

REDISCOVERY OF *SPHAEROCARCINUS BEDOTI* ZEHNTNER, 1894
(DECAPODA: BRACHYURA: PORTUNIDAE) AT SOCOTRA ISLAND
(REPUBLIC OF YEMEN) AND PLACEMENT IN THE GENUS *CAPHYRA*
GUÉRIN, 1832

Michael Apel and Carola Steudel

Forschungsinstitut Senckenberg, Senckenbergsanlage 25, D-60325 Frankfurt a.M., Germany
(e-mail: mapel@sng.uni-frankfurt.de; csteudel@sng.uni-frankfurt.de)

A B S T R A C T

Two brachyuran crabs collected at Socotra Island (Republic of Yemen) in the northwestern part of the Indian Ocean turned out to be conspecific with *Sphaerocarcinus bedoti* Zehntner, 1894, so far only known from a single female collected at Amboina, Indonesia, without any information on its ecology. Based on the new material and especially the availability of a male for comparison of the morphology of the copulatory appendages (gonopods), *Sphaerocarcinus* Zehntner, 1894, is synonymised with *Caphyra* Guérin, 1832. The extremely convex and globose carapace shape of the type specimen from Amboina turned out to be atypical and possibly caused by parasitic infection. Ecologically, *C. bedoti*, like most species of the genus *Caphyra*, lives epibiotic on soft corals (Octocorallia: Alcyonaria).

During a survey on Socotra Island in the northwestern Indian Ocean in spring 1999, a pair of small crabs living on the soft coral *Cladiella australis* (Macfadyen, 1936) (Octocorallia: Alcyonidae) was collected by the first author (Fig. 1A). After close examination it became clear that these specimens were at least very similar to *Sphaerocarcinus bedoti* Zehntner, 1894, which had been described from a single female from Amboina (Moluccas, Indonesia) (Fig. 1B). Subsequently no further material has ever been published, and because the original description lacks an indication of the habitat, no information on the ecology of that species is available.

Zehntner (1894) established the monotypic genus *Sphaerocarcinus* mainly because of the very convex carapace, the truncate front, and the morphology of the external maxillipedes and female abdomen of *S. bedoti*, which he otherwise considered to be very close to *Lissocarcinus* Adams and White, 1849. Subsequently Alcock (1899) placed the genus in the portunid subfamily Caphyrinae Paulson, 1875, where he considered it to be intermediate between *Lissocarcinus* and *Caphyra* Guérin, 1832. It is, however, difficult to follow this view because he defines the genus as follows: “As *Lissocarcinus*, but the last pair of legs are as in *Caphyra*, and the carapace is very strongly convex”, while on the other hand he uses the morphology of the “last pair of legs” (fifth pereiopods) as the main dis-

tinguishing character between *Lissocarcinus* and *Caphyra*. Obviously Alcock had not seen the type of *S. bedoti* and just followed Zehntner’s statement regarding the similarity to *Lissocarcinus* without re-evaluating the morphological characters.

Balss (1957) placed the genus in the subfamily Caphyrinae. Stephenson and Campbell (1960) and Stephenson (1972), in their revisionary works on the family Portunidae, did not discuss the genus in detail. Within their keys it appears to be close to *Caphyra*, being distinguished from the latter by the very convex carapace, the lamellate front and anterolateral border, the carpus of the fifth pereiopod being broader than the propodus, and the wrist and hand of the chelipeds being markedly carinate. Obviously the authors, however, did not examine the type of *S. bedoti* and did not discuss the significance of the characters they used to delimit the genus. Furthermore, the lack of a male specimen did not allow an examination of the sexual appendages (gonopods) which are known to be of high taxonomic value (Türkay, 1975; Guinot, 1979). Türkay (1971) re-examined the type specimen, providing good photographs of carapace shape, but also did not discuss the characters used for generic distinction or its systematic position.

