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" Two New Species of Potamonemus Cumberlidge and Clark from the Rain Forests of West Africa"

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TWO NEW SPECIES OF
POTAMONEMUS CUMBERLIDGE AND CLARK, 1992
(BRACHYURA: POTAMOIDEA: POTAMONAUTIDAE)
FROM THE RAIN FORESTS OF WEST AFRICA

Neil Cumberlidge

A B S T R A C T

Two new species of West African fresh-water crabs are described from specimens in the Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg, Germany, and from material in the author's collection. The new species are distinguished by a combination of characters of the gonopods, chelipeds, and carapace. These species are found in the rain forest zone of southwest Cameroon and southeast Nigeria, West Africa. They are compared to *Potamonemus mambilorum* Cumberlidge and Clark, 1992, the type species of the genus, and to other fresh-water crabs in the family Potamonautidae occurring in West Africa. A key to distinguish between the three species in the genus *Potamonemus* is provided.

An examination of fresh-water crabs from West and Central Africa held in the Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg, Germany, revealed the existence of two new species of *Potamonemus* Cumberlidge and Clark, 1992, from Cameroon and Nigeria. These specimens differed significantly from *Potamonemus mambilorum*, the type species of this genus (Cumberlidge and Clark, 1992). The new species were discovered among material previously assigned (in unpublished opinions) to *Sudanonautes* Bott, 1955. The two species are distinguished by a combination of characters of the gonopods, chelipeds, and carapace. Some characters varied with age, with adult crabs having a relatively higher and wider carapace than juvenile crabs. The new species are compared to *P. mambilorum* and to the other fresh-water crabs in the family Potamonautidae occurring in West Africa.

METHODS

The right mandible and the right first and second gonopods were removed from the specimens to illustrate these structures under magnification. Four dimensions of the carapace—carapace width, carapace length, carapace thickness, and front width—were recorded from all available specimens using digital calipers. The relative proportions of the last 3 measurements (adjusted for body size, CL) of the 3 species of *Potamonemus* were calculated (Tables 1, 2, Figs. 7, 8). One-factor ANOVA repeated measures analysis was used to test for significant differences between the carapace proportions of the 3 species (Table 3). A key to distinguish between the three species of *Potamonemus* was constructed.

The following abbreviations are used: NHM = the

Natural History Museum, London, U.K.; NMU = Northern Michigan University, Marquette, U.S.A.; NNM = Nationaal Natuurhistorisch Museum, Leiden, The Netherlands; ZIM = Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg, Germany; ZMB = Zoologisches Museum der Humboldt-Universität, Berlin, Germany; CW = carapace width at widest point; CL = carapace length, measured along median line; CT = cephalothorax thickness, maximum depth of cephalothorax; FW = front width, width of front measured along anterior margin; M = male; F = female; ad = adult; pub = pubescent; juv = juvenile; A = segment of abdomen; P = pereopod; *r* = correlation coefficient; *d.f.* = degrees of freedom.

Potamonemus sachsi, new species

Figs. 1, 2, 5c, d, 6d–f

Sudanonautes orthostylis Cumberlidge, 1989: 232, 239, tables 1, 2, fig. 2e–h [not *S. orthostylis* (Bott, 1955), not fig. 1a–g].

Material Examined.—Bamenda, Cameroon (5°54'N, 10°13'E), 4 M, 4 F, ZIM K-30395; 1 M, 1 F, NNM 30874, all collected by Dr. J. Voelker, 21 April 1975. Obudu Cattle Ranch, Obudu plateau, Cross River State, Nigeria, 1 km north of ranch (7°29'N, 9°16'E), altitude 1,000 m, 1 M ad, 1 M juv, 1 F juv, NMU 8.IV.1983A; 1 km south of ranch (7°27'N, 9°16'E), 1 M ad, 1 F ad, 2 M juv, 5 F pub, 2 F juv, NMU 8.IV.1983B, all collected by N. Cumberlidge, 8 April 1983. Largest male from Bamenda, Cameroon (ZIM K-30395), CW = 33.1 mm, designated holotype, other 7 specimens, paratypes.

Type Locality.—Bamenda highlands, southwest Cameroon.

Distribution.—Bamenda highlands, southwest Cameroon, Obudu plateau, southeast Nigeria.

Diagnosis.—Carapace with patches of short hairs along anterolateral and posterolateral margins continuing around to flanks in sub-

