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Some Freshwater, Semi-terrestrial and Land Crabs (Crustacea, Decapoda, Brachyura) from Ghana, West Africa

Masatsune Takeda[1] and Hiromu Sugiyama[2]

[1] Department of Zoology, National Museum of Nature and Science,
4–4–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan
E-mail: takeda@kahaku.go.jp
[2] Department of Parasitology, National Institute of Infectious Diseases,
1–23–1 Toyama, Shinjuku, Tokyo 162–8640, Japan
E-mail: hsugi@niid.go.jp

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Abstract Two freshwater crabs of the family Potamonautidae, *Liberonautes chaperi* (A. Milne–Edwards, 1887) and *Potamonautes triangulus* Bott, 1959, two semi-terrestrial crabs of the families Grapsidae and Sesarmidae, *Goniopsis pelii* (Herklots, 1851) and *Guinearma huzardi* (Desmarest, 1825), and a land crab of the family Gecarcinidae, *Cardisoma armatum* Herklots, 1851, are recorded from Ghana, West Africa. All the species are presented with brief taxonomical notes and some photographs for ready and steady identification.
Key words: Freshwater crab, Semi-terrestrial crab, Land crab, *Cardisoma armatum*, *Goniopsis pelii*, *Liberonautes chaperi*, *Guinearma huzardi*, *Potamonautes triangulus*, Ghana, West Africa.

Introduction

In the collections of the National Museum of Nature and Science, Tsukuba, are several specimens of freshwater, semi-terrestrial and land crabs and three specimens of freshwater *Macrobrachium* prawn from Ghana, West Africa, collected by Mr. Sachio Yamamoto of JICA (Japan International Corporation Agency) in 1990 and later donated by Prince Hitachino-miya Masahito for study.

All of the crab specimens were identified with the known species, with aid of monographic studies by Monod (1956), Manning and Holthuis (1981) and Cumberlidge (1999), who dissolved many nomenclatural problems and complex synonymies of the West African species. In spite of their contributions, however, the identification of the West African freshwater crabs seems to be still difficult for the researchers other than the decapologists dealing with the freshwater crabs, because of lack of detailed figures or fine photographs of the closely related species.

Some species of crabs dealt with in this paper will serve the second intermediate hosts of lung flukes not only for the primate and other wild mammals but also for the native people. Although two representative West African *Paragonimus* species, *P. uterobilateralis* and *P. afrikanus*, both described by Voelker and Vogel (1965), are unknown to date from Ghana, one of the second intermediate hosts of them, *Liberonautes chaperi* (A. Milne–Edwards, 1887), is included in the collection at hand. We, therefore, briefly reviewed the literatures of the parasitological studies on *Paragonimus* species and their host crabs that were reported from the countries neighboring Ghana for the forthcoming studies in this country. The present report of freshwater, semi-terrestrial and land crabs from Ghana will contribute to the study of lung flukes for ready and steady identification of the possible intermediate hosts, even if the numbers of the crab species are few.

In the following lines, the breadth and length of the carapace are abbreviated as cb and cl, respectively, and indicated in mm. All the specimens are preserved in the collections of the National Museum of Nature and Science, Tsukuba (NSMT).

Records of the Species

Phylum Arthropoda: Subphylum Crustacea: Class Malacostraca: Order Decapoda: Suborder Pleocyemata: Infraorder Brachyura
Superfamily Potamoidea
Family Potamonautidae
Genus ***Liberonautes*** Bott, 1955
Liberonautes chaperi (A. Milne–Edwards, 1887)

(Fig. 1)

Remarks. The specimens at hand are a mature female (NSMT–Cr 25808, Fig. 1A–D; cb including lateral teeth 67.3 × cl 45.2 mm) and an immature female (NSMT–Cr 25809, Fig. 1E–F; cb 48.2 × cl 32.5 mm). This species attains to large size, as one of the females examined is still immature in spite of its considerable size. This species is most characterized by the presence of the intermediate spiniform or rather tubercular tooth between the external orbital and epibranchial teeth, the imperfect postfrontal crest not reaching the epibranchial tooth at each lateral side, and the presence of three to six, mostly five, spiniform teeth behind the epibranchial tooth at the anterolateral carapace margin. Among these characters, the spiniform teeth at each anterolateral carapace margin enable to this species quite distinctive among the eight congeneric species of *Liberonautes*, as shown in the key made by Cumberlidge (1985), with the spiny river crab as the common name in Liberia.

This species was originally referred to the genus *Parathelphusa* H. Milne Edwards, 1853, by A. Milne–Edwards (1887, p. 144, pl. 8 fig. 4), and then recorded by Rathbun (1905, p. 202, pl. 12 fig. 6) under the name of *Potamon* (*Parathelphusa*) *chaperi*, and later by Bott (1955, p. 298) as *Sundanautes* (*Sundanautes*) *africanus chaperi*. Finally, Cumberlidge (1985, p. 2703, fig. 1) transferred this species to the genus *Liberonautes* Bott, 1955, with the detailed description and comparison of the first male pleopod with those of the congeneric species. Cumberlidge and Sachs (1989) made a key for the identification of four freshwater and semi-terrestrial crabs from Liberia including this species.

