with 2 rows of 3 (midlength) and 3 (distally) spinules along outer margin; apophysis straight with piece of membrane at its tip, being one third longer than thumb, which is sharply pointed at its tip.

Leg 4 (fig. 3F) with 1 spinule row at outer distal corner of coxa. Basis with outer seta and short row of 3 small spinules at outer margin and of 3 large ones at base of endopod, the two innermost of these spinules are outwardly curved and have a broad base, the outermost spinule being straight and slender. Exopod much elongate; second segment short, first and third segments longer and about equal in

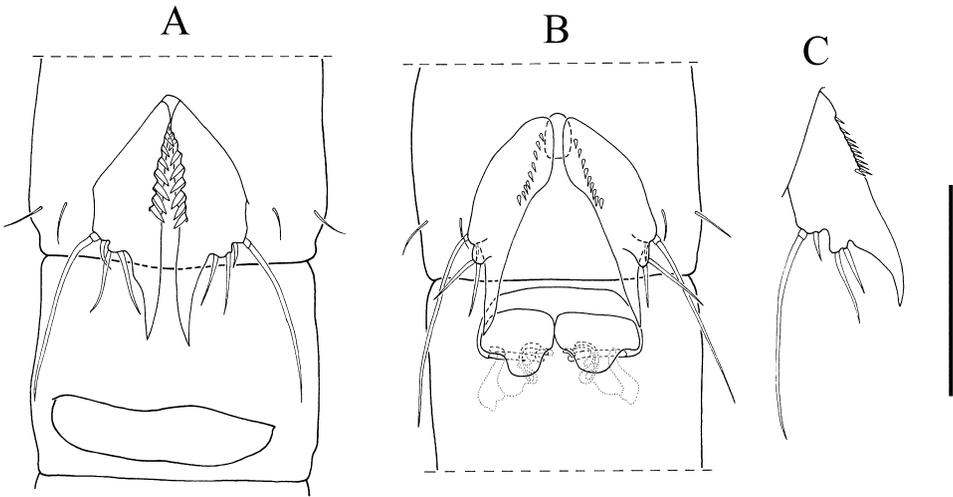


Fig. 4. *Monodicaris larsi* gen. n., sp. n. A, leg 5 and part of urosome, ventral view (male holotype); B, leg 5 and genital field, ventral view (female paratype); C, leg 5 (female allotype). Scale bar, 50 μm .

length; first segment with outer spine and 3 oblique spinule rows on outer margin, 1 spinule row at inner distal corner and a tuft of hair-like spinules proximally on inner margin opposite endopod; second (with short) and third segments (with longer) longitudinal row of spinules along outer distal margin; third segment additionally with longitudinal row along inner margin and with bipinnate outer and bipinnate apical seta. Endopod 1-segmented, short, with a deep notch at its tip out of which arises a bare seta that is slightly shorter than endopod.

Leg 5 (fig. 4A) strongly developed, simple triangular plate, with inner distal corner drawn out into massive, pointed, outwardly curved, spinous process, reaching almost middle of following segment; armature consisting of very long outer basal seta and 3 additional small setae along outer margin, of which outermost is shortest, middle and innermost seta longer and equal in length, together arising from a little protrusion, a row of spinules along inner margin.

Description of adult female (allotype). — Total body length of allotype, measured from rostrum to margin of anal operculum 490 μm , length of furcal rami 45.8 μm . Cuticle, antenna, mouthparts and leg 1 as in male. Genital field as in fig. 4B. Urosomal somite 2/3 (= genital double somite) with one dorso-lateral integumental window (fig. 1D).

Antennule (fig. 2C) 7-segmented. Segment 1 with 1 ventral row of spinules. Segment 2 longest. Segments 1-7 with 0, 4 (1 unipinnate), 4, 2, 1, 1, and 9 setae, respectively. Segments 4 and 7 each with aesthetasc, that on segment 4 reaching to tip of terminal segment; that on segment 7 relatively short and acicular.

Leg 2 as in male except for endopod (fig. 3G), which is 1-segmented and slender, with apically 1 prominent seta and a row of 4 spinules.

Leg 3 (fig. 3H) with 2 spinule rows at outer distal corner of coxa. Basis with long outer seta and spinule row at outer margin and above endopod. Exopod 2-segmented, first segment longer than second one; first segment with 1 spine at outer distal corner, 2 spinule rows at outer margin, and with a few spinules distally; second segment with small spinules arranged longitudinally along outer margin and with 1 long pinnate apical seta and 1 pinnate outer spine. Endopod 1-segmented, reaching three quarters of length of first exopod segment, fused with bipinnate terminal seta.