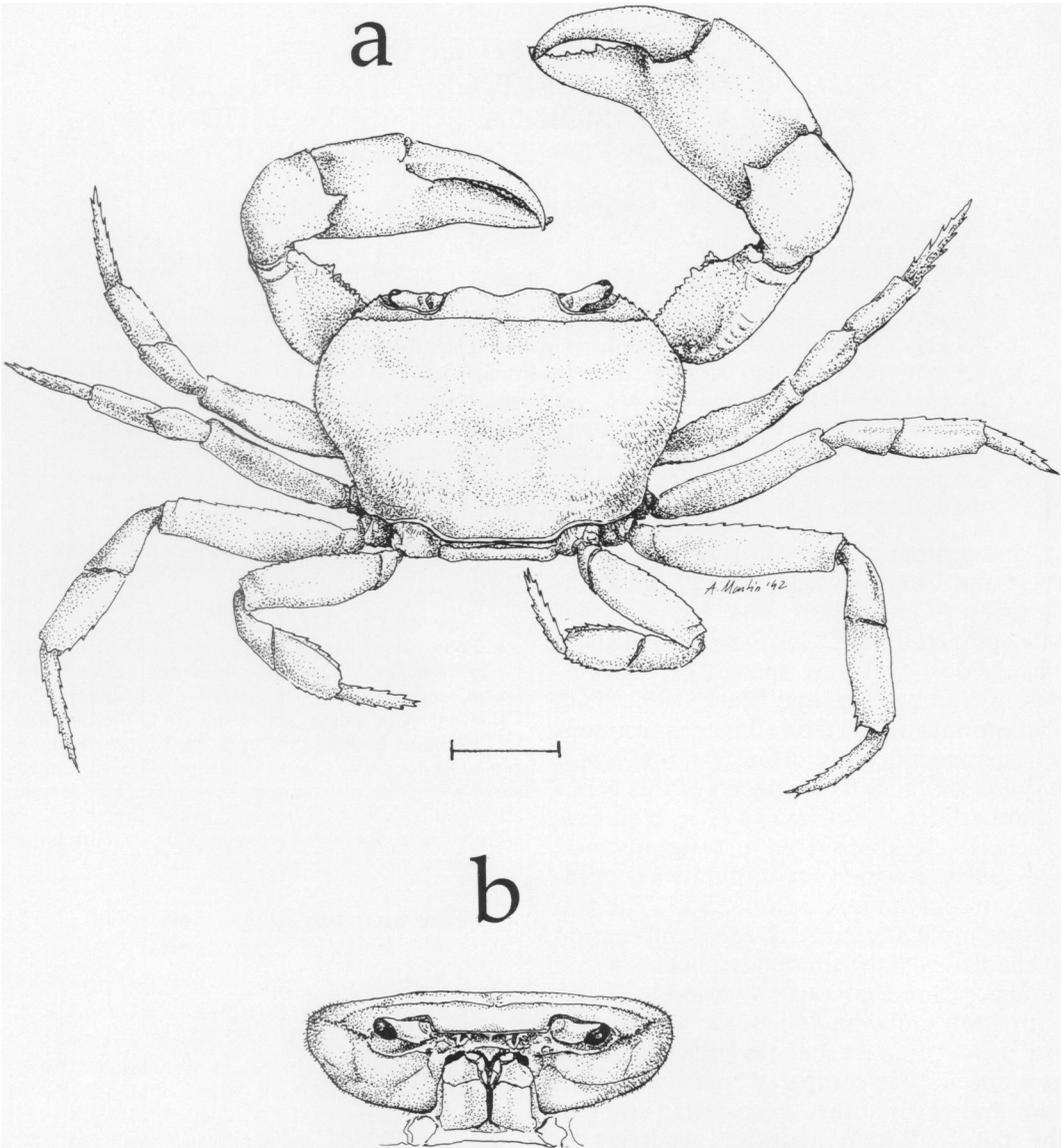
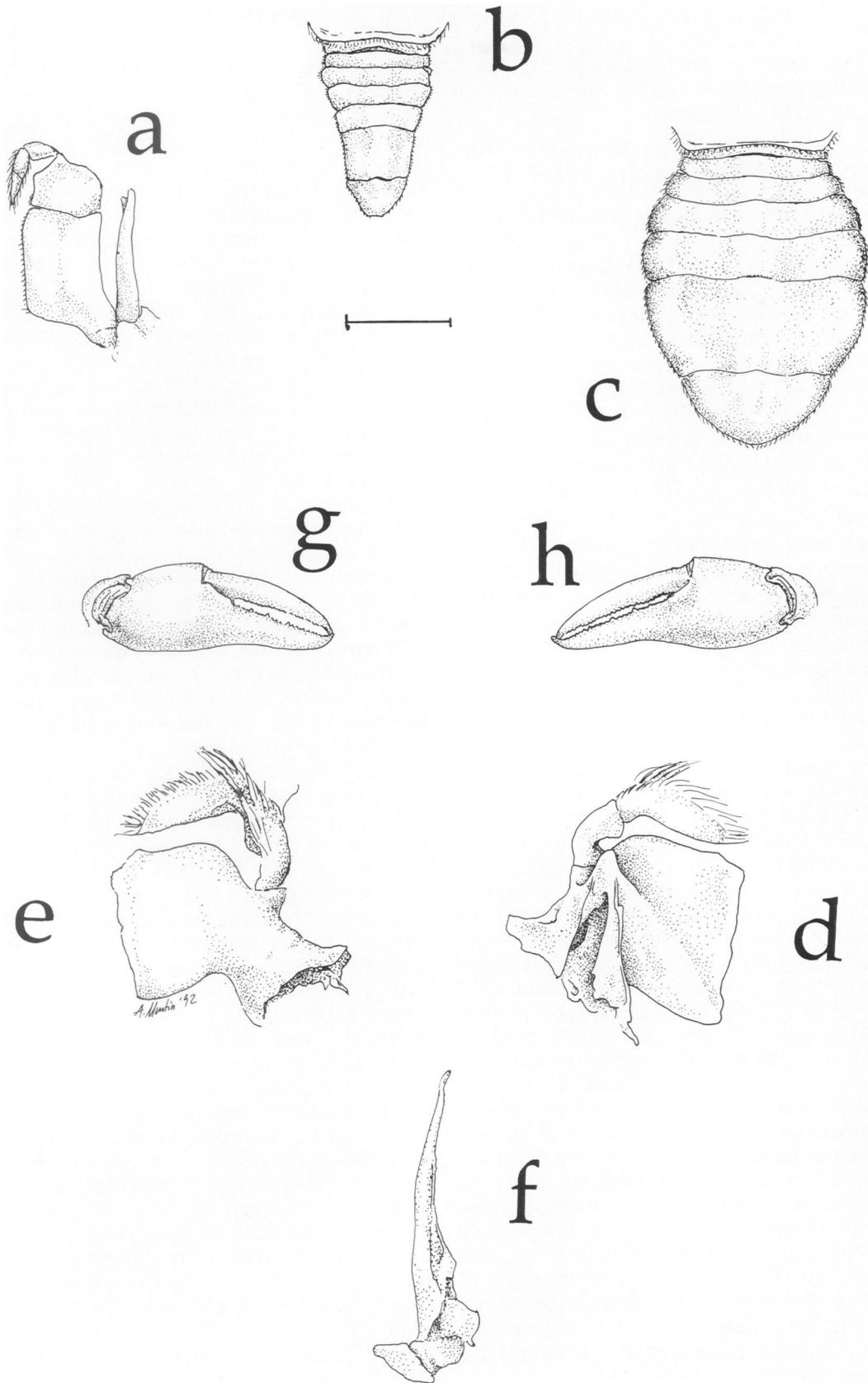


Fig. 1. *Potamonemus sachsi*, new species. Male from Bamenda, Cameroon (holotype, CW = 33.1 mm), ZIM K-30395. a, whole animal, dorsal aspect; b, cephalothorax, frontal aspect. Scale bar equals 10 mm.

hepatic and pterygostomial regions. Vertical flank groove beginning on anterolateral margin between exorbital and epibranchial teeth. Twisting longitudinal groove along

dorsal surface of terminal segment of gonopod 1, reaching to tip of segment; no hairs or bristles on terminal segment; groove not visible on caudal surface. Anterior margin

→
Fig. 2. *Potamonemus sachsi*, new species. a, b, d, e, male from Bamenda, Cameroon (holotype, CW = 33.1 mm), ZIM K-30395. a, left third maxilliped; b, abdomen; d, left mandible, anterior view; e, left mandible, posterior view; f, left gonopod 2, caudal view. c, g, h from female paratype from Bamenda, Cameroon (CW = 33.5 mm). c, abdomen; g, female right cheliped, frontal view; h, female left cheliped, frontal view. Scale bar equals 5 mm (a), 10 mm (b, c, g, h), 2 mm (d, e, f).



of merus of right cheliped with 2 large teeth at distal end. Small species, mature between $CW = 23.0\text{--}28.0$ mm.

Description.—Following description based on male holotype (Figs. 1a, b, 2a, b, d, e, f, 5c, d, 6d–f).

Size.—Measurements given in Table 1.

Carapace (Fig. 1a, b).—Cephalothorax ovoid, widest at anterior third (ratio $CW/CL = 1.47$), distinctly arched, maximum height in anterior region (ratio $CT/CL = 0.47$). Anterior margin of front indented, wide, one-third carapace width (ratio $FW/CW = 0.32$). Distinctive patches of short hairs on carapace along anterolateral, posterolateral margins continuing around to flanks in subhepatic, pterygostomial regions. Rest of carapace texture smooth, no deep grooves. Exorbital tooth blunt, low, epibranchial tooth almost undetectable. Anterolateral margin between exorbital and epibranchial teeth with row of very small teeth, no distinct intermediate tooth. Anterolateral margin behind epibranchial tooth lacking teeth, spines, or granulations, but possessing coat of fine hairs. Postfrontal crest extending laterally in straight line across entire carapace, meeting both anterolateral margins at epibranchial teeth; short groove at midpoint of postfrontal crest.

Each flank with longitudinal, vertical grooves, dividing flank into 3 parts. Longitudinal flank groove beginning near respiratory opening, curving backward across flank, dividing suborbital and subhepatic regions from pterygostomial region. Vertical flank groove beginning on anterolateral margin between exorbital and epibranchial teeth ending at longitudinal flank groove, dividing suborbital region from subhepatic region. First sternal groove complete, second sternal groove reduced to 2 small notches at sides of sternum. Third maxillipeds filling entire oral field, except for oval efferent respiratory openings. No flagellum on exopod of third maxilliped (Fig. 2a). Ischium of third maxilliped smooth, lacking distinct vertical groove. Mandibular palp 2-segmented with single, undivided, end segment (Fig. 2d, e). First 5 segments of male abdomen broad, short, tapering inward; last 2 segments (A6, A7) long, narrow, last segment (A7) rounded at distal margin (Fig. 2c).

Gonopods.—Proximal two-thirds of terminal segment of gonopod 1 straight, angled distinctly outward (about 45° to midline axis); distal third curving sharply outward away from midline, tapering to pointed tip (Fig. 6d–f). Sperm channel indicated by twisting longitudinal groove on cephalic surface running along entire length of segment. Groove not visible on caudal side. Lateral, medial margins of terminal segment entirely smooth. Penultimate segment of gonopod 1 with groove for gonopod 2 on caudal surface beginning proximally, margins of groove far apart, then tapering distally, finally fusing together shortly before junction with terminal segment. Medial and lateral margins of penultimate segment of gonopod 1 smooth.

