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"A New Genus and Species of Freshwater Crab from Northern Madagascar, and a Second New Species Associated with Pandanus Leaf Axils"

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A new genus and species of freshwater crab (Crustacea, Decapoda, Potamoidea) from northern Madagascar, and a second new species associated with *Pandanus* leaf axils

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Two new species of freshwater crab are described from Madagascar, one from streams in a high-elevation locality, and the other from *Pandanus* leaf axils in low altitude localities. The unusual combination of characters of the new high-elevation species warrants the establishment of a new genus to accommodate this taxon. The new taxa are compared to the other species of freshwater crabs occurring in Madagascar, including *Gecarcinautes antongilensis vondrozi* Bott, 1965, which is considered here to be a synonym of *G. antongilensis* (Rathbun, 1904). Both of the new taxa are endemic to Madagascar, as are all of the genera and species of freshwater crabs found on the island.

KEYWORDS: Crustacea, Brachyura, Potamoidea, freshwater crab, taxonomy, Madagascar, *Pandanus*.

Introduction

The freshwater crabs of Madagascar exhibit a high degree of endemism, a characteristic they share with many other terrestrial and freshwater organisms from this tropical island. To date, more than a dozen endemic species of freshwater crabs in at least four endemic genera are known to occur in the lakes, streams, rivers, and adjacent terrestrial habitats throughout the island (Bott, 1965; Ng and Takeda, 1994; Cumberlidge, 1999). We report here on the discovery of two new species of freshwater crabs from Madagascar, one of which belongs to a new genus. Specimens of *Marojejy longimerus* n. gen. n. sp. were collected from a high-elevation locality, while the other taxon (*Gecarcinautes goodmani* n. sp.) is known from two separate

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localities where it inhabits the leaf axils of *Pandanus* palms. The specimens reported on here are distinctly different from each other and from described taxa in a number of important taxonomic characters including those of the carapace, mandible, third maxilliped, first gonopod, chelipeds, and walking legs. These differences are sufficient to warrant the recognition of a new species of *Gecarcinautes* Bott 1960, and a new monotypic genus (*Marojejy*).

The existing taxonomic scheme for the freshwater crabs of Madagascar is unsatisfactory and is badly in need of revision (Cumberlidge, 1999). The present classification was developed by Bott (1955), who assigned these crabs first to one subfamily (the Hydrothelphusinae) in the then current family Potamonidae, and later (Bott, 1965) to three subfamilies (Hydrothelphusinae, Gecarcinucinae and Potamoninae) in that family. Subsequent revisions by Bott (1970a,b) ignored the Madagascan freshwater crabs entirely, but recognized four families of freshwater crabs in Africa: Potamidae, Potamonautidae, Deckeniidae and Gecarcinucidae. Ng and Takeda (1994) placed the Madagascan freshwater crabs within Bott's (1970a,b) taxonomic scheme, assigning the Hydrothelphusinae to the Potamonautidae, and the Gecarcinucinae to the Gecarcinucidae. The new taxa described here are both distinctive, but show the closest affinities with those Madagascan species presently included in the Gecarcinucinae (i.e., *Gecarcinautes*). However, the status of the Gecarcinucinae as currently defined (which includes taxa from India (Bott, 1970a,b) the Seychelles (Ng *et al.*, 1995) and Madagascar (Bott, 1965)) has been thrown into serious doubt by the cladistic studies of Cumberlidge (1999), Sternberg *et al.* (1999), and Sternberg and Cumberlidge (1999). Further, the genus *Gecarcinautes* is unstable and in need of revision (Cumberlidge, 1999), and it is clear that great changes need to be made to the taxonomy of the freshwater crabs of Madagascar (Cumberlidge and Sternberg, in prep.). We, therefore, provisionally assign one of the new taxa described herein to *Gecarcinautes*, and we treat the subfamily and family status of both genera as uncertain, so as to avoid further contributing to the taxonomic confusion that surrounds the freshwater crabs of Madagascar.