According to Cumberlidge (1985) and Cumberlidge and Sachs (1989), this species inhabits the rocky bottom of fast-flowing shallow water in Liberia, Côte d'Ivore and Ghana, and is never found in the small streams or creeks.

Distribution. Côte d'Ivore, Ghana and Liberia.

Parasitological notes. Sachs and Cumberlidge (1991a) found *Liberonautes chaperi* as the second intermediate host of *Paragonimus uterobilateralis* in Liberia. Otherwise, according to Voelker and Sachs (1977), Sachs and Voelker (1982), Sachs and Cumberlidge (1991b), and Cumberlidge (1999), the following three of eight *Liberonautes* species, *L. latidactylus* (De Man), *L. nanoides* Cumberlidge and Sachs, and *L. paludicolis* Cumberlidge and Sachs, have also been shown to harbor the metacercariae of *Paragonimus uterobilateralis* [Japanese name: Fohgeruhai-kyuchu] or *P. afrikanus* [Japanese name: Afurika-hai-kyuchu], both of which were described by Voelker and Vogel (1965).

According to Aka *et al.* (2008) who summarized the human paragonimiasis in Africa, *Sundanonautes africanus* (A. Milne–Edwards) is the main carrier of metasercariae of *Paragonimus uterobilateralis* in Cameroon and Nigeria, and two species of the same genus, *S. aubryi* (H. Milne Edwards) and *S. granulatus* (Balss), are of little importance, being the hosts of metacercariae of *P. uterobilateralis* or *P. africanus*. In addition to the two species, Aka *et al.* (2008) listed *S. pelii* (Herklots) as carrier of metacercariae, but as seen in Ng *et al.* (2008), *S. pelii* is now taxonomically known as a synonym of *S. aubryi*. In Liberia the unique host crab is *Liberonautes latidactylus* which is infected only with *P. uterobilateralis*. It is noted here that the occurrence of unidentified

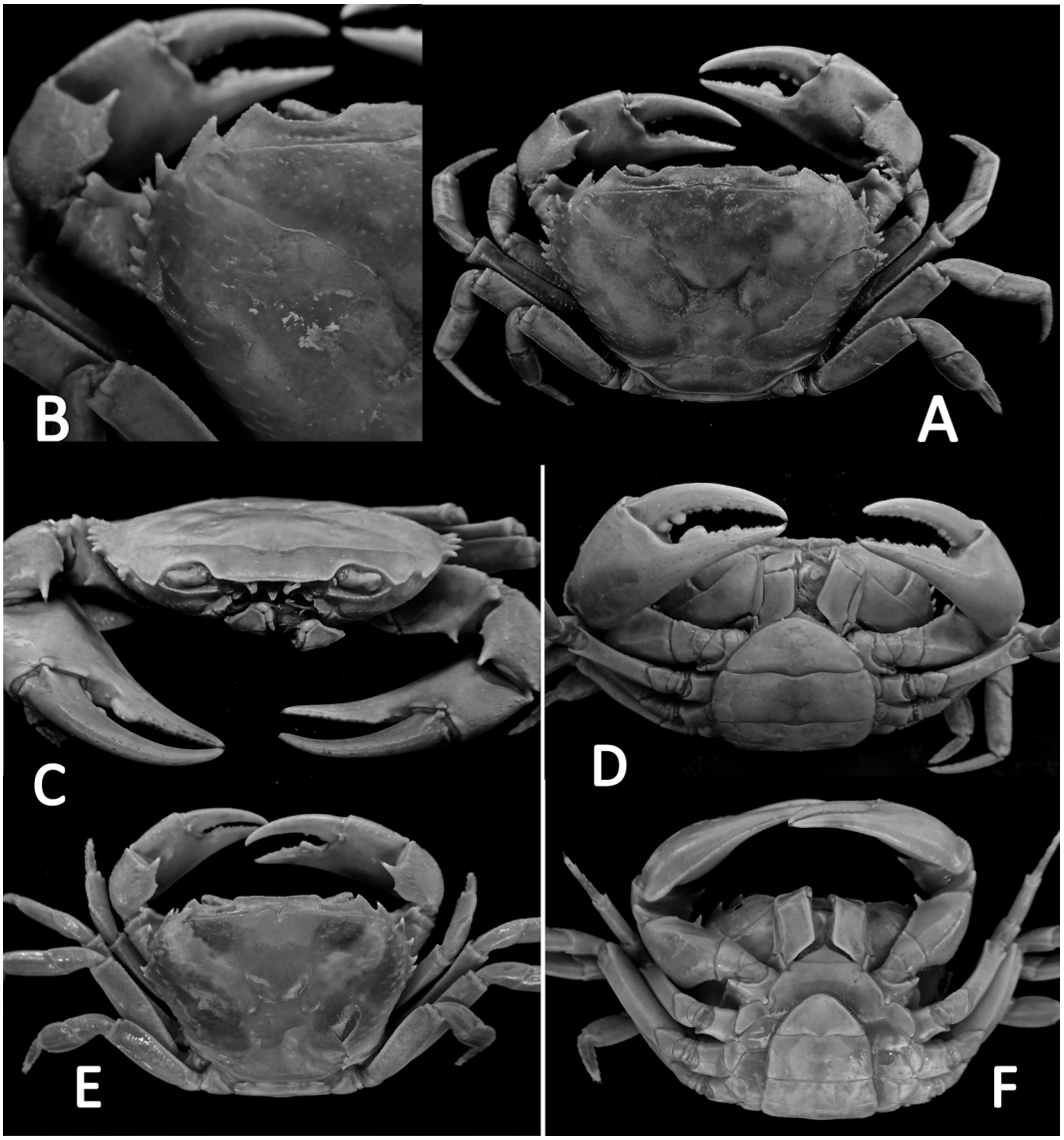

Fig. 1. *Liberonautes chaperi* (A. Milne–Edwards, 1887). A–D: Female (NSMT–Cr 25808; cb including lateral teeth 67.3 × cl 45.2 mm). E–F: Young female (NSMT–Cr 25809; cb 48.2 × cl 32.5 mm).