Leg 4 (fig. 3I) with row of small spinules on basis above endopod. Exopod 3-segmented, third segment slightly longer than first, second one shortest. Otherwise like in male. Endopod 1-segmented, terminally with bipinnate seta and row of 6 spinules, endopod and seta together almost as long as first segment of exopod.

Leg 5 (fig. 4B, C) as in male except for size of spinules along inner margin, which are smaller in female.

Ecology. — At the type locality, the new species was found in good numbers. The fauna that co-occurred with it was diverse but not rich, and included the following: Nematoda, Oligochaeta, Acari, a few insects and insect larvae, Cyclopoida, other Harpacticoida, and the bathynellacean, *Nannobathynella eburnea* Schminke, 1979.

DISCUSSION

The new species has one characteristic feature that is rare within Parastenocarididae. This is the short, stub-like endopod of leg 2 male, which carries a short terminal seta (fig. 3B, C). Cottarelli (1982) also found such an endopod when describing *Parastenocaris cataractae* from Sierra Leone and drew attention to *P. macaco* from Madagascar with the same kind of endopod (which in the meantime is also known from *P. crenobia* Galassi, 1997). He could also have mentioned two species geographically much nearer to where his new species was found, viz., *P. monodi* from Mali and *P. christiani* from Guinea. It is interesting to note that this endopod is normal in the female (fig. 3G), where it is slender and rod-like, with a seta and a few spinules apically. This sexual dimorphism is not depicted but mentioned in the text for *P. monodi* by Chappuis (1959). It is not known for *P. christiani* for lack of females. It is present in *P. cataractae*, the present new species, and seemingly also in *P. macaco* in which, however, this is due to the fact that male and female belong to different species. This was already suspected by Chappuis (1952) himself, because of the completely different structure of leg 5 and the furcal rami in both

sexes. Leg 5 and furcal rami are also completely different (as also in *P. crenobia*) when compared with the new species, which, however, has several more characters in common with *P. monodi*, *P. christiani*, and *P. cataractae* than the endopod of leg 2. These characters are:

- Endopod of leg 3 female (fig. 3H) fused with terminal seta, which is bipinnate (this is apparent in *P. cataractae* and the new species; it is not clear for *P. christiani* for lack of females and for *P. monodi*, because of Chappuis' (1959) opinion that it is useless to describe females since all look alike).
- Exopod of leg 3 male (fig. 3D) with two rows of spinules along outer margin, one at midlength, the other distally; apophysis being longer than thumb and ending in a terminal membrane (both conditions apply in all four species).
- Endopod of leg 4 female (fig. 3I) a slender rod, terminally with a short bipinnate seta, together reaching 90% of the length of first exopod segment (not verifiable for *P. christiani* and *P. monodi*).
- Endopod of leg 4 male (fig. 3F) with short bare terminal seta (in all four species); spinules on basis above endopod different in size, becoming smaller from internal to external (*P. christiani* with one large spinule only); first segment of exopod with a tuft of hair-like spinules proximally on inner margin opposite the endopod (not described for *P. monodi*, but present in the other three species).
- Leg 5 in both sexes a strongly developed triangular plate held close to the body, with inner distal corner drawn out into a massive, pointed, outwardly curved, spinous process and proximally with a row of spinules along inner margin (to be observed in all four species).
- Furcal rami (fig. 1A, B) elongate, at least 3.6 times as long as maximum width, lateral group of 3 setae at least at midlength, if not more proximally; dorsal seta located opposite to 3 lateral setae (to be observed in all four species).
- Urosomal somites 4 and 5 with paired lateral elliptical integumental windows (fig. 1C, D), which are slightly smaller on urosomal somite 4 than those on somite 5; urosomal somites 2 and 3 also with windows (windows present in the new species and verified for *P. monodi* by Soyer (1965) who re-investigated the type specimen, not mentioned for *P. cataractae* or *P. christiani*).
- Pitted cuticle (fig. 1C) (present in *P. christiani* and the new species, verified by Soyer (1965) for *P. monodi*, not mentioned for *P. cataractae*).