Abbreviations

cw = the distance across the carapace at the widest point; cl = carapace length measured along the median line, from the anterior to the posterior margin; ch = carapace height, the maximum height of the cephalothorax; fw = front width, the width of the front measured along the anterior margin; sw = sternum width, the width of the sternum measured across the widest point; s = thoracic sternite; e = episternite; s4/s5, s5/s6, s6/s7, s7/s8 = sternal sutures between adjacent sternites; s4/e4, s5/e5, s6/e6, s7/e7 = episternal sutures between adjacent sternites and episternites; a1 to a7 = abdominal segments 1–7; P1 to P5 = pereiopods 1–5. AMNH = American Museum of Natural History, New York, USA; FMNH = Field Museum of Natural History, Chicago, USA; MNHN = Museum nationale d'Histoire naturelle, Paris, France; NMU = Northern Michigan University, Marquette, MI, USA.

Systematic account

Marojejy n. gen.

Type species. *Marojejy longimerus* new species.

Diagnosis. Anterolateral regions of carapace granular, exorbital, epibranchial teeth low, blunt; front wide, moderately deflexed; eyestalk tapering distally, cornea

very reduced; terminal segment of mandibular palp bilobed, with medium sized anterior process, approximately 0.5 length of terminal segment; third maxilliped exopod with short flagellum; merus, carpus, propodus of both chelipeds extremely elongated, ratio total length of chelipeds (from ischium to dactylus) to cw 2.7 (right), 2.3 (left); walking legs long, slender.

Etymology. *Marojejy* is a masculine noun derived from the name of the Réserve Naturelle Intégrale de Marojejy, a forested mountain range in the north-eastern region of Madagascar.

Remarks. *Marojejy* can be distinguished from the four other genera of Madagascan freshwater crabs (*Hydrothelphusa* A. Milne-Edwards, 1872; *Gecarcinautes* Bott, 1960; *Madagapotamon* Bott, 1965, and *Skelosophusa* Ng and Takeda, 1994) by its tapering eyestalks with reduced corneas and by the extremely elongated merus of the cheliped. In addition, *Gecarcinautes* can be distinguished from *Marojejy* by its relatively large and pointed exorbital and epibranchial teeth, the conspicuously toothed anterolateral carapace margins, and the narrow, sharply deflexed front. *Madagapotamon* can be distinguished from *Marojejy* by the absence of an anterior process on the terminal segment of the mandibular palp, and by the vestigial flagellum on the exopod of the third maxilliped. *Skelosophusa* can be distinguished from *Marojejy* by the small, ledge-like anterior process of the terminal segment of the mandibular palp. Finally, *Hydrothelphusa* can be distinguished from *Marojejy* by its relatively short and stout walking legs.

Marojejy longimerus n. sp.
(figures 1–3)

Material examined. HOLOTYPE: male adult (cw 23, cl 15.1, ch 7.45, fw 5.9 mm) (AMNH 18345), under rocks, at source of Andranomifototra river (14°26′8″S, 49°44′1″E), 1,875 m, 11 km north-west of Manantenina, Province d'Antsiranana, Réserve Naturelle Intégrale de Marojejy, **Madagascar**, leg. E. Quinter, 13–19 November 1996. PARATYPES: subadult female (cw 15.1, cl 11.3, ch 5.4, fw 4.5 mm), juv. male (cw 11.1, cl 8.4, ch 4.5, fw 3.1 mm) (AMNH 17833); four males (cl 13.0–14.7 mm), five females (cl 12.2–14.2 mm) (FMNH 4656), under rocks, at source of Andranomifototra river (14°26′8″S, 49°44′1″E), 1,875 m, 11 km north-west of Manantenina, Province d'Antsiranana, Réserve Naturelle Intégrale de Marojejy, **Madagascar**, leg. E. Quinter, 13–19 November 1996; ovigerous female (cl 13.1 mm) (AMNH 17831), three males (cl 12–14.2 mm) (AMNH 17834), along tributary at head of Andranomifototra River (14°26′4″S, 49°44′5″E), 1,625 m, 10.5 km north-west of Manantenina, Province d'Antsiranana, Réserve Naturelle Intégrale de Marojejy, **Madagascar**, leg. E. Quinter and S. M. Goodman, 6–12 November 1996.

Diagnosis. As for genus.