Besides being an interesting rediscovery and range extension, the specimens from Socotra, and especially the availability of

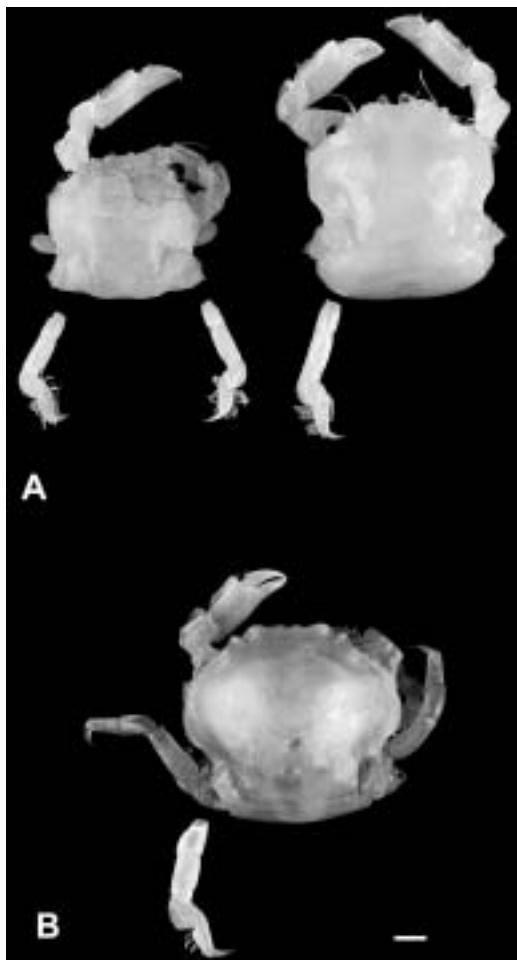


Fig. 1. Dorsal view of: A. *Caphyra bedoti* from Socotra Island (SMF 25279); B. The holotype of *Caphyra bedoti* from Amboina (Mus. Geneva).

gonopods, thus offer an opportunity to reconsider the systematic position of *Sphaerocarcinus* Zehntner, 1894, and its affinities to the other genera within the Caphyrinae.

MATERIALS AND METHODS

The new material was collected by the first author on the coast of Socotra Island (Republic of Yemen) in March 1999 at a depth of 8 m using SCUBA. It was immediately fixed in 4% Formalin before being shipped to the laboratory. Here the material was rinsed and transferred to 70% ethanol for examination and long-term storage. It is now permanently deposited in the Senckenberg Museum, Frankfurt (SMF). Furthermore, the type specimen of *S. bedoti* from the "Musée d'Histoire Naturelle de Genève" was examined for comparison. Drawings of the outer morphology and of the gonopods were made under a stereoscopic microscope using a "camera lucida." Measurements were made to the nearest 0.1 mm by calliper and ocular micrometer.

RESULTS

Examination of the material collected on Socotra Island and comparison with the type specimen of *S. bedoti* revealed no relevant morphological differences, except for the convexity of the carapace (Fig. 2A, B). While the carapace of the two specimens from Socotra is only moderately convex in both directions, that of the type is extremely swollen, giving the specimen an almost globose appearance. The observed carapace shape in the type specimen, however, rather appears to be a pathological phenomenon as it is known to be caused by certain parasites like *Nectonema* sp. (Nematomorpha) or certain Turbellaria (J. Shields, personal communication). Despite the difference in carapace shape, we thus are convinced that the specimens from Socotra are conspecific with the type from Amboina. Even though direct proof of a parasitic infection was not possible, this hypothesis is supported by the slightly asymmetrical shape of the carapace in the type specimen. Furthermore, even though considerably larger than the specimens from Socotra, the type is not sexually mature and the abdomen shows a subadult morphology. The female from Socotra on the other hand has a fully developed abdomen and is carrying eggs. This observation can also be explained by a parasitic infection, because a number of parasites, as for example *Nectonema* or turbellarians, are known to act as castrators, preventing sexual maturity in their hosts (J. Shields, personal communication).

Because the strong convexity is one of the most conspicuous characters defining the genus *Sphaerocarcinus*, it becomes necessary to reconsider the validity of that genus and the characters used for its distinction from other genera related to it, in particular *Lissocarcinus* and *Caphyra*. This includes a comparison of the gonopod morphology, now that a male specimen is available. From *Lissocarcinus* the genus *Sphaerocarcinus* is clearly distinguished by the strongly convex sternum and the lack of paddle-shaped fifth pereiopods in the latter (Fig. 3A-C). Furthermore, the different morphology of the first gonopods (Fig. 3D) leaves no doubt that there is a clear distinction between these two genera. This is supported by differences in host preference.