metacercariae in *Callinectes marginatus* (A. Milne–Edwards) from Benin reported by Aka *et al.* (2008) is not always reliable, because the crab is marine swimming crab (Portunidae) living in shallow waters. Later, Bayssade–Dufour *et al.* (2014, 2015) showed *S. africanus* from Cameroon as the second intermediate host of two new lung fluke species, *P. gondwanensis* and *P. kerberti*. Otherwise, absence of paragonimiasis in Ghana is remarkable, but the fact is yet to be measured and further investigated. In the present collection are two specimens (Fig. 1) identified as *Liberonautes chaperi*, but no specimen referable to the congeneric species, *L. latidactylus*, which was originally described from Ghana and occurs in the West African rain forest area from Ghana to

northwards to Senegal. Occurrence of paragonimiasis in Ghana seems to be reasonable as far as the present knowledge concerned.

Genus ***Potamonautes*** MacLeay, 1838
Potamonautes triangulus Bott, 1959

(Fig. 2)

Remarks. The specimens examined are two juvenile females (NSMT–Cr 25810, Fig. 2A–B, cb 33.4 × cl 24.1 mm; NSMT–Cr 25811, Fig. 2C–D, cb 33.5 × cl 23.9 mm), representing a typical form of *Potamonautes* in the flattened and ovate carapace, without intervening tooth between the external and epibranchial teeth. It is identified with *P. triangulus* described by Bott (1959, p. 1002) and redescribed by Cumberlidge (1999, p. 135). The carapace is nearly smooth, only with small granules along the anterolateral margins. The postfrontal crest is strong, complete, transverse, reaching the epibranchial tooth to each anterolateral carapace margin. The external orbital angle is triangular, directed forward with subacute tip. The ebibranchial tooth is similar to the external orbital tooth in shape, but smaller. The anterolateral carapace margin is regularly convex, narrowly ridged and granulated throughout the length. The posterior end of the marginal ridge is weakly directed dorsally. The carapace postero-dorsal surface is weakly depressed and ornamented with some weak, oblique ridges. The abdomen of the female specimen at hand is still not developed and similar to male abdomen (Fig. 2B).

According to Cumberlidge (1999), the West African *Potamonautes* are represented by four species, *P. ecorssei* (Marchand, 1902), *P. senegalensis* Bott, 1970, *P. reidi* Cumberlidge, 1999,

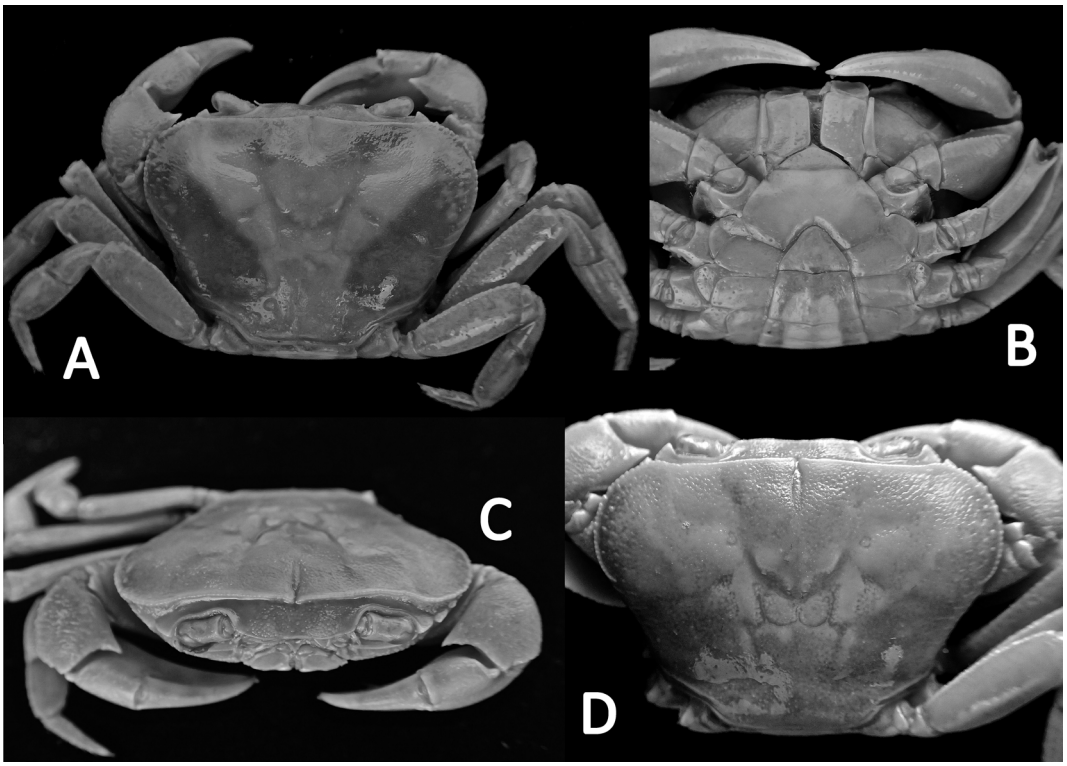

Fig. 2. *Potamonautes triangulus* Bott, 1959. A–B: Juvenile female (NSMT–Cr 25810; cb 33.4 × cl 23.9 mm). C–D: Juvenile female (NSMT–Cr 25811; cb 33.5 × cl 23.9 mm).