Description. Based on holotype, an adult male from Marojejy, Madagascar, cw 23.0 mm (AMNH 18345). Carapace ovoid outline, high (ch/fw 1.26), extremely wide anteriorly (cw/fw 3.8), tapering sharply posteriorly; posterior margin straight, relatively wide (0.33 cw). Anterolateral regions of carapace granular, rest of dorsal carapace smooth; semi-circular, urogastric, cardiac grooves shallow; cervical grooves deep, long, ending before meeting postorbital crests. Epigastric crests lying posterior to epibranchial teeth; postorbital crests low, indistinct, aligned with, but not joined to, epigastric crests; postorbital crests fading laterally before meeting epibranchial teeth; front slightly indented, margin thin, raised, smooth; front moderately deflexed,

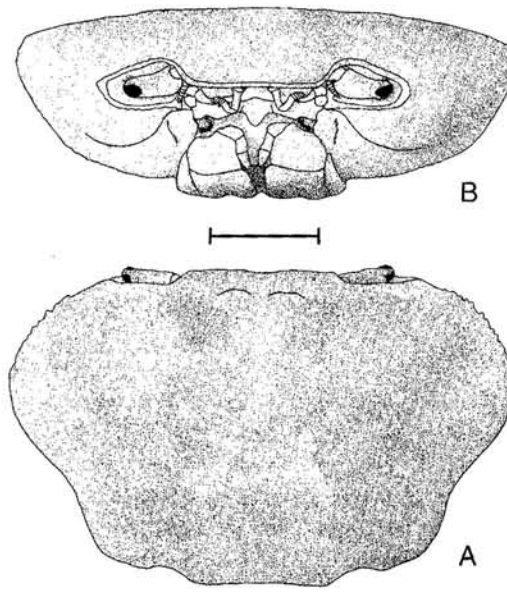

FIG. 1. *Marojejy longimerus* new genus, new species, from Madagascar, male, holotype, carapace width = 23 mm: (A) cephalothorax, dorsal aspect; (B) cephalothorax, frontal aspect. Scale bar equals 5.1 mm.

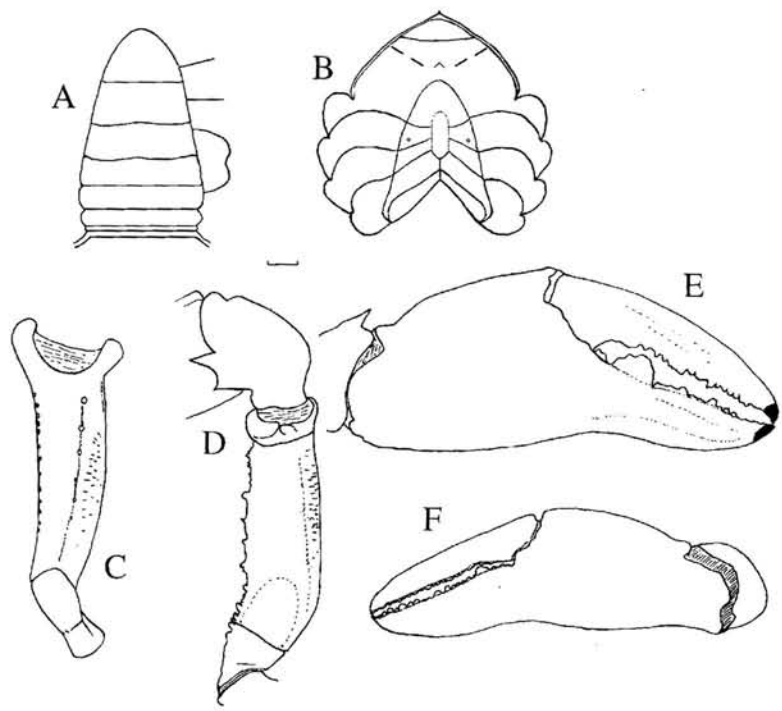

FIG. 2. *Marojejy longimerus* new genus, new species, from Madagascar, male, holotype, carapace width = 23 mm: (A) abdomen; (B) sternum; (C) merus of right cheliped inferior view; (D) carpus and merus of right cheliped, superior view; (E) right cheliped, frontal aspect; (F) left cheliped, frontal aspect. Scale bar equals 10.0 mm.