This comparison shows that there are many characters that the four West African species have or may have in common. As usual, incomplete descriptions do not allow being certain in all cases but there is enough information to conclude that these species represent a phylogenetic entity. This becomes even more evident when these species are compared with the genus *Kinnecaris* Jakobi, 1972 which seems to be very closely related. They share quite a number of characters (even though, unfortunately, not all are known for all species). They have a pitted cuticle,

they have lateral integumental windows on urosomal somites 4 and 5 that agree in position and size, they have elongate furcal rami with the lateral group of 3 setae and the dorsal seta located opposite to each other at least at 2/3 of ramus length, they have a very short outer terminal seta on the third exopodal segment of leg 4 (and most likely also on the second exopodal segment of leg 3 female), they have two longitudinal rows of spinules along the outer margin of the exopod of leg 3 male, they have the endopod of leg 3 female fused with the terminal seta, they have a row of spinules on the basis of leg 4 male above the insertion of the endopod, and they have the same form of leg 5, which is a triangular plate with the inner distal corner drawn out into a massive, pointed, outwardly curved, spinous process.

Despite these common characters, the West African species do not belong to the genus *Kinnecaris* because of the following differences:

- In addition to the lateral integumental windows on urosomal somites 4 and 5 they also have windows on urosomal somites 2 and 3 that are dorso-lateral in the new species and according to Soyer (1965) dorsal in *P. monodi*. These are lacking in *Kinnecaris*.
- Furcal rami with lateral group of 3 setae and with dorsal seta located at least at midlength or even more proximally. In *Kinnecaris* these setae are located more distally at 2/3 of ramus length.
- Of the two rows of spinules along the outer margin of the exopod of leg 3 male one is at midlength and not proximally as in *Kinnecaris*.
- The spinules on the basis of leg 4 male above the insertion of the endopod are of different size, becoming smaller from internal to external, whereas all are of the same size in *Kinnecaris*.
- Legs 5 have the same form as in *Kinnecaris* but differ in having a row of spinules along the inner margins. Also the posture of the legs is different. They are held close to the body in the West African species whereas they are spread apart and held downwards in *Kinnecaris* (see Karanovic, 2005, figs. 2 and 17).

The main difference, however, is that the West African species despite the same ‘pocket knife’ mechanism, have a normally prehensile male antennule (fig. 2A) (as documented for the new species and *P. cataractae*), whereas in *Kinnecaris* it is grossly prehensile with the proximal inner corner of the fifth segment being extended into a large conical protrusion. This was assumed by Schminke (2008) as being one of the possible autapomorphies of *Kinnecaris*. On the other hand, the West African species have their own possible autapomorphies, such as the short, stub-like endopod of leg 2 male (fig. 3B, C), and the spinules (partly in the form of hooks) on the basis of leg 4 male above the insertion of the endopod (fig. 3F) being different in size, becoming smaller from internal to external. Nothing like that is known from other species of Parastenocarididae.

It can, therefore, be concluded that the West African species represent a separate genus, which is named here *Monodicaris* gen. n. in honour of the great savant and naturalist Théodore Monod (1902-2000), who spent 25 years in West Africa as director of the Institut Français d'Afrique Noire in Dakar (Senegal), made several expeditions to the Central Sahara, spent his military service in the desert (Schminke, 1982) and also collected Parastenocarididae on the bank of the River Niger in Mali (Chappuis, 1959).

Monodicaris gen. n.

Generic diagnosis. — Body with pitted cuticle. Lateral integumental windows present on urosomal somites 4 and 5, windows also on urosomal somites 2 and 3 of the male. Elongate furcal rami with lateral group of 3 setae and dorsal seta located opposite to each other at midlength or even more proximally. Antennules of male 8-segmented and normally prehensile. Antennules of female 7-segmented. Endopod of leg 2 male short and stub-like with a short terminal seta. Endopod of leg 2 female normal (i.e., 1-segmented, slender and rod-like, with a seta and a few spinules apically). Two rows of spinules along outer margin of exopod of leg 3 male, one at midlength, the other distally; apophysis longer than thumb, with a terminal membrane. Endopod of leg 3 female fused with pinnate terminal seta. Spinules on basis of leg 4 male above insertion of endopod different in size, becoming smaller from internal to external. Leg 5 a strongly developed triangular plate held close to the body, with inner distal corner drawn out into a massive, pointed, outwardly curved, spinous process and with a row of spinules along inner margin.

Type species. — *Monodicaris larsi* gen. n., sp. n.

Other species. — *M. cataractae* (Cottarelli, 1982) comb. n., *M. christiani* (Dumont, 1981) comb. n., *M. monodi* (Chappuis, 1959) comb. n.

Monodicaris larsi sp. n. is distinguished from the other three species by its leg 1 having an inner and outer basal seta, by its leg 4 male having an endopod with a deeply cleft tip, and by its leg 5 male having along the inner margin a row of spinules larger than those in the female.

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