and this species. Of these, *P. ecorssei* and this species are known from Ghana, but *P. ecorssei* is readily distinguished from this species by the distinctly quadrate carapace shape, and the sharp external orbital and epibranchial teeth.

Distribution. Endemic to Ghana, living in the rivers.

Superfamily Grapsoidea
Family Grapsidae
Genus ***Goniopsis*** De Haan, 1833
Goniopsis pelii (Herklots, 1851)

(Fig. 3E–F)

Remarks. A female (NSMT–Cr 25812, cb 29.3 × cl ca. 23.2 mm) at hand is somewhat damaged for the main part of the carapace, but agrees well with the line drawing of a male of *Goniopsis cluenlata* (Latreille, 1803) by Monod (1956, fig. 564). Manning and Holthuis (1981, p. 227) dissolved some nomenclatural problems as for the priority and synonymy, and indicated that the correct name of the West African *Goniopsis* species is not *G. cluenlata* (Latreille), but *G. pelii* (Herklots), with detailed comparison of two species from South America and Africa.

The carapace (Fig. 3E) is quadrate and slightly wider than long, with the lateral margins weakly converging posteriorly; the dorsal surface is not convex, divided into regions by shallow furrows, with some transverse linear furrows at the frontal and gastric regions, and several at the branchial regions. A small notch is just behind the external orbital angle. The female specimen at hand lacks the left cheliped. The right chela (Fig. 3F) is moderate in size, with the smooth palm, and both fingers are armed with sharp granules along margins. The ambulatory legs are stout and depressed; the meri are more or less foliate, many linear transverse furrows on each dorsal surface, with small subterminal notch at each anterior margin.

Manning and Holthuis (1981) summarized the habit and habitat of this species. Most of the records in the literature reported on them living in the muddy bottom of mangroves. Literatures and records of the specimens are referred to Monod (1956) as *G. cluenlata* and Manning and Holthuis (1981) as *G. pelii*.

Distribution. West African coast from Senegal to Angola.

Family Sesarmidae
Genus ***Guinearma*** Shahdadi and Schubart, 2017
Guinearma huzardi (Desmarest, 1825)

(Fig. 3A–D)

Remarks. A male (NSMT–Cr 25813, Fig. 3A–D, cb 28.2 × cl 23.5 mm), and a female (NSMT–Cr 25814, cb 30.0 × cl 25.2 mm) at hand agree well with the line drawing of *Sesarma* (*Chiromantes*) *huzardi* (Desmarest) given by Monod (1956, fig. 593). However, the subgenus *Chiromantes* Gistel, 1848, a replacement name for preoccupied *Pachysoma* De Haan, 1833, is a senior objective synonym of *Holometopus* H. Milne Edwards, 1853, as definitely shown by Holthuis (1977, pp. 170–171), and the subgenus *Chiromantes* used by Serène and Soh (1970) and most of the recent authors should be known as the genus *Perisesarma* De Man, 1895. Since then, *Sesarma* (*Chiromantes*) *huzardi* is known as *S.* (*Perisesarma*) *huzardi* dealt with by Manning and Holthuis (1981, p. 245) or *Perisesarma huzardi* listed by Ng *et al.* (2008, p. 222).

Ng *et al.* (2008) listed 21 definite and 2 suspended species in the genus *Perisesarma*, although *P. kammermani* (De Man, 1883) should be included in the suspended species group from West Africa together with *P. huzardi* (Desmarest, 1825) and *P. alberti* Rathbun, 1921. Afterwards Davie (2010) and Shahdadi *et al.* (2017) described each a new species from Western Australia and Vietnam, respectively. In the description of the new species from Western Australia, Davie (2010) noted that three West African species sharing a number of unique apomorphies are certainly need to be transferred to the genus distinct from the Indo–West Pacific species. Very recently, Shahdadi and Schubart (2017) thoroughly revised the genus *Perisesarma* based not only by the morphological characters but also the