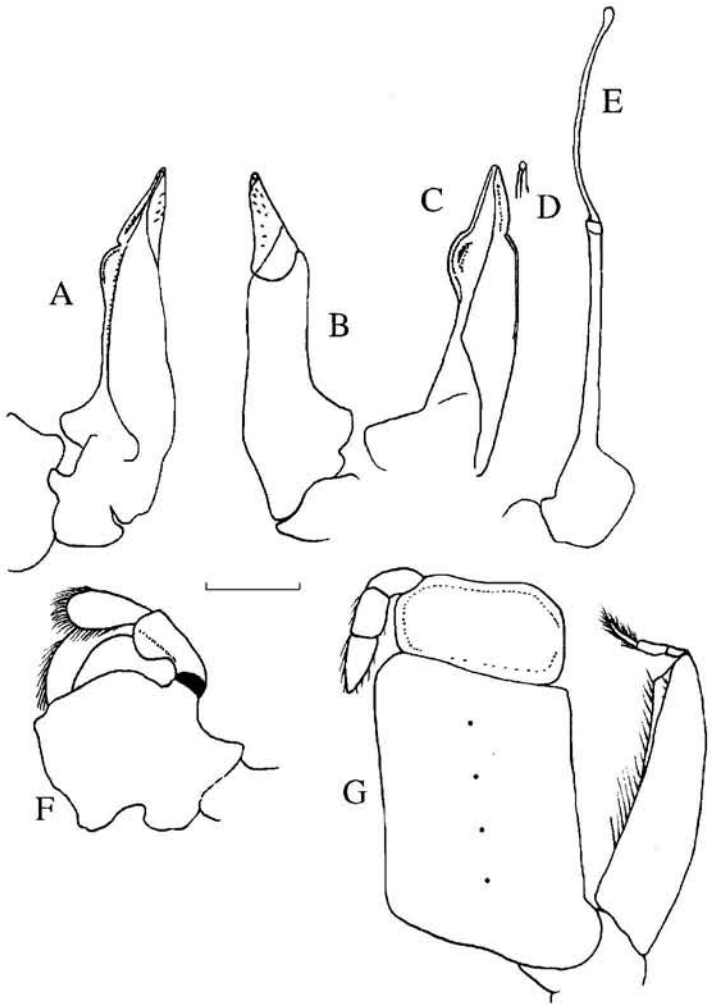

FIG. 3. *Marojejy longimerus* new genus, new species, from Madagascar, male, holotype, carapace width = 23 mm: (A) right gonopod 1, ventral aspect; (B) right gonopod 1, dorsal aspect; (C) right gonopod 1 turned to show longitudinal groove; (D) right gonopod 1 showing details of tip; (E) right gonopod 2, ventral aspect; (F) left mandible showing details of palp; (G) left third maxilliped showing details of the exopod. Scale bar equals 2.0 mm (A–E), 5.0 mm (F).

not meeting inferior margin of antennulular fossae; epistomial tooth triangular, deflexed, granulated. Exorbital angle low, lacking tooth, continuous with anterolateral margin. Epibranchial tooth reduced to small granule; anterolateral margin between exorbital angle and epibranchial tooth short, lacking intermediate tooth; anterolateral margin granular, curving sharply outward, posterior end curving inward, not continuous with posterolateral margin of carapace. Eyestalk tapering sharply distally, cornea very reduced; suborbital margin smooth. Subhepatic, pterygostomial regions of carapace sidewall granulated, suborbital region smooth. Vertical sulcus on carapace sidewall granular, curving, running from base of epibranchial tooth to epimeral sulcus, separating suborbital from subhepatic region, dividing carapace sidewall into three parts.