Gonopod 2 (Fig. 2f) shorter than gonopod 1 (reaching only junction between segments of gonopod 1). Terminal segment gonopod 2 extremely short, only one-tenth as long as penultimate segment. Terminal segment gonopod 2 solid, tip rounded. Penultimate segment gonopod 2 widest at base, tapering inward about one-third along length, last two-thirds forming long, thin, tapering, upright process supporting short terminal segment.

Chelipeds and walking legs (Figs. 1a, 5c, d).—Chelipeds of adult male unequal, right much longer (29.0 mm), higher (13.1 mm) than left (24.0 mm, 8.9 mm, respectively). Palm of right dactylus swollen, 2 closed fingers enclosing long narrow space; dactylus broad but not arched; ends of dactylus and pollex ending in sharp, overlapping points (pollex over dactylus). Several (5 or 6) small cutting teeth on dactylus and pollex. Anterior margin of merus of right, left chelipeds with row of small teeth, two larger teeth in distal region. Left cheliped smaller than right in all respects, lacking narrow gape of right cheliped. Walking legs (pereopods 2–5) slender, P4 longest, P5 shortest. Dactyli of P2–5 tapering to point, each bearing rows of downward-pointing sharp bristles; dactylus of P5 shortest segment.

Juvenile and pubertal stages (Fig. 7, Table 1).—Mature females with abdomen overlapping bases of coxae of walking legs; with broad, hair-fringed pleopods. Largest female with immature abdomen measuring $CW = 22.5$ mm. Pubertal molt of *P. sachsii*, from pubescent stage to sexual maturity, oc-

Table 1. *Potamonemus sachsi*, new species, from Cameroon and Nigeria, West Africa. Carapace dimensions and proportions relative to the carapace width of all 24 known specimens.

| Sex | CW | CL | CT | FW | CW/CL | CT/CL | FW/CL |
|---|------|------|------|------|-------|-------|-------|
| ZIM K-30395, Bamenda, Cameroon | | | | | | | |
| M (Holotype) | 33.1 | 22.6 | 10.6 | 10.6 | 1.50 | 0.47 | 0.47 |
| F ad | 34.4 | 24.4 | 11.6 | 10.9 | 1.41 | 0.48 | 0.45 |
| F ad | 33.8 | 23.0 | 11.9 | 9.9 | 1.47 | 0.52 | 0.43 |
| F ad | 33.4 | 23.5 | 11.0 | 10.0 | 1.42 | 0.47 | 0.43 |
| M | 32.8 | 22.4 | 10.7 | 10.2 | 1.45 | 0.48 | 0.46 |
| M | 29.0 | 21.0 | 9.3 | 9.1 | 1.38 | 0.44 | 0.43 |
| M | 26.0 | 18.1 | 7.6 | 7.7 | 1.44 | 0.42 | 0.43 |
| F juv | 14.9 | 10.7 | 4.5 | 4.5 | 1.48 | 0.42 | 0.42 |
| NNM 30874, Bamenda, Cameroon | | | | | | | |
| M ad | 31.2 | 21.3 | 10.3 | 9.5 | 1.46 | 0.48 | 0.45 |
| F ad | 32.6 | 22.9 | 10.9 | 10.0 | 1.42 | 0.48 | 0.44 |
| NMU 8.IV.1983A, Obudu plateau, 1 km north of ranch, Nigeria | | | | | | | |
| M | 32.0 | 22.0 | 10.5 | 9.5 | 1.45 | 0.48 | 0.43 |
| M | 18.5 | 13.5 | 6.0 | 6.0 | 1.37 | 0.44 | 0.44 |
| F pub | 18.0 | 13.0 | 6.0 | 6.0 | 1.38 | 0.46 | 0.46 |
| NMU 8.IV.1983B, Obudu plateau, 1 km south of ranch, Nigeria | | | | | | | |
| F ad | 31.6 | 21.0 | 10.0 | 10.0 | 1.50 | 0.48 | 0.48 |
| M | 25.5 | 17.5 | 8.0 | 8.6 | 1.46 | 0.46 | 0.49 |
| M pub | 23.0 | 15.5 | 6.5 | 7.5 | 1.48 | 0.42 | 0.48 |
| F pub | 22.5 | 16.0 | 6.8 | 7.0 | 1.41 | 0.43 | 0.44 |
| F pub | 19.5 | 13.5 | 6.5 | 6.2 | 1.44 | 0.48 | 0.46 |
| F pub | 19.2 | 13.8 | 6.0 | 6.0 | 1.39 | 0.43 | 0.43 |
| F pub | 19.0 | 13.0 | 6.0 | 6.0 | 1.46 | 0.46 | 0.46 |
| M | 18.6 | 13.5 | 6.0 | 6.0 | 1.38 | 0.44 | 0.44 |
| F pub | 17.0 | 12.0 | 5.8 | 5.8 | 1.42 | 0.48 | 0.48 |
| F pub | 14.0 | 10.0 | 4.5 | 4.5 | 1.40 | 0.45 | 0.45 |
| F juv | 9.0 | 7.0 | 2.5 | 3.2 | 1.29 | 0.36 | 0.46 |

curring somewhere between size classes CW = 23.0–28.0 mm. Relative proportions of carapace of juvenile, pubescent *P. sachsi* differing from adults in several ways (Fig. 7, Table 1). Carapace width (CW/CL), height (CT/CL) increasing as crabs grow. Relationships described by $CW/CL = 1.331 + 0.005 CL$, $d.f. = 20$, r value of 0.58 indicating significant correlation ($P < 0.01$), $CT/CL = 0.385 + 0.004 CL$, $d.f. = 20$, r value of 0.626 indicating significant correlation ($P < 0.01$) between size groups. Relative front width of juveniles similar to that of adults. Relationship described by $FW/CL = 0.46 - 0.004 CL$, $d.f. = 20$, r value of 0.1 indicating no significant correlation ($P > 0.05$) between size groups. In summary, carapace of adult *P. sachsi* relatively higher, wider than juveniles; width of frontal margin similar in all age groups.

Color.—Freshly caught, living specimens of *P. sachsi* from Nigeria with dark brown or pale purple carapace and legs; sternum light brown or pale purple; abdomen light

brown; underside of pereiopods pale purple or light brown-purple. Chelipeds of adult males pink-red, chelipeds of juveniles lacking pink-red color.

Etymology.—*Potamonemus sachsi* is named for parasitologist Prof. Dr. Rüdiger Sachs, formerly of the Bernhard Nocht Institute for Tropical Medicine, Hamburg (now of the International Academy of Sciences, San Marino), in recognition of his considerable contributions to the study of zoology in Africa over the years. The specimens from Cameroon from which the species has been described were collected during field work carried out by Prof. R. Sachs and Dr. J. Voelker aimed at identifying the cause of an outbreak of paragonimiasis in West Africa in the early 1970s.

Ecological Notes.—There are no ecological notes available for the specimens from Cameroon. The following notes refer to the specimens from the Obudu plateau in Cross River State, Nigeria. The steep-sided pla-

teau is some 1,000 m above sea level rising out of the rain forests of southeast Nigeria. This highland region continues across the nearby border into the Bamenda highlands of southwest Cameroon, where the specimens held in the ZIM, Hamburg, were collected. The climate on top of the plateau is cooler, but still humid, supporting a tropical montane vegetation, including extensive grasslands. The streams and rivers where the specimens of *P. sachsi* were collected drain south into the Cross River, just to the east of the Nigeria-Cameroon border. These streams are about 2 m wide and 10 cm deep, with a medium flow, and with a gravel-sand bed. The crabs were all caught by hand, from under boulders in stretches which were shaded by trees.

