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MORPHOLOGY AND SYSTEMATIC POSITION OF THE ANTARCTIC AND SUB-ANTARCTIC SYNOPIID *CARDENIO PAURODACTYLUS* STEBBING, 1888 (CRUSTACEA, AMPHIPODA)

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ABSTRACT

Hitherto overlooked morphological characters of *Cardenio paurodactylus*, a common burrowing subantarctic and west antarctic amphipod, incline the authors to keep this species in the family Synopiidae.

INTRODUCTION

Cardenio paurodactylus was described by Stebbing (1888) on the basis of 4 specimens collected by the "Challenger" expedition at Kerguelen Islands. The holotype was a rather small and immature female some 5 mm in length. The genus *Cardenio* was originally allocated to the family Pontoporeiidae. Della Valle (1893) repeated — in part erroneously — some of Stebbing's drawings and information and placed *C. paurodactylus* in his "Gammaridi" between phoxocephalids and haustoriids. Later, Stebbing (1906) formally placed the species in Haustoriidae and, until quite recently, was followed by most authors (Schellenberg 1926, K. H. Barnard 1932, Stephensen 1947, Thurston 1974, Lowry &

Bullock 1976, Bellan-Santini & Ledoyer 1986). Bousfield (1965), however, in his rearrangement of haustoriids, noticed problems in defining affinities of *C. paurodactylus* with other haustoriid genera. J. L. Barnard & Drummond (1982) briefly mentioned for the first time that *Cardenio* should be removed to Synopiidae, but finally J. L. Barnard & Karaman (1987) erected for *Cardenio* the new family Cardenioidae.

K. H. Barnard (1932) found and described the male of *C. paurodactylus* at South Georgia, like all the subsequent authors he did not pay any special attention to the striking sexual dimorphism of the gnathopod 1.

However, abundant new material allowed the present authors to describe overlooked morphological characters, to correct some previous