Mandibular palp two-segmented, terminal segment bilobed, with medium-sized anterior process (about 0.5 as large as terminal segment) arising from junction between segments. Exopod of third maxilliped medium length, reaching to mid-point of merus; exopod with distinctly reduced, but still substantial, flagellum; ischium with faint, shallow, vertical groove. First sternal sulcus s1/s2 short but visible; second sternal sulcus s2/s3 deep, completely crossing sternum, s2 distinctly lower than s3. Sternal sulcus s3/s4 consisting of two short notches at edges of sternum, continuing over s4 as shallow, barely visible, v-shaped groove whose point meets granulated anterior margin of sterno-abdominal cavity midway along s4. Anterior sternum appearing smooth, but sparse short hairs visible under magnification. Episternal sulci s4/e4, s5/e5, s6/e6, s7/e7 smooth, all lacking visible groove. Sternite s5 with pair of sternal knobs ('bouton-pressions' of Guinot, 1977). Last five segments of adult male abdomen (a3 to a7) forming triangle, a3 widest, telson (a7) narrowest. Telson with straight sides, triangular, not bell-shaped; a6 long, almost as long as width of distal margin of a6. Sternal groove s4/s5 meeting a7 close to junction between a7/a6; s5/s6 meeting a6 in middle of segment, s6/s7 meeting a5 just short of a5/a6 junction.

Terminal article of gonopod 1 relatively short (ratio of length of terminal article to subterminal segment 0.3), longitudinal groove on terminal article wide near junction, narrowing sharply distally, clearly visible on ventral, superior sides, not visible on dorsal side; lateral, medial folds on ventral terminal article equal in height, width; terminal article cone-shaped, almost straight, directed slightly outward; slim, tapering to upcurved tip with clear apical opening; subterminal segment of gonopod 1 with distinct, raised, rounded shoulder on external margin near junction with terminal article. Junction between terminal article and subterminal segment of gonopod 1 not clear on ventral side, but marked by deep sulcus dorsally; gonopod 1 with broad dorsal membrane. Gonopod 2 longer than gonopod 1; terminal article of gonopod 2 flagellum shorter than subterminal segment (ratio length terminal article to subterminal segment 0.7).

Merus, carpus, propodus, dactylus of P1 all elongated, chelipeds both extremely elongated: ratio of total length of chelipeds (from ischium to dactylus) to cw (P1/cw) 2.7 (right), 2.3 (left). Dactylus of right, left chelipeds relatively slim (one-third height of palm); upper margin of dactylus smooth; finger of propodus slim (one-third height of palm), lower margin of propodus of cheliped slightly indented. Finger of propodus with large, fused molar tooth in proximal region, rest of propodus and dactylus with series of small teeth, closed fingers leaving long, narrow interspace. Inner margin of inferior face of ischium of pereiopod 1 with two small teeth; outer margin smooth. Inner margin of inferior face of merus of pereiopod 1 lined by row of small uneven teeth, outer margin lined by small even teeth; low, faint tooth in middle of distal margin; superior surface of merus rough, granulated. Inner margin of carpus of pereiopod 1 with two large teeth, second about half size of first; first carpal tooth broad, triangular, blunt, second carpal tooth small, low, blunt. Merus, carpus, propodus, dactylus of P2 to P5 all elongated, walking legs slender: ratio of total length of P2/cw to P5/cw 1.36, 1.47, 1.53, 1.23 respectively. Inner margins of propodi of P2 to P5 smooth.

Size. Largest known specimen is the male holotype, cw 23 mm.

Colour. Carapace, eyestalks, chelipeds uniformly pale orange. Merus of cheliped with dark brown wash, fingertips pale white. Merus, carpus of walking legs pale white with pale orange mottling; mottling decreasing on propodus and dactylus.

Distribution. Madagascar.

Type locality. Andranomifototra river (14°26′8″S, 49°44′1″E), 1,875 m, 11 km north-west of Manantenina, Province d'Antsiranana, Réserve Naturelle Intégrale de Marojejy, Madagascar.

Comparisons. Marojejy longimerus is superficially similar to other small long-legged crabs found in Madagascar (*Gecarcinautes*, *Madagapotamon* and *Skelosophusa*) but can be distinguished from these taxa by the characters discussed above for the genus.