Remarks.—The 14 specimens of *P. sachsi* from Obudu, Nigeria (NMU 8.IV.1983A, NMU 9.IV.1983B) had been described by Cumberlidge (1989) as variants of *S. orthostylis* (Bott, 1955). This material is reassigned here to *P. sachsi* following comparison with the holotype of *S. (S.) decazei orthostylis* Bott, 1955, from Bipindihof, Cameroon (ZMB, Berlin, 11093). The holotype of *S. orthostylis* possesses a flagellum on the exopod of the third maxilliped, and lacks a groove on the end segment of gonopod 1. The specimens of *P. sachsi* from Cameroon (ZIM K-30395, NNM 30874) had been identified as *Sudanonautes (S.) p. pelii* (Herklots, 1861) (unpublished opinions). However, the lack of a flagellum on the exopod of the third maxilliped and the lack of a clearly defined intermediate tooth on the anterolateral margin of the carapace place these specimens in *Potamonemus*.

Potamonemus sachsi may be distinguished from *P. mambilorum* by the following features of adult males. The carapace of *P. sachsi* is coated with patches of fine hairs, while that of *P. mambilorum* is smooth. The vertical groove on the flank of *P. sachsi* begins on the anterolateral margin midway between the exorbital and epibranchial teeth, whereas in *P. mambilorum* this groove begins at the epibranchial tooth. The major cheliped of adult male *P. sachsi* is shorter than the carapace width (Fig. 1a), while that of *P. mambilorum* is longer than the carapace width. In addition, when the right cheliped is closed and the tips of the chelipeds are touching, the arched dactylus of *P.*

mambilorum (Fig. 5e, f) encloses a wide, ovoid space, whereas the less arched dactylus of *P. sachsi* encloses a long, narrow space (Fig. 5c, d).

***Potamonemus asylos*, new species**

Figs. 3, 4, 5a, b, 6a–c

Material Examined.—Between Buea (4°18'N, 9°23'E) and Kumba (4°53'N, 9°35'E), Cameroon, 4 M, 3 F (NMU 1969/1991), collected 1969 by Dr. R. H. L. Disney. Victoria, Cameroon (4°2'N, 9°12'E), 2 M (ZIM K-3607), collected 6.II.1912 by Dr. E. Fickenday ("Essbare Landkrabben," edible land crabs). Largest male from Buea/Kumba (CW = 27.6 mm) designated holotype, deposited in NHM, London, 6 other specimens being paratypes.

Type Locality.—Between Buea and Kumba, southwest Cameroon.

Distribution.—From Kumba to Victoria, southwest Cameroon.

Diagnosis.—Dactylus of major (right) cheliped of male broadened, laterally flattened, not arched. Terminal segment gonopod 1 with bristles along margins; widest in mid-section, longitudinal groove ending before tip; groove visible in caudal view, not seen in cephalic view, entire groove seen only when gonopod viewed along medial edge. Anterior margin of merus of right cheliped with row of large teeth. Vertical flank groove beginning on anterolateral margin at exorbital tooth. Small species, mature at CW = 26.0 mm.

Description.—Following description based on male holotype.

Size.—Measurements given in Table 2.

Carapace (Figs. 3a, b, 7a, b, Table 3).—Cephalothorax ovoid, widest at anterior third (ratio CW/CL = 1.51), distinctly arched, maximum height in anterior region (ratio CT/CL = 0.49). Anterior margin of front indented, narrow, one-quarter carapace width (FW/CW = 0.27). Carapace texture smooth, no deep grooves; cervical and semicircular grooves faint. Exorbital tooth blunt, low, epibranchial tooth almost undetectable. Anterolateral margin between exorbital, epibranchial teeth smooth, lacking intermediate tooth. Vertical flank groove beginning at epibranchial tooth. Anterolateral margin behind epibranchial tooth smooth, lacking teeth, spines, or hairs. Post-frontal crest slightly wavy, extending laterally across entire carapace, meeting both anterolateral margins at epibranchial teeth;

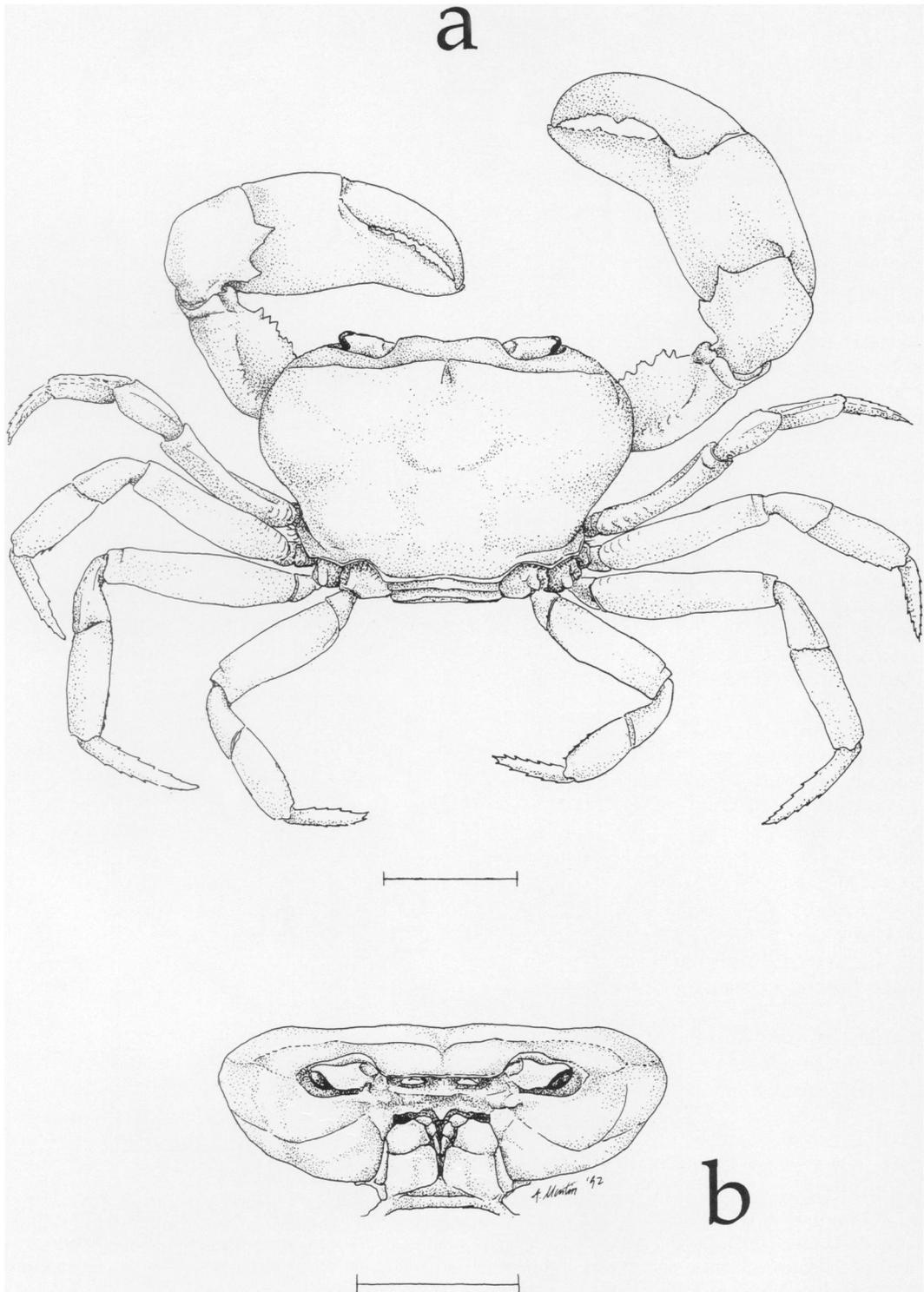


Fig. 3. *Potamonemus asylos*, new species. Male from Buea, Cameroon (holotype, CW = 27.6 mm, NMU 1969/1991). a, whole animal, dorsal aspect; b, cephalothorax, frontal aspect. Scale bars equal 10 mm.