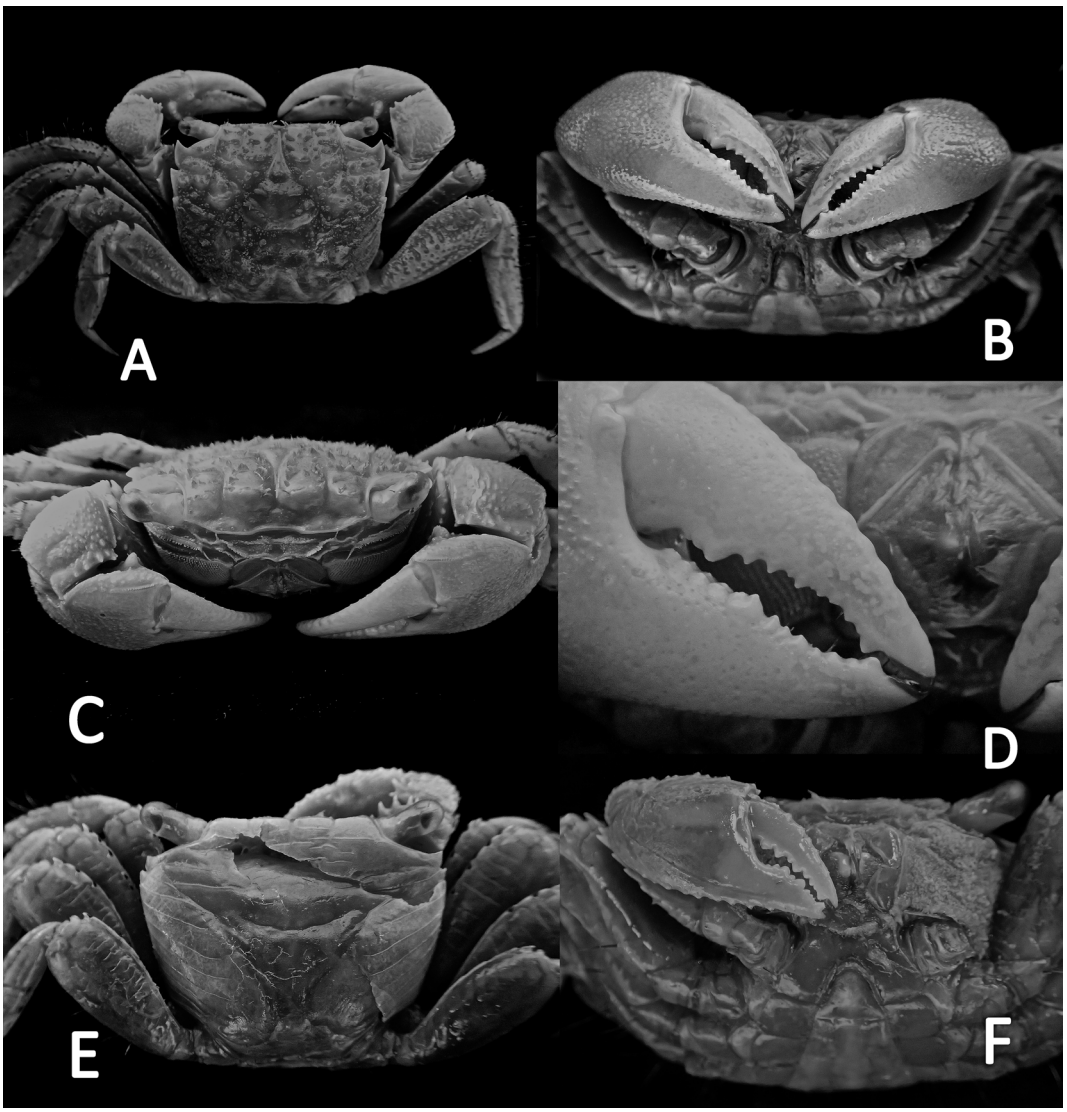

Fig. 3. *Guinearma huzardi* (Desmarest, 1825). A–D: Male (NSMT–Cr 25813; cb 28.2 × cl 23.5 mm). *Goniopsis pelii* (Herklots, 1851). E–F: Female (NSMT–Cr 25812; cb 29.3 × cl ca. 23.2 mm).

molecular analysis. As a result, 1) the genus *Perisesarma* is restricted only to the type species, *Sesarma dussumieri* H. Milne Edwards, 1853, 2) *Perisesarma fasciatum* (Lanchester, 1900) was designated as the type species of a new genus *Fasciarma*, 3) three West African species were generically separated from the Indo–West Pacific species under the new name *Guinearum*, and the other 19 Indo–West Pacific *Perisesarma* species were transferred to the genus *Parasesarma* De Man, 1895. The most recently described *Perisesarma tuerykayi* Shahdadi, Davie and Schubart, 2017 is reasonably referred to *Parasesarma*.

The carapace (Fig. 3A) is distinctly quadrate, with areolated and roughened dorsal surface covered with many but isolated patches of short setae. The frontal part of the carapace is almost perpendicularly deflexed, and in the frontal view (Fig. 3C), four prominent lobes occupy the space between the orbits of both sides. The lateral mar-

gins of the carapace are nearly longitudinal, with a distinct notch behind each external orbital angle and a small interruption further posteriorly; the tips of the external orbital and lateral teeth thus formed are pointed and directed forward and obliquely outward, respectively. The male chelipeds are heavy and slightly different in size. The upper surface of the palm is armed with about four oblique subparallel granulated ridges. The upper surface of the movable finger is ornamented with about 15 blunt stridulating granules each crossed by fine impressed lines.

The old literature, records of many specimens from Senegal to Angola, and line drawing of a male are referred to Monod (1956, p. 437, fig. 593) as *Sesarma* (*Chiromantes*) *huzardi*, and the description and photographs are referred to Rathbun (1918, p. 287, pl. 75; 1921, p. 446, pl. 41, pl. 42 fig. 2) as *S.* (*C.*) *africanum* H Milne Edwards, 1837. Manning and Holthuis (1981, p. 245) also recorded many specimens from wide areas along the West African coast from Senegal to Angola including Ghana.