Remarks. The Réserve Naturelle Intégrale de Marojejy is a 60,000 ha reserve in north-east Madagascar, north of Andapa, that includes the Marojejy mountains and consists of a continuous steep climb from 100 m to over 2100 m. The vegetation in the reserve includes closed canopy forest, mountain woodland, and ericoid bush, and palms, ferns, orchids and balsams are abundant. Some of the fauna, including lemurs, birds and insects, is endemic to the reserve (Jolly *et al.*, 1984).

Gecarcinautes goodmani n. sp.
(figures 4–6)

Gecarcinautes n. sp. cf. *antongilensis antongilensis* (Rathbun 1905) Harvey and Boyko, 1998: 145–146.

Material. HOLOTYPE: male adult/subadult (cw 23.0, cl 17.6, ch 6.8, fw 4.7 mm) (FMNH 4651), Station Forestière de Tampolo, Province de Toamasina, **Madagascar** (17°17′2″S, 49°24′5″E), 10 m, in leaf axils of *Pandanus*, coll. S. M. Goodman, 4.iv.1997. PARATYPES: adult/subadult female (cw 23.5, cl 18.4, ch 8.0, fw 5.4 mm), juv. male (cw 12.6, cl 10.6, ch 4.2, fw 3.1 mm) (FMNH 4651), male (cl 16.5 mm) (AMNH 17530), ovigerous female (cl 18.1 mm) (AMNH 17530a), Station Forestière

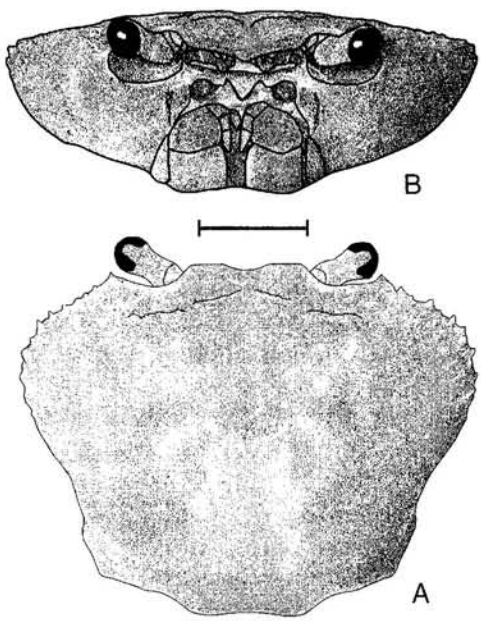

FIG. 4. *Gecarcinautes goodmani*, new species, from Madagascar, male, holotype, carapace width = 23.5 mm: (A) cephalothorax, dorsal aspect; (B) cephalothorax, frontal aspect. Scale bar equals 5.8 mm.