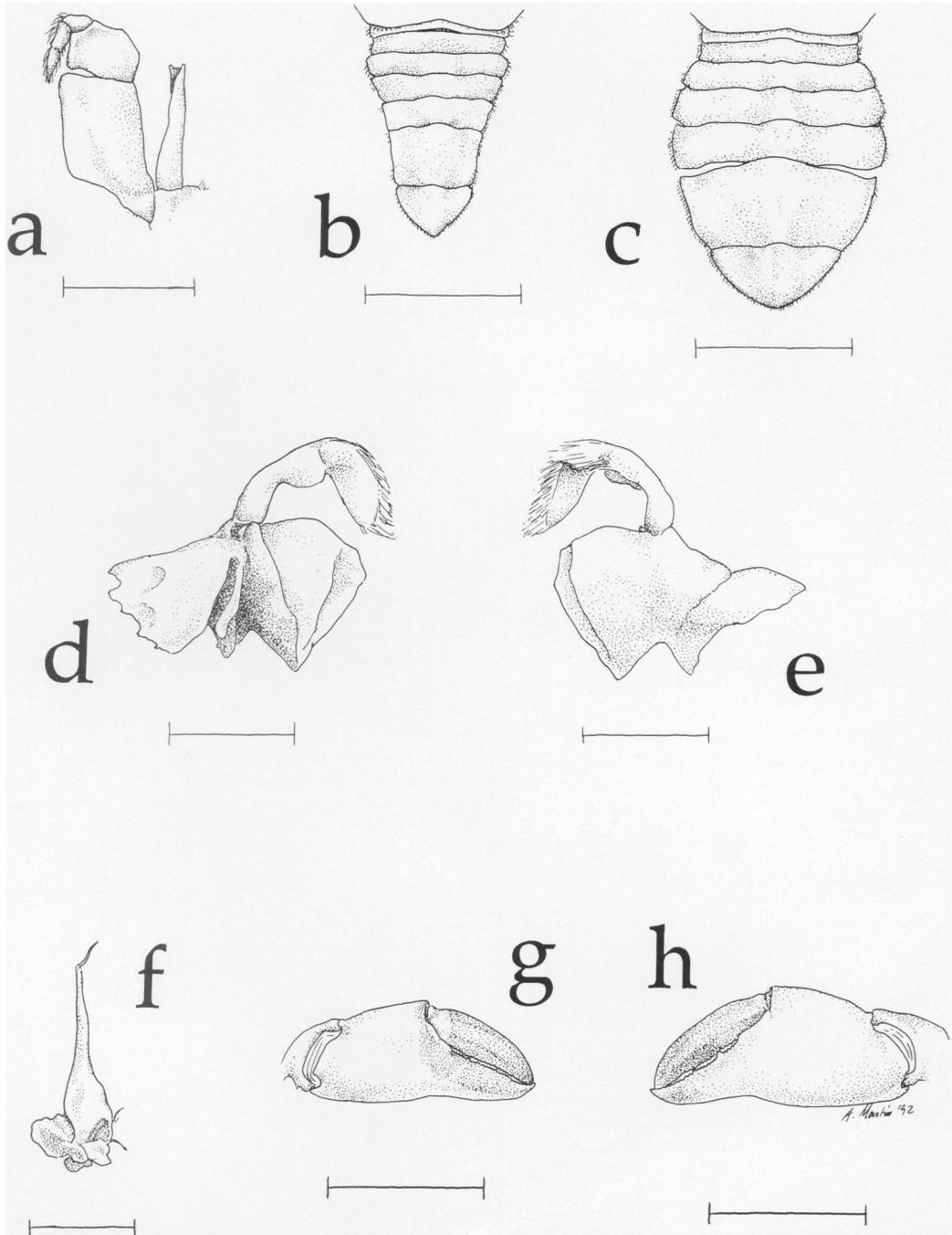


Fig. 4. *Potamonemus asylos*, new species. a, b, d, e, f, Male from Buea, Cameroon (holotype, CW = 27.56 mm), NMU 1969/1991. a, left third maxilliped; b, abdomen; d, left mandible, anterior view; e, left mandible, posterior view; f, left gonopod 2, caudal view. c, g, h from female paratype from Buea, Cameroon (CW = 25.5 mm). c, abdomen; g, female right cheliped, frontal view; h, female left cheliped, frontal view. Scale bars equal 5 mm (a), 10.0 mm (b, c, g, h), 2.0 mm (d, e, f).

Table 2. *Potamonemus asylos*, new species, from Cameroon, West Africa. Carapace dimensions and proportions relative to the carapace width of all 9 known specimens.

| Sex | CW | CL | CT | FW | CW/CL | CT/CL | FW/CL |
|--------------------------------|------|------|-----|-----|-------|-------|-------|
| NMU 1969/1991, Buea, Cameroon | | | | | | | |
| Holotype M | 27.6 | 18.3 | 9.0 | 7.5 | 1.51 | 0.49 | 0.41 |
| Paratype F | 25.4 | 17.8 | 8.6 | 7.5 | 1.43 | 0.49 | 0.42 |
| Paratype F | 23.7 | 16.7 | 7.8 | 7.0 | 1.42 | 0.47 | 0.42 |
| Paratype M | 22.3 | 15.8 | 7.3 | 7.1 | 1.41 | 0.46 | 0.44 |
| Paratype M | 20.1 | 14.2 | 6.5 | 6.5 | 1.42 | 0.46 | 0.46 |
| Paratype M | 19.8 | 13.7 | 6.1 | 6.1 | 1.45 | 0.45 | 0.45 |
| Paratype F | 18.7 | 13.6 | 6.0 | 6.0 | 1.38 | 0.44 | 0.44 |
| ZIM K-3607, Victoria, Cameroon | | | | | | | |
| M | 21.3 | 14.1 | 7.8 | 6.2 | 1.51 | 0.55 | 0.42 |
| M | 20.1 | 13.7 | 6.9 | 6.0 | 1.47 | 0.50 | 0.43 |

short groove at midpoint of postfrontal crest. Features of sternum, third maxillipeds (Fig. 4a), mandibular palp (Fig. 4d, e), and abdomen (Fig. 4b) same as described above for *P. sachsii*.

Gonopods (Figs. 6a–c, 4f).—Terminal segment of gonopod 1 long, half as long as penultimate segment. Terminal segment of gonopod 1 widest in midsection, longitudinal groove ending before tip; groove visible in caudal view, not seen in cephalic view, entire groove seen only when gonopod viewed along medial edge; hairs, bristles along margins of terminal segment. Medial, lateral margins of penultimate segment of gonopod 1 folded inward forming groove containing gonopod 2. These 2 margins lined with occasional short hairs and bristles. Proximal end (closest to sternum) margins wide apart; margins tapering to meet at, or near, junction with terminal segment of gonopod 1. Features of gonopod 2 same as described above for *P. sachsii*.

Chelipeds (Figs. 3a, 5a, b).—Chelipeds of male greatly unequal, right much longer (19.8 mm), and higher (8.9 mm) than left (14.2 mm, 5.5 mm, respectively). Dactylus very broad, flattened laterally, not arched. Palm of right dactylus swollen, closed fingers enclosing long narrow space. Tips of dactylus and pollex ending in sharp, overlapping points (pollex over dactylus). Two large cutting teeth on dactylus, 3 large cutting teeth on pollex. Left cheliped showing some degree of palmar enlargement, dactylar broadening, tooth development. Features of periopods 2–5 same as described above for *P. sachsii*.