Manning and Holthuis (1981) recorded that this species is found in mangroves, salt marshes, tidal rice lands and mouths of rivers. As far known from the literature, the habit and habitat are quite similar to those of the Indo-West Pacific *Perisesarma* species known as *Parasesarma* at present.

Distribution. West African coast from Senegal to Angola.

Family Gecarcinidae

Genus ***Cardisoma*** Latreille, 1828

Cardisoma armatum Herklots, 1851

(Fig. 4)

Remarks. The land crab family Gecarcinidae from the eastern Atlantic coast is represented only by two species of two genera, *Cardisoma armatum* Herklots, 1851 and *Gecarcinus weileri* (Sendler, 1912). Both species are distinctive at the first glance in the general appearance of the carapace; the front-orbital border is wider than 1/2 carapace breadth in *C. armatum* and narrower in *C. weileri*.

The specimen at hand is a male (NSMT–Cr 25815, cb 45.0 × cl 33.5 mm) and safely identified with *Cardisoma armatum* which represents the typical *Cardisoma* shape of the carapace, chelipeds and ambulatory legs like the Indo–West Pacific species. It may attain larger size of 10 cm or more in carapace breadth as recorded by Rathbun (1921, p. 262). The carapace (Fig. 4A) is smooth, vaulted at both branchial regions, and strongly convergent posteriorly; mesogastric, cardiac and intestinal regions are marked with linear furrows, and also the bifurcation of the beginning of the gastric region is distinct at the postofrontal region. The outer half of the supraorbital margin is narrowly raised, with the external margin being sharply anguler. The branchial margin is convex and fringed with a linear ridge, with a small notch just behind the external orbital angle. The posterolateral margin of the carapace is shallowly concave dorsally, with a linear ridge from the anterolateral branchial margin and also with some oblique, linear ridges. The pterygostomial region (Fig. 4D) is covered with short setae, with the infraorbital margin being entire and almost transverse for its most part. Both chelipeds (Fig. 4B) are quite unequal in the size and shape; in the right smaller chela both fingers are nearly straight, with small teeth throughout the cutting edges, leaving no space between both fingers; the left larger cheliped (Fig. 4C) is heavy, and the palm is smooth for its most outer surface, but heavy granulated along the lower margin; the immovable finger is armed with a strong tooth just in the middle of the cutting edge, and the movable finger with a similar tooth at the basal one third of the cutting edge, leaving a space interrupted at the teeth. The male abdomen (Fig. 4E) is narrow, the penultimate segment being thrice as long as the telson. The male first pleopod (Fig. 4F) is short and hairy, with the terminal horny tip directed dorsally and the large flap against the terminal tip.

The full descriptions, complete synonymies, photographs of the specimens and line drawings of the first male pleopod were given by Rathbun