The relationship between *Sphaerocarcinus* and *Caphyra* appears to be completely dif-

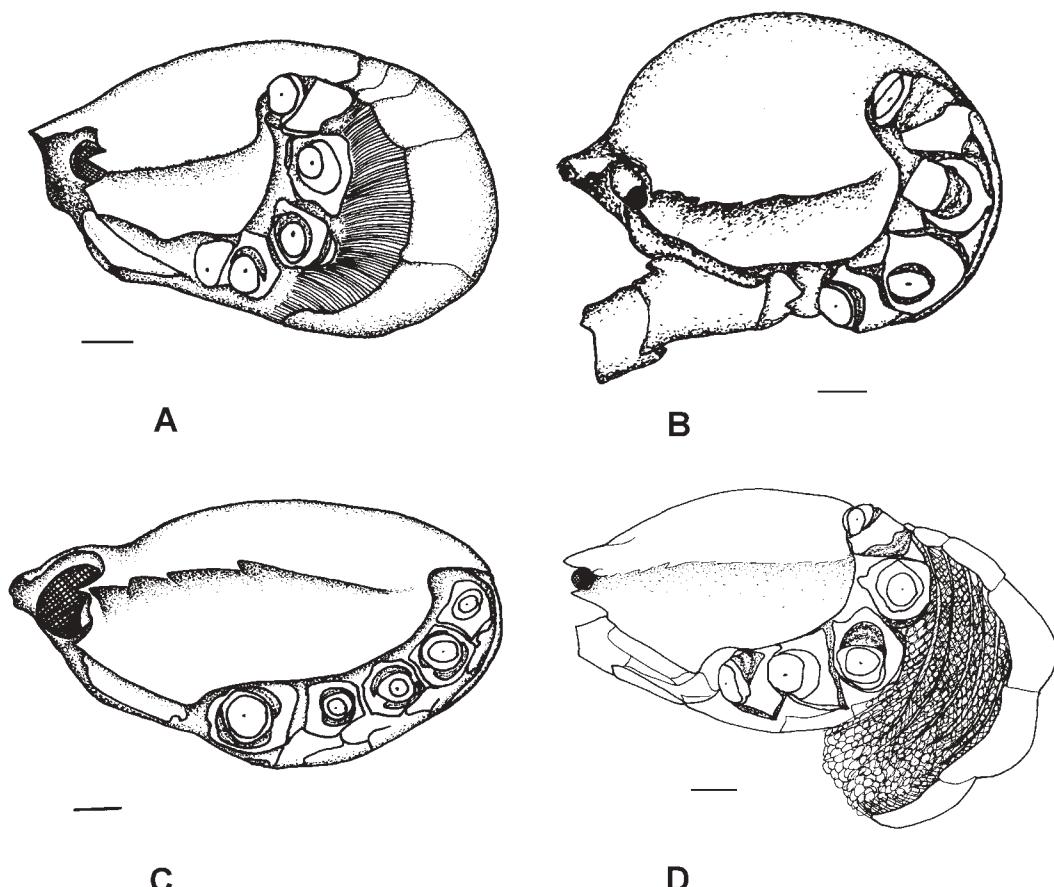


Fig. 2. Lateral view of: A. *C. bedoti*, female specimen from Socotra (SMF 25279); B. Holotype of *C. bedoti* (Mus. Geneva); C. *Lissocarcinus laevis* Miers, 1886, from the Gulf of Aden (SMF 22956); D. *Caphyra laevis* (A. Milne Edwards, 1869) from the Philippines (SMF 19736). (Scale 1 mm.)