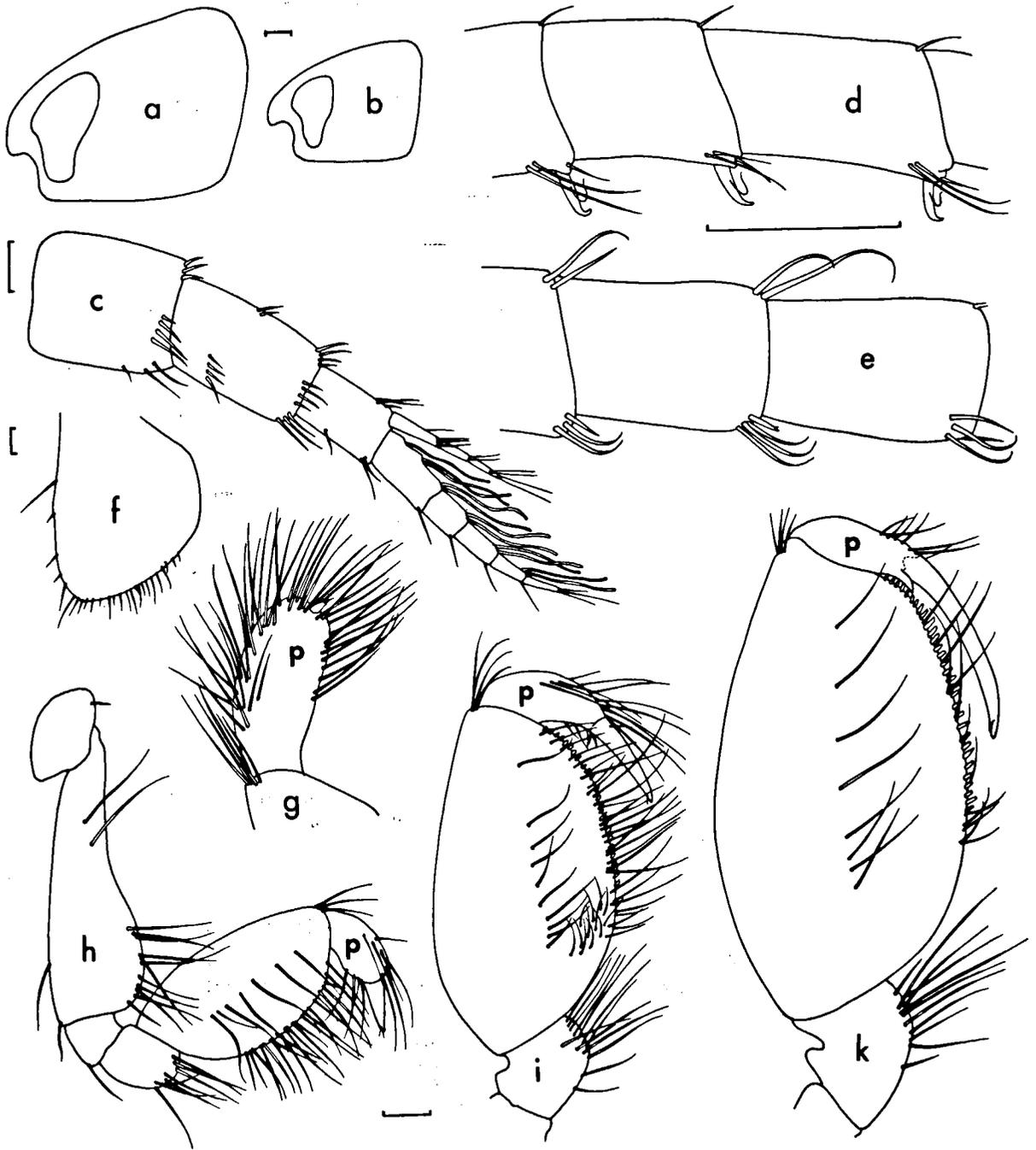


Fig. 1. *Cardenio paurodactylus* Stebbing. a: head, ♀, 12 mm. b: head, ♂, 7 mm. c: antenna 1, ♂, 9 mm. d: proximal part of antenna 2 flagellum, ♂, 9 mm. e: idem, ♀, 13 mm. f: coxa 2, ♂, 9 mm. g-k: gnathopod 1. g: distal articles, ♀, 12 mm; h: ♂ imm., 5.5; i: ♂, 7 mm; k: ♂, 9 mm (p = propodus). Scale: 100 μm.

misinterpretations or mistakes and to more correctly define the systematic position of *C. paurodactylus*.

MATERIAL

Several hundred specimens from some 15 samples, collected between 1977 and 1988 (leg. P. Presler, J. Siciński, K. Jażdżewski, J. Żychliński) in the shallow sublittoral (15-40 m) of Admiralty Bay, King George Island, South Shetlands, West Antarctica. Length of females attains 15 mm, that of males 9 mm.

RESULTS AND DISCUSSION

The original drawings of Stebbing (1888) are reliable and nearly exhaustive. We will only present here some aspects of the morphology of *C. paurodactylus* so far overlooked or misinterpreted by former authors.

1. The head (Fig. 1 a, b) is weakly but clearly galeate, in contradiction to diagnoses of *Cardenio* and Cardenioidae by J. L. Barnard & Karaman (1987). In addition, the head of *Cardenio* is massive and as long as the 2 first peraeon segments, a condition that is typical of Synopiidae. The rostrum is short and blunt (very comparable, for instance, to the rostrum of *Pseudotiron coas* J. L. Barnard, 1967) and somewhat stronger in males than in females.

2. The accessory flagellum (Fig. 1c) is comparatively long and consisting of several articles, from 2 in young specimens up to 5 in adults. The information given by Stebbing (1888), who figured and mentioned two articles, was transformed by Della Valle (1893) into "flagelle accessorio rudimentale, 1-articolato" and then wrongly repeated by J. L. Barnard & Karaman (1987) in the diagnosis of Cardenioidae.

3. Antenna 2 is sexually dimorphic, much longer in males (5 times longer than head) than in females (3 times longer than head). Flagellum has up to 12 articles in adults. In males, each article, except some apical ones, is armed with a special hooked spine, not a

spiniform calceolus as suggested by K. H. Barnard (1932). (Fig. 1 d, e).

4. Setae on the article 3 of the mandibular palp are inserted not only apically as mentioned by J. L. Barnard & Karaman (1987). The rich setosity of this article, extending along at least the half of its ventral margin, was already shown by Stebbing (1888).