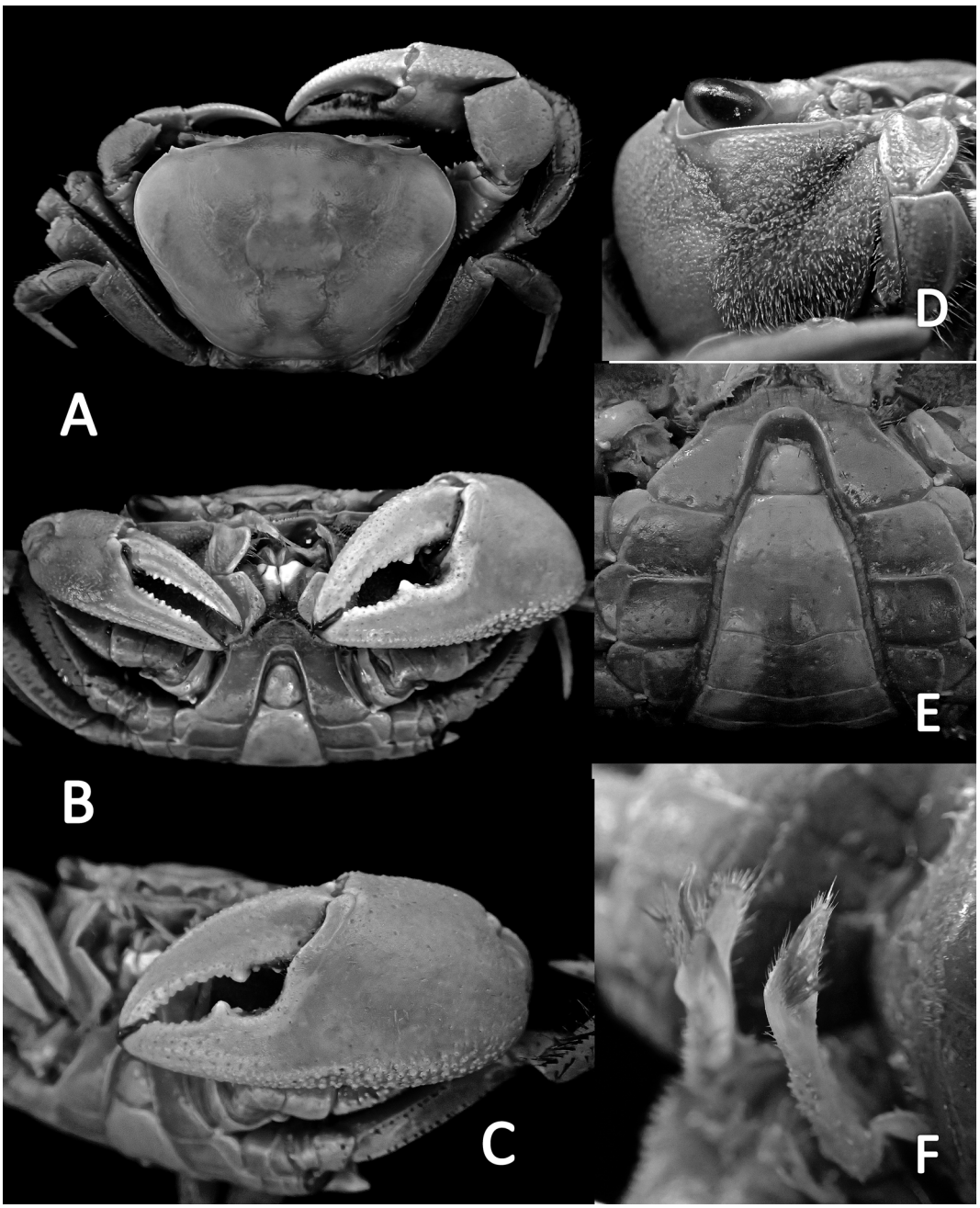

Fig. 4. *Cardisoma armatum* Herklots, 1851. A–F: Male (NSMT–Cr 25815; cb 45.0 × cl 33.5 mm).

(1921, p. 456, fig. 21, pl. 48 figs. 1–2) and Türkay (1973, p. 86, figs. 1, 3, 7–8), the fine line drawing of a male by Monod (1956, fig. 618), and many specimens from the West African countries were recorded by Monod (1956) and Manning and Holthuis (1981).

Distribution. Cape Verde Islands, and West African coast from Senegal to Angola.

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References

Aka, N. A., K. Adoubryn, D. Rondelaud and G. Dreyfuss 2008. Human paragonimiasis in Africa. Annals of African Medicine, 7: 153–162.

Bayssade–Dufour, C., R. Chermette, D. Šundić and B. K. Radujković 2014. *Paragonimus gondwanensis* n. sp. (Digenea, Paragonimidae), parasite of mammals (humans and carcinvores) in Cameroon. Ecologica Montenegrina, 1: 256–267.

Bayssade–Dufour, C., R. Chermette, D. Šundić and B. K. Radujković 2015. *Paragonimus kerberti* n. sp. (Digenea, Paragonimidae), parasite of carnivores in Cameroon. Ecologica Montenegrina, 2: 271–277.

Bott, R. 1955. Die Süßwasserkrabben von Afrika (Crust., Decap.) und ihre Stammesgeschichte. Annales du Musée du Congo Belge, C (Zoologie), 3: 209–352.

Bott, R. 1959. Potamoniden aus West–Afrika (Crust. Dec.). Bulletin de l'Institut Fondamental d'Afrique Noire, (A), 21: 994–1008.

Bott, R. 1970. Die Süßwasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte. Eine Revision der Potamoidea und der Parathelphusoidea (Crustacea, Decapoda). Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft, 526: 1–338.

Cumberlidge, N. 1985. Redescription of *Liberonautes chaperi* (A. Milne–Edwards, 1887) n. comb. (Brachyura, Potamonautidae) from Ivory Coast and Ghana. Canadian Journal of Zoology, 63: 2703–2706.

Cumberlidge, N. 1999. The freshwater crabs of West Africa. Family Potamonoautidae. Faune et Flore Treopicales, 36: 1–382.

Cumberlidge, N. and R. Sachs 1989. A key to the crabs of Liberian freshwaters. Zeitschrift für Angewandte Zoologie, 76: 221–229.

Davie, P. J. F. 2010. A new species of *Perisesarma* (Brachyura, Sesarmidae) from Western Australia. In Fransen, C., S. de Grave and P. K. L. Ng (eds.): Studies on Malacostraca: Lipke Bijdeley Holthuis Memorial Volume. Crustaceana Monographs, 14: 195–207.

Desmarest, A.–G. 1825. Considérations Générales sur la Classe des Crustacés, et description des espèces de ces animaux, qui vivent dans la mer, sur les côtes ou dans les eaux douices de la France. F. G. Levrault, Libraire, Paris and Strasbourg, xix + 446 pp., 56 pls.

Herklots, J. A. 1851. Additamenta ad Faunam Carcinologicam Africae Occidentalis, sive descrptiones specierum novarum e crustaceorum ordine, quas in Guinea collegit vir strenuous H. S. Pel, praefectus residentiis in littore guineae. 28 pp., 2 pls. Lugduni–Batavorum.

Holthuis, L. B. 1977. The Grapsidae, Gecarcinidae and Palicidae (Crustacea: Decapoda: Brachyura) of the Red Sea. Israel Journal of Zoology, 26: 141–192.

Lanchester, W. F. 1900. On a collection of crustaceans made at Singapore and Malacca. Part I. Crustacea Brachyura. Proceedings of the Zoological Society of London, 1: 719–770.