Juvenile, pubertal stages (Fig. 8, Table 2).—Largest female with immature abdo-

men having CW = 25.4 mm. Pubertal molt of *P. asylos*, from pubertal stage to sexual maturity, occurring somewhere between size classes CW = 26.0–29.0 mm. Relative proportions of carapace of juvenile, pubertal *P. asylos* differing from adults in several ways (Fig. 8a, b). Relative front width of juveniles wider than adults. Relationship described by $FW/CL = 0.523 - 0.005 CL$, $d.f. = 7$, r value of 0.673 indicating significant correlation ($P < 0.05$) between size groups. Relative width (CW/CL), relative height (CT/CL) of carapace not changing as crabs grow. Relationships described by $CW/CL = 1.379 + 0.004 CL$, $d.f. = 7$, r value of 0.181, $d.f. = 7$, indicating no significant correlation ($P > 0.05$), $CT/CL = 0.448 + 0.002 CL$, r value of 0.114, $d.f. = 7$, indicating no significant correlation ($P > 0.05$) between size

Table 3. The ratio of carapace length (CL) to carapace width (CW), carapace height (CT), and front width (FW), in *Potamonemus* Cumberlidge and Clark, 1992, from Cameroon and Nigeria.

| | CW/CL | CT/CL | FW/CL |
|---|-------------|-------------|-------------|
| <i>Potamonemus sachsii</i> , new species | | | |
| | 1.44 | 0.47 | 0.45 |
| | (SD = 0.03) | (SD = 0.04) | (SD = 0.02) |
| | (N = 24) | (N = 24) | (N = 24) |
| <i>Potamonemus asylos</i> , new species | | | |
| | 1.44 | 0.48 | 0.43* |
| | (SD = 0.04) | (SD = 0.03) | (SD = 0.02) |
| | (N = 9) | (N = 9) | (N = 9) |
| <i>Potamonemus mambilorum</i> Cumberlidge and Clark, 1992 | | | |
| | 1.41 | 0.49 | 0.46 |
| | (SD = 0.04) | (SD = 0.03) | (SD = 0.02) |
| | (N = 16) | (N = 16) | (N = 16) |

* FW/CL of *P. asylos* significantly different from FW/CL of *P. mambilorum* at 95% confidence limits.

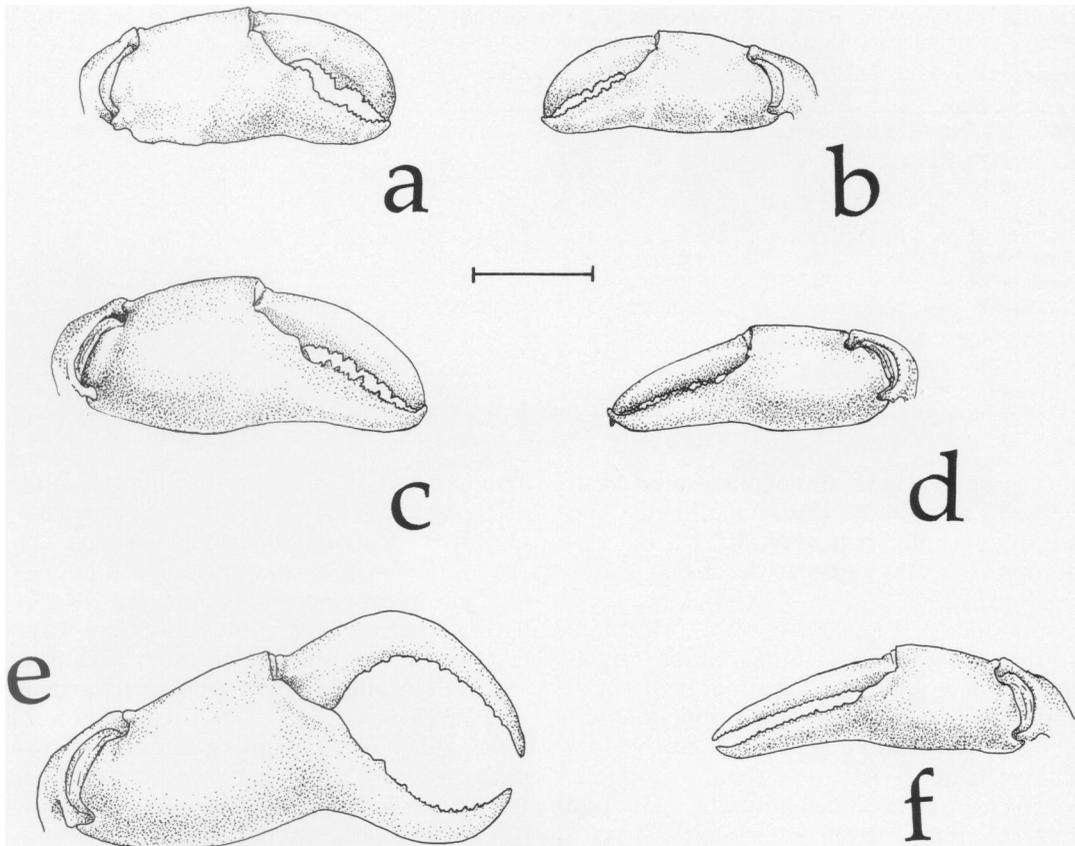


Fig. 5. Comparison of chelipeds of the genus *Potamonemus* Cumberlidge and Clark, 1992. a, b, *P. asylos*, new species, male from Buea, Cameroon (holotype, CW = 27.6 mm), NMU 1969/1991. a, right cheliped, frontal view; b, left cheliped, frontal view. c, d, *Potamonemus sachsi*, new species, male from Bamenda, Cameroon (holotype, CW = 33.1 mm), ZIM K-30395. c, right cheliped, frontal view; d, left cheliped, frontal view. e, f, *Potamonemus mambilorum* Cumberlidge and Clark, 1992, male from Cameroon (CW = 35.4 mm), ZMB 20209. e, right cheliped, frontal view; f, left cheliped, frontal view. Scale bar equals 10 mm.

groups. In summary, adult *P. asylos* with relatively narrower frontal margin than juveniles, but width, thickness of carapace similar in all age groups.

Etymology.—*Potamonemus asylos* is found in a forested lowland area in south Cameroon which is included within the boundaries of one of Africa's Pleistocene forest refuges (Kingdon, 1989). The species has been named for its presence in this forest refugium, "asylos" being Greek for refuge dweller.

Remarks.—The short terminal segment of the second gonopod of *P. asylos* resembles that of *Sudanonautes*. However, the lack of a flagellum on the exopod of the third maxilliped, and the lack of a clearly defined intermediate tooth on the anterolateral margin of the carapace of *P. asylos* argue for its

inclusion in *Potamonemus*. The same features of the cheliped that distinguish *P. sachsi* from *P. mambilorum* (outlined above) also distinguish *P. asylos* from *P. mambilorum*. In addition, the groove on the terminal segment of gonopod 1 of *P. asylos* is on the caudal face, whereas in *P. mambilorum* this groove is on the cephalic face (Fig. 3e, f). *Potamonemus asylos* can be distinguished from *P. sachsi* as follows (Figs. 5a–d, 6a–f). The groove on the terminal segment of gonopod 1 of *P. asylos* runs along the medial edge and is just visible in the caudal view of the gonopod, ending before reaching the gonopod tip. In *P. sachsi* this groove follows a twisting path, is visible only from the cephalic view of the gonopod, and runs to the tip of the segment. The carapace of *P. asylos* is smooth, that of *P. sachsi* is