5. The maxilliped palp is not 3-articulate (J. L. Barnard & Karaman 1987) but 4-articulate. The dactyl is minute, vestigial and hidden among dense apical setae of the third article. This feature was also noticed by Bellan-Santini & Ledoyer (1986).

6. Coxa 1 is really strongly reduced, nearly vestigial, armed with one short seta (Fig. 1 h), but coxae 2-4 are not "poorly" (J. L. Barnard & Karaman 1987) but rather richly setose (Fig. 1 f).

7. Gnathopods in females have a structure very similar to that of *Synopia*, the type genus of the family. The similarity consists mainly in the very short ischium and merus in both gnathopods, in the large, broad, almond-shaped carpus in gnathopod 1 and long and slender carpus and propodus in gnathopod 2, with long bristles bordering these articles (see Stebbing 1888, Ledoyer 1979, Andres 1984, J. L. Barnard & Thomas 1989, for species of *Synopia*). However, gnathopod 1 in *C. paurodactylus* is strongly sexually dimorphic. The female dactyl of gnathopod 1 is vestigial (Fig. 1 g), as observed already by Stebbing (1888), but is considered absent by Bellan-Santini & Ledoyer (1986). On the other hand, the male dactyl is large and elongate. K. H. Barnard (1932) clearly figured this appendage but misinterpreted the arrangement of other articles. The "palm" is not formed by the propodus, but by the carpus, whereas the propodus is much reduced and forms a short base for the dactyl. Young males of about 5 mm in length show the intermediate shape of gnathopod 1, clearly indicating the way in which the juvenile (feminine) gnathopod 1 is masculinized in successive moults (Figs. 1h, i, k).

Distinct sexual dimorphism in *C. paurodactylus* is noteworthy in view of the opinion of J.

L. Barnard (1972) and Lincoln (1979) on the similarity of sexes in the whole family Synopiidae. More recent information by Karaman (1986) and J. L. Barnard & Thomas (1989) do show that sexual dimorphism is quite clear at least in such genera like *Garosyrrhoë* and *Syrrhoites*. On the other hand, as many synopiid species have been described from single holotype specimens or even from type specimen of unknown sex, it is quite premature to consider all Synopiidae as weakly sexually dimorphic.

8. Further synopiid features of *C. paurodactylus* consist in long, massive pleon, denticulate pleonites 1-3, lanceolate rami of uropod 3 and long telson strongly exceeding in length the uropod 3 peduncle.

In conclusion of this brief analysis, it appears to us that, as the head can be regarded as galeate, the only main diagnostic character distinguishing Cardenioidae from Synopiidae remains the strongly reduced coxa 1. But, on one hand, a trend toward the reduction of the coxa 1 exists in *Latacunga* or *Synopia* and the character state found in *Cardenio* can be regarded as the extreme step. On the other hand, this character alone has no sufficient taxonomic weight, to allow the establishment of a new family.

Since J. L. Barnard's (1972) revision of Synopiidae, where 69 species in 14 genera were mentioned, 9 new species were added to this list, all belonging to hitherto known genera (Ledoyer 1977, 1979, Just 1981, Goeke 1982, Andres 1984, Bellan-Santini 1985, Karaman 1986), whereas one species (*Garosyrrhoë disjuncta*) was synonymized by J. L. Barnard & Thomas (1989). The only new genus, *Metatiron*, created by Rabindranath (1972) was rejected by Just (1981) and Jażdżewski (1990) as not sufficiently substantiated. Therefore, the present list of Synopiidae including *C. paurodactylus* would encompass 78 species in 15 genera.

The genus *Cardenio* fits in J. L. Barnard's (1972) key in the following way:

KEY TO THE GENERA OF SYNOPIIDAE

1. Both telson and peduncle of uropod 3 very short and subequal in length, mandibular

- palp extremely stout *Synopia*
- Telson elongate, exceeding peduncle of uropod 3 even when peduncle elongate, mandibular palp not extremely stout 2
- 2. Gnathopod 2 with dactyl; eyes, if present, not very large, eye length not more than 1.5 times the diameter of the antenna 1 base 3
- Gnathopod 2 lacking dactyl; eyes very large, eye length more than twice the diameter of antenna 1 base *Cardenio*
- 3. From couplet 3 one can proceed with the J. L. Barnard's key, taking into account that our couplet 3 is Barnard's couplet 2.

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