ferent, however. Taking into account the concept of the latter genus as used by Stephenson and Campbell (1960), Stephenson (1972) and Crosnier (1975), we do not see any problem to include *S. bedoti* within *Caphyra*. All characters used for distinction (shape of front and anterolateral border, carinate chelipeds, and morphology of fifth pereiopods) are highly variable within *Caphyra*. The shapes do not differ to a greater degree between *S. bedoti* and certain species of *Caphyra* than they do within the genus *Caphyra* as it is presently defined. In particular the "lamellate" appearance of the front and anterolateral border is quite similar to that of *Caphyra unidentata* Lenz, 1910 (Crosnier, 1962: fig. 33) and *C. tridens* Richters, 1880 (Crosnier, 1975: fig. 3). Carinate chelipeds are present in several species of *Caphyra*, but most con-

spicuous in *Caphyra alata* Richters, 1880 (Crosnier, 1962: fig. 43 under the name *C. yookadai* Sakai, 1933; Crosnier, 1975: fig. 1b).

Thus, the only remaining distinctive character is the morphology and relative width of the carpus and propodus in the last pereiopods. In *S. bedoti* the carpus of the fifth pereiopod has a quite typical shape, being relatively short, strongly bent and broader than the propodus (Fig. 3A). The morphology of the fifth pereiopods, however, is very variable within the genus *Caphyra* (Fig. 3B, C). Mainly, they differ in curvature, width, and length of the dactylus, which functions as a hook and might be used for clinging to different hosts. The propodus is more uniform within the genus, being short and broad, and its width reflects the extension of the powerful muscles that move the dactylus. In the