Man, J. G. de 1883. Carcinological studies in the Leyden Museum. No. 3. Notes from the Leyden Museum, 5: 150–169.

Man, J. G. de 1895. Bericht über die von Herrn Schiffscapitän Storm zu Atrjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java–See gesammelten Decapoden und Stomatopoden. Zweiter Theil. Zoologische Jahrbücher. Abtheilung für Systematik, Geographie und Biologie der Thiere, 8: 485–609, pls. 12–14.

Manning, R. B. and L. B. Holthuis 1981. West African brachyuran crabs (Crustacea: Decapoda). Smithsonian Contributions to Zoology, 306: i–xii, 1–379.

Marchand, E. 1902. Description de deux Arthropodes nouveaux provenant du Soudan français (*Trox Borgognoi* [Coléopt.] et *Pot.* (*Potamonautes*) *Ecorssai* [Crust.]). Bulletin de la Société des Sciences Naturelles de l'Ouest de la France, (2), 2: 331–342, pl. 13.

Milne–Edwards, A. 1887. Observations sur les crabs des eaux douces de l'Afrique. Annales des Sciences Naturelles, (Zoologie), Paris, (7), 4: 121–149.

Milne Edwards, H. 1853. Mémoire sur la famille des ocypodiens. Suite (1). Annales des Sciences Naturelles, (Zoologie), Paris, 20: 163–228.

Milne Edwards, H. 1837. Histoire Naturelle des Crustacés Comprenant l'Anatomie, la Physiologie et la Classification de ces Animaux. Librairie Encyclopédique de Roret, Paris, 2: 1–531.

Monod, Th. 1956. Hippidea et Brachyura oust-africains. Mémoires de l'Institut Français d'Afrique Noire, 45: 1–674.

Ng, P. K. L., D. Guinot and P. J. F. Davie, 2008. Systema Brachyurorum: Part I. An annotated checklist of extant brachyuran crabs of the world. The Raffles Bulletin of Zoology, 17: 1–286.

Rathbun, M. J. 1905. Les crabs d'eau douce (Potamonidae). Nouvelles Archives du Muséum d'Histoire Naturelle, Paris, (4), 7: 159–323, pls. 13–22.

Rathbun, M. J. 1918. The grapsoid crabs of America. Bul-

letin of the United States National Museum, 97: i–xxii, 1–461, pls. 1–161.

Rathbun, M. J. 1921. The brachyuran crabs collected by the American Museum Congo Expedition, 1909–1915. Bulletin of the American Museum of Natural History, 43: 379–474, pls. 15–64.

Sachs, R. and N. Cumberlidge 1991a. First record of the spiny river crab, *Liberonautes chaperi* (A. Milne–Edwards, 1887), as second intermediate host of *Paragonimus uterobilateralis* in Liberia. Annals of Tropical Medicine and Parasitology, 85: 471–472.

Sachs, R. and N. Cumberlidge 1991b. The dwarf river crab *Liberonautes latidactylus nanoides* Cumberlidge & Sachs, 1989, from Liberia—a new second intermediate host of *Paragonimus uterobilateralis.* Tropical Medicine and Parasitology, 42: 73–74.

Sachs, R. and J. Voelker 1982. Human paragonimiasis caused by *Paragonimus uterobilateralis* in Liberia and Guinea, West Africa. Tropical Medicine and Parasitology, 33: 15–16.

Sendler, A. 1912. Zehnfusskrebse aus dem Wiesbadener Naturhistorischen Museum. Jahrbücher des Nassauischen Vereins für Naturkunde, Wiesbaden, 65: 189–207.

Serène, R. and C. L. Soh 1970. New Indo–Pacific genera allied to *Sesarma* Say 1817 (Brachyura, Decapoda, Crustacea). Treubia, 27: 387–408, pls. 1–8.

Shahdadi, A., P. J. F. Davie and C. D. Schubart 2017. *Perisesarma tuerkayi*, a new species of mangrove crab from Vietnam (Decapoda, Brachyura, Sesarmidae), with an assessment of its phylogenetic relationships. Crustaceana, 90: 1155–1175.

Shahdadi, A. and C. D. Schubart 2017. Taxonomic review of *Perisesarma* (Decapoda: Brachyura: Sesarmidae) and closely related genera based on morphology and molecular phylogenetics: new classification, two new genera and the questionable phylogenetic value of the epibranchial tooth. Zoological Journal of the Linnean Society, 20: 1–32.

Türkay, M. 1973. Die Gecarcinidae Afrikas (Crustacea: Decapoda). Senkenbergiana Biologica, 54: 81–103.

Voelker, J. and R. Sachs 1977. Über die Verbreitung von Lungenegeln (*Paragonimus africanus* und *P. unterobilateralis*) in West-Kamerun und Ost–Nigeria auf Grund von Untersuchungen an Süßwasserkrabben auf Befall mit Metacercarien. Tropenmedicine und Parasitologie, 28: 120–133.

Voelker, J. and H. Vogel 1965. Zwei neue *Paragonimus*–Arten aus West Afrika: *Paragonimus africanus* und *Paragonimus uterobilateralis* (Troglotrematidae; Trematoda). Zeitschrift für Tropenmedizin und Parasitologie, 16: 125–148.