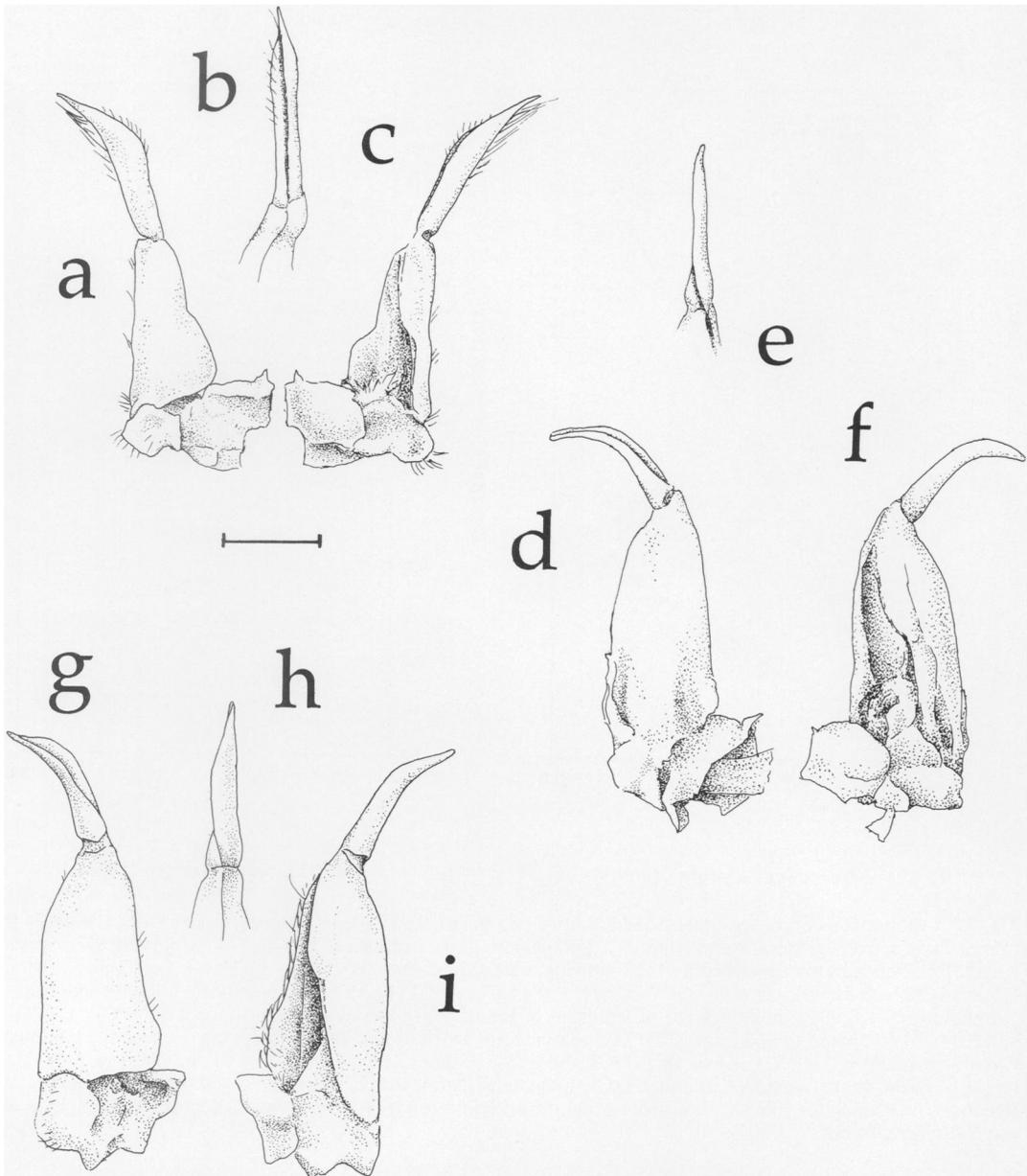


Fig. 6. Comparison of gonopods of the genus *Potamonemus* Cumberlidge and Clark, 1992. a–c, *Potamonemus asylos*, new species, male from Buea, Cameroon (holotype, CW = 27.6 mm), NMU 1969/1991. a, left gonopod 1, caudal view; b, same, medial margin; c, same, cephalic view. d–f, *Potamonemus sachsi*, new species, male from Bamenda, Cameroon (holotype, CW = 33.1 mm), ZIM K-30395. d, left gonopod 1, caudal view; e, same, medial margin; f, same, cephalic view. g–i, *Potamonemus mambilorum* Cumberlidge and Clark, 1992, male from Cameroon (CW = 35.4 mm), ZMB 20209. g, left gonopod 1, caudal view; h, same, medial margin; i, same, cephalic view. Scale bar equals 2 mm.

coated with patches of fine hairs. Finally, the vertical groove on the flank of *P. asylos* begins at the epibranchial tooth, whereas in *P. sachsi* this groove begins on the anterolateral margin midway between the exorbital and epibranchial teeth.

DISCUSSION

Potamonemus asylos and *P. sachsi* both conform to the description of the genus *Potamonemus* (Cumberlidge and Clark, 1992). This genus includes fresh-water crabs with

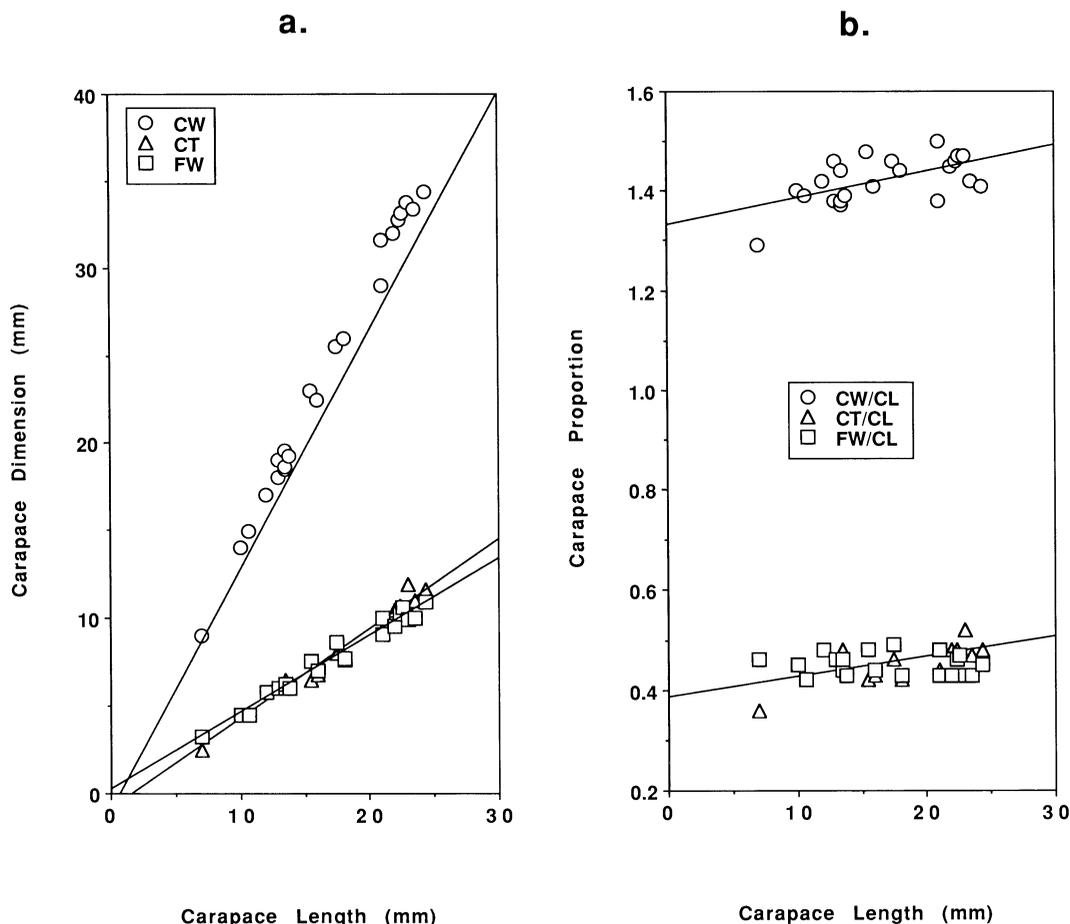


Fig. 7. Comparisons of 22 specimens of *Potamonemus sachsi*, new species, ranging in size from CW = 34.4 mm to 9.0 mm from Cameroon and Nigeria. a. Dimensions of the carapace (CW, CT, FW) compared to carapace length. Relationships are described by the following regression equations: $CW = -1.103 + 1.5 CL$, $r = 0.996$; $CT = -0.88 + 0.51 CL$, $r = 0.988$; $FW = 0.21 + 0.44 CL$, $r = 0.99$. All r values indicate a highly significant correlation ($P < 0.001$), at 20 degrees of freedom. b. Relative proportions of the carapace (CW/CL, CT/CL, and FW/CL) compared to body size (CL). The relationships are described by the following regression equations: $CW/CL = 1.331 + 0.005 CL$, $r = 0.58$; $CT/CL = 0.385 + 0.004 CL$, $r = 0.626$; $FW/CL = 0.46 - 0.0004 CL$, $r = 0.1$. The r values for CW/CL and CT/CL indicate a significant correlation ($P < 0.01$) at 20 degrees of freedom; the r value for FW/CL indicates no significant relationship ($P > 0.05$) at 20 degrees of freedom. r = correlation coefficient.

the following combination of characters: no flagellum on the exopod of the third maxilliped; a two-segmented mandibular palp with a single (simple) terminal segment; a short terminal segment of gonopod 2; and no distinct intermediate tooth between the exorbital and epibranchial teeth on the anterolateral margin.