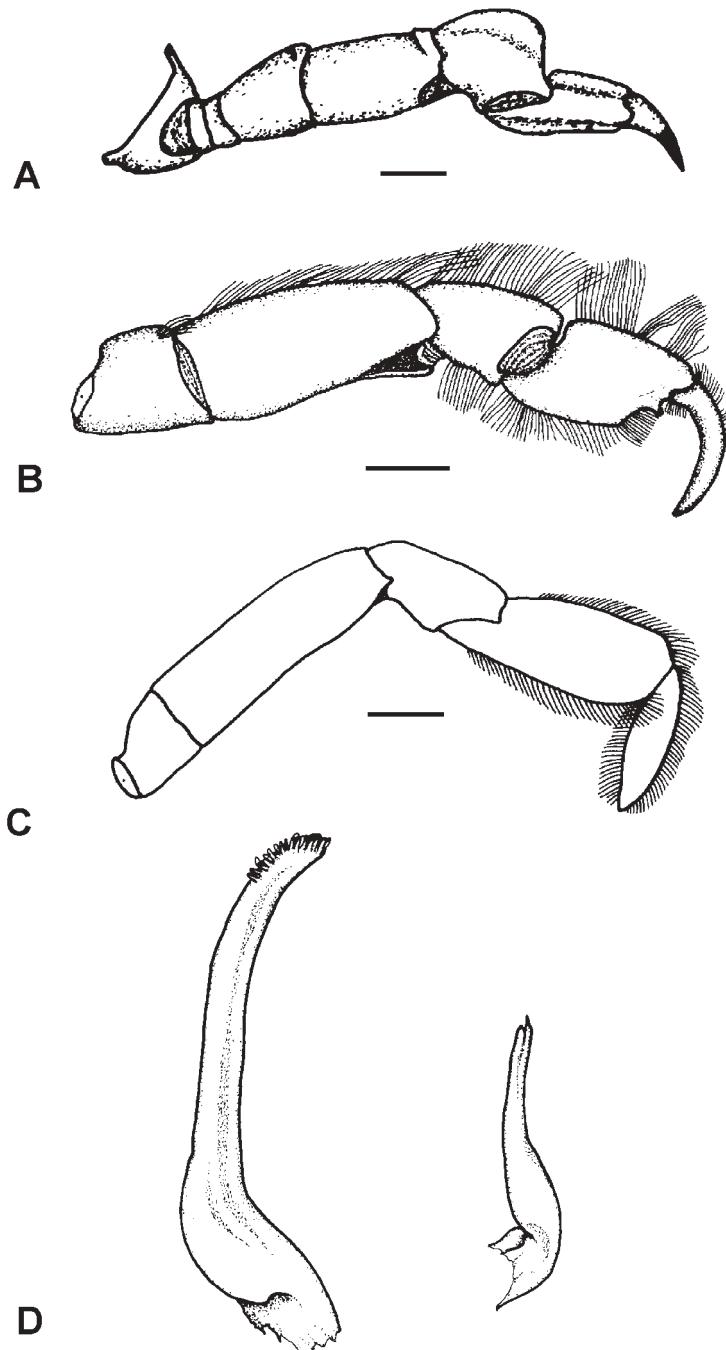


Fig. 3. A. Fifth pereiopod of *C. bedoti*, holotype (Mus. Geneva); B. Fifth pereiopod of *C. rotundifrons* (A. Milne Edwards, 1869) from Socotra (SMF 24510); C. Fifth pereiopod of *C. laevis* from the Philippines (SMF 19736); D. First and second right gonopod of *C. bedoti*, male from Socotra (SMF 25279). (Scale 1 mm.)

same way, size and shape of the carpus reflect the dimensions of the muscles moving the propodus, which swings perpendicular to the propodus-dactylus plane. In *S. bedoti* this

musculature is extremely well developed, and thus the carpus is broadened and thickened. This, however, is also found within *Caphyra*, even though it is more conspicuous in *S.*

bedoti. Other species like *Caphyra polita* (Heller, 1861) and to a certain degree *C. rotundifrons* (A. Milne Edwards, 1869) (Fig. 3B) show similar shapes of these articles. In all these species the three distal articles form a “three-dimensional hook” which improves the ability to hold on to their hosts and facilitates locomotion in a three-dimensional environment. Formation of the “three-dimensional hook” is the functional explanation of the special shape of the carpus. Because no discontinuity in the shaping of that character can be found, we doubt its validity as a generic character.

Looking at the morphological similarity between *S. bedoti* and species of the genus *Caphyra*, it is not immediately comprehensible why Zehntner (1894) not only placed the species in a separate genus but also did not compare it to *Caphyra* at all. This is even more strange because in the same publication he describes *Caphyra natatrix* Zehntner, 1894. Obviously, he thus considered the lack of distinct frontal and anterolateral teeth as the most important character distinguishing the species from *Caphyra* and relating it to *Lissocarcinus*. Within *Caphyra*, however, the shape of the front and anterolateral border appears to be highly variable within the genus and even at an intraspecific level (Stephenson and Campbell, 1960; Crosnier, 1975). Furthermore, the finding of a male specimen revealed that the morphology of the male abdomen and first gonopods of *S. bedoti* (Fig. 3D) is very similar to those found in a number of species of *Caphyra* (e.g., *C. alata*, *C. unidentata*, and *C. yookadai*). Being an epibiont of alcyonarian octocorals, *S. bedoti* also appears to be a “typical” *Caphyra* ecologically. Taking all this into account we are convinced that there is no discontinuity justifying the placement of *S. bedoti* in a separate genus distinct from *Caphyra* and thus consider *Sphaerocarcinus* Zehntner to be a junior subjective synonym of *Caphyra* Guérin.

Systematics *Caphyra* Guérin, 1832

Caphyra Guérin, 1832: 285.
Camptonyx Heller, 1861: 357.
Sphaerocarcinus Zehntner, 1894: 163, 164.

Type Species.—*Caphyra rouxi* Guérin, 1832. [by monotypy]

Diagnosis.—Carapace subcircular, subquadri- or suboctogonal, slightly broader than long.

Surface convex in both directions, smooth or granular, usually glabrous. Epibranchial ridge present in all, other transverse carapace ridges in some, species. Front cut into 2 to 6 lobes or teeth, often low and indistinct. Anterolateral border complete or cut into variable number of teeth or lobes. Basal segment of antenna expanded anterolaterally, projecting into and completely closing orbital hiatus, thus excluding antennal peduncle and flagellum from orbit. Chelipeds short, equal, of about same length or little longer than ambulatory legs. Sternum convex in lateral view. Articulation of ambulatory legs forming arch with last pair in dorsal position. Dactyl of pereiopods 2–4 short, claw-shaped. Pereiopod 5 with propodus and dactylus not strongly expanded and paddle-shaped. Male abdomen with segments 3–5 fused, penultimate segment broader than long (not checked for all species). First gonopod short, almost straight or evenly curved laterally; tip either simple or strongly flared with wide opening.