The three species of *Potamonemus* resemble each other in a number of other ways. For example, all have rounded, smooth-textured carapaces which lack large pointed

teeth, all have a first gonopod with a terminal segment which is widened on its inner margin, and all possess a longitudinal groove on the terminal segment. Finally, all are small crabs found in the same tropical rain forest habitat of southwest Cameroon.

Potamonemus mambilorum can be distinguished from both *P. asylos* and *P. sachsi* on the basis of the following characters of the chelipeds (Fig. 5). (1) The major cheliped of *P. mambilorum* is longer than the

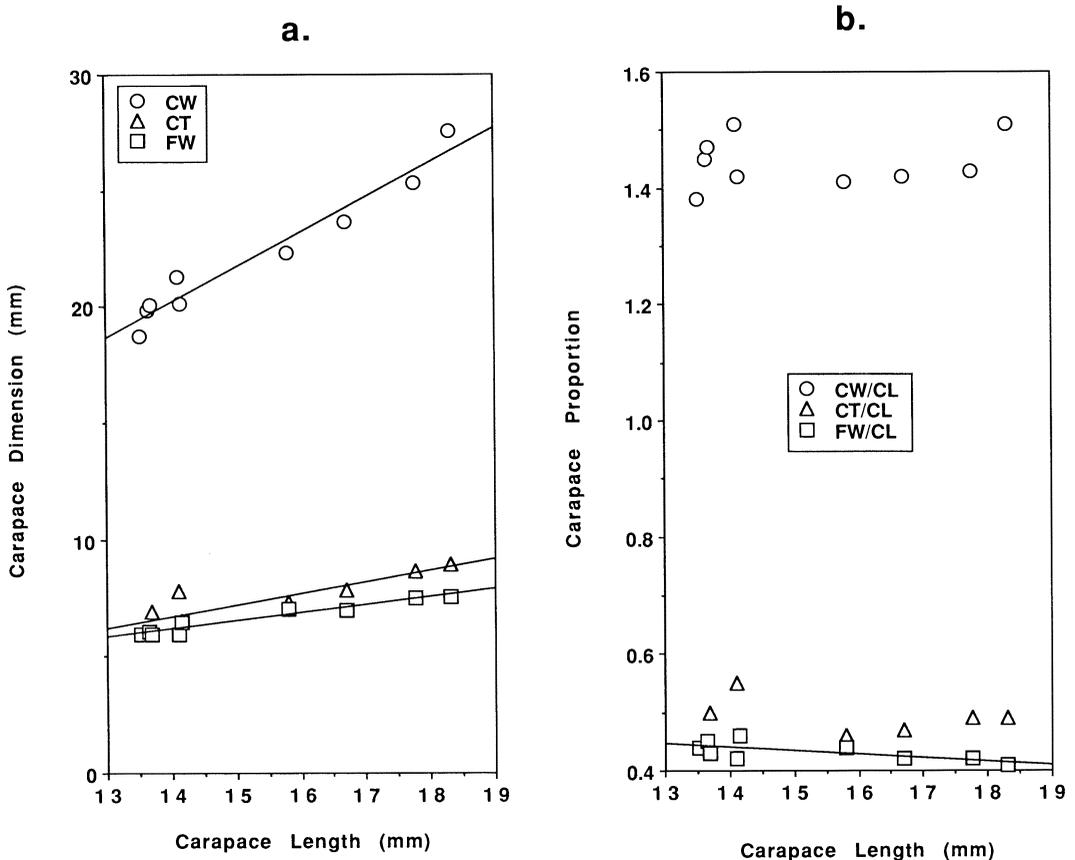


Fig. 8. Comparisons of 9 specimens of *Potamonemus asylos*, new species, ranging in size from CW 27.6 mm to 18.7 mm, from Cameroon. a. Dimensions of the carapace (CW, CT, FW) compared to carapace length. Relationships are described by the following regression equations: $CW = -0.886 + 1.501 CL$, $r = 0.973$; $CT = -0.392 + 0.505 CL$, $r = 0.89$; $FW = 1.404 + 0.34 CL$, $r = 0.996$. All r values indicate a highly significant correlation ($P < 0.001$), at 7 degrees of freedom. b. Relative proportions of the carapace (CW/CL, CT/CL, and FW/CL) compared to carapace length. The relationships are described by the following regression equations: $CW/CL = 1.379 + 0.004 CL$, $r = 0.181$; $CT/CL = 0.448 + 0.002 CL$, $r = 0.114$; $FW/CL = 0.523 - 0.005 CL$, $r = 0.673$. The r values for CW/CL and CT/CL indicate no significant correlation ($P > 0.05$), at 7 degrees of freedom. The r value for FW/CL indicates a significant correlation ($P < 0.05$) at 7 degrees of freedom. r = correlation coefficient.

carapace width, while this cheliped is shorter in *P. asylos* and *P. sachsi*. (2) The narrow, arched dactylus of *P. mambilorum* encloses a wide, ovoid space, whereas the less arched, broader dactyli of *P. asylos* and *P. sachsi* enclose a long narrow space.

The chelipeds of the female paratypes of both *P. sachsi* and *P. asylos* (Figs. 2g, h, 4g, h) do not show the enlargement of the major cheliped described for the males of these species. The abdomen of the mature female specimens of both species is broadened in the manner shown in Figs. 2c and 4c and is consistent with the abdomen shape and size of females of *P. mambilorum*.

The recognition of the genus *Potamonemus* throws some light on the taxonomic position of *Globonautes balssi* Bott, 1959 (Bott, 1959, 1970). Cumberlidge (1987) doubted the assignment of *balssi* to *Globonautes*, on the basis of its mandibular palp structure. Indeed, the undivided terminal segment of the mandibular palp of *balssi*, together with the lack of a flagellum on the exopodite of the third maxilliped, would position *balssi* closer to *Potamonemus*, than to *Sudanonautes* Bott, 1955. However, the lack of a description of the second gonopod of *balssi* (both sides are missing in the holotype) prevents further discussion.

KEY TO THE SPECIES OF THE GENUS
POTAMONEMUS
CUMBERLIDGE AND CLARK, 1992

1. Length of lower margin of propodus of major cheliped greater than carapace width; dactylus of major cheliped narrow and greatly arched (Fig. 5e); space between fingers of major cheliped ovoid (Fig. 5e). *Potamonemus mambilorum*
Cumberlidge and Clark, 1992
- Length of lower margin of propodus of major cheliped less than carapace width; dactylus of major cheliped broad and not arched (Fig. 5a, c); space between fingers of major cheliped long and narrow (Fig. 5a, c). 2
2. Twisting longitudinal groove along caudal surface of terminal segment of gonopod 1, reaching to tip of segment; no hairs or bristles on terminal segment (Fig. 6d, e); groove not visible on cephalic surface (Fig. 6f). Vertical flank groove beginning on anterolateral margin between exorbital and epibranchial teeth (Fig. 1b). Carapace with patches of short hairs along anterolateral and posterolateral margins (Fig. 1a, b). *Potamonemus sachsi*, new species
- Terminal segment gonopod 1 with longitudinal groove visible in caudal view and ending before tip (Fig. 6b, c); groove not seen in cephalic view (Fig. 6a), entire groove seen only when gonopod viewed along medial edge (Fig. 6b), terminal segment with bristles along margins (Fig. 6a-c). Vertical flank groove beginning on anterolateral margin at exorbital tooth (Fig. 3b). Carapace smooth all over (Fig. 3a, b). *Potamonemus asylos*, new species

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