Habitat.—Most species of the genus are known to live epibiotic on octocorallia, mainly alcyonarians. An exception is *C. rotundifrons* (A. Milne Edwards, 1869), living amongst filamentous green algae.

Caphyra bedoti (Zehntner, 1894), new combination

Figs. 1A, B; 2A, B; 3A, D

Sphaerocarcinus bedoti Zehntner, 1894: 164–167, pl. 8 figs. 16, 16a–c; Türkay, 1971: 121, pl. 1 fig. 2, pl. 2 figs. 1, 2; Stephenson, 1972: 28.

Holotype.—1 female, Amboina, Moluccas, Indonesia, Bedot and Pictet coll., 1890, Mus. Geneva: no catalogue number.

Other Material.—1 male, 1 female, Socotra Island, east of Ras Qadamah, N-coast, 12°41.902'N, 53°39.681'E, 8 m, 29.03.1999, M. Apel coll., SMF 25279.

Diagnosis.—Carapace suboctogonal, broader than long, moderately convex; surface minutely granular, without transverse ridges except epibranchials. Front truncate, sinuous or indistinctly 4-lobed; anterolateral border with 1 distinct tooth and indistinct lobe behind pointed exorbital corner. Chelipeds markedly carinate, carpus with 3 and propodus with 2 pronounced carinae on dorsal surface. Pereiopods 2–4 short, stout, with short claw-shaped dactylus. Pereiopod 5 with merus short, straight; carpus very broad, vo-

Table 1. Carapace measurements of the three known species of *S. bedoti* [in mm].

	Total carapace breadth	Total carapace length	Frontal breadth	Fronto-orbital breadth	Carapace height
Holotype	9.1	7.3	3.9	7.1	5.4
Female from Socotra	7.8	6.0	3.4	6.1	4.7
Male from Socotra	6.2	5.1	2.9	5.2	3.9

luminous, strongly bent forming almost right angle; propodus short, less broad than carpus, with fringes of pinnate setae on dorsal and ventral edges; dactylus short, stout, slightly incurved, proximal part with few setae on dorsal face.

Description of Male Characters.—Male abdomen broadly triangular, segments 3–5 fused, without any traces of segmental division; penultimate segment slightly broader than long, with lateral margins converging in distal half; ultimate segment forming equilateral triangle. First gonopod flattened mesiolaterally, straight in basal part, curved laterally in distal third; tip not flared, with rows of strong setae along dorsal and ventral borders. Second gonopod about half length of first, slightly curved, with bifid tip.

Measurements.—See Table 1.

Habitat and Distribution.—The original description does not give any detailed habitat information. Zehntner (1894), however, mentions in the introduction to his work that a great part of the material had been collected in “old” [vieux] Madreporaria and in Tubipora. The specimens from Socotra were collected as a pair living on *Cladiella australis* (Macfadyen, 1936) (Octocorallia: Alcyonidae).

Zoogeographically, it was surprising to discover *C. bedoti* at Socotra in the westernmost part of the Indian Ocean, because it was only known previously from Indonesia. This, however, might reflect a lack of adequate sampling than a disjunct distribution. Little is known about host specificity in the genus *Caphyra*, but at least for some species a prevalence for certain taxa is apparent. While *C. unidentata* and *C. yookadai* repeatedly have been reported from *Alcyonium* sp. (Alcyonidae) (Sakai, 1933; Stephenson and Rees, 1968), *C. laevis* (A. Milne Edwards, 1869) and *C. polita* (Heller, 1861) are known to be

associated with species of the family Xenidae (Klunzinger, 1913; Stephenson and Campbell, 1960; Crosnier, 1975). Because the alcyonian host *Cladiella australis* is known to occur from South and East Africa to the Andaman Islands and Australia and the genus *Cladiella* as a whole from East Africa to the southern central Pacific a wide distribution of *C. bedoti* seems probable.

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