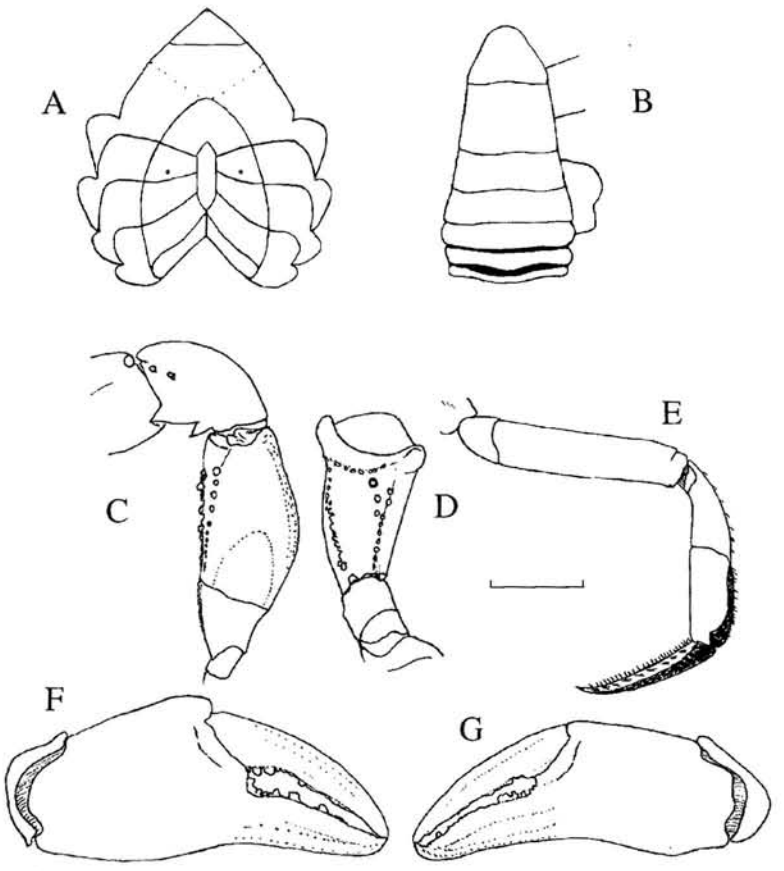

FIG. 5. *Gecarcinautes goodmani,* new species, from Madagascar, male, holotype, carapace width = 23.5 mm: (A) sternum; (B) abdomen; (C) carpus and merus of right cheliped, superior view; (D) merus of right cheliped superior view; (E) right fifth pereiopod, posterior aspect; (F) right cheliped, frontal aspect; (G) left cheliped, frontal aspect. Scale bar equals 10.0 mm.

de Tampolo, Province de Toamasina, **Madagascar** (17°17′2″S, 49°24′5″E), 10 m, in leaf axils of *Pandanus*, coll. S. M. Goodman, 4 April 1997; ovigerous female (cl 20.3 mm) (AMNH 17830), near tributary of Manantenina River (14°26.0′S, 49°45.7′E), 775 m, in leaf axils of *Pandanus*, 100 km north-west of Manantenina, Province d'Antsiranana, Réserve Naturelle Intégrale de Marojejy, **Madagascar**, leg. S. M. Goodman, 15–22 October 1996.

Diagnosis. Outer margins of dactylus, propodus of P2 to P5 with thick covering of velvet-like hair.

Description. Based on holotype male from Station Forestière de Tampolo, Province de Toamasina, Madagascar, cw 23.0 mm (FMNH 4651). Carapace outline heart-shaped, elongated (cl/fw 3.76), high (ch/fw 1.46), widened anteriorly (cw/fw 4.9), tapering sharply posteriorly. Anterolateral carapace regions heavily granulated with short carinae; branchial, semi-circular, urogastric, cardiac, grooves deep; cervical grooves deep, long, ending before meeting postorbital crests. Epigastric crests in line with epibranchial teeth; postorbital crests incomplete, marked by interrupted series of granules; epigastric crests clearly separated from postorbital crests; front

from base of epibranchial tooth to epimeral sulcus, separating suborbital region from hepatic region, sidewall clearly divided into three parts.

Mandibular palp two-segmented, terminal segment bilobed, with medium-sized anterior process (about 0.5 × terminal segment) at junction between segments. Third maxilliped exopod short, reaching only to lower lateral corner of merus; exopod flagellum medium length, ischium with deep vertical groove. First sternal sulcus s1/s2 barely visible; second sternal sulcus s2/s3 deep, horizontal; third sternal sulcus s3/s4 deep at edges, angling inward as faint groove almost meeting anterior margin of sterno-abdominal cavity on sternite s4. Episternal sulci s4/e4, s5/e5, s6/e6, s7/e7 smooth, all lacking visible groove. Last five segments of abdomen (a3 to a7) tapering inward, forming long triangle, a3 widest, telson (a7) narrowest; telson with straight sides, triangular, not bell-shaped; a6 long, slightly longer than width of distal margin of a6. Sternal sulcus s4/s5 meeting a7 about one-third along length of segment; s5/s6 meeting a6 about one-third along length of segment; s6/s7 meeting a5 about one-third along length of a5. Terminal article of gonopod 1 relatively short (ratio of length of terminal article to subterminal segment 0.33). Longitudinal groove on terminal article wide near junction, narrowing sharply distally, clearly visible on ventral, superior sides, not visible on dorsal side; lateral, medial folds on ventral terminal article equal in height, width; terminal article slim, cone-shaped, almost straight, directed slightly outward, tapering to slightly upcurved tip with clear apical opening; subterminal segment of gonopod 1 with distinct triangular shoulder on external margin near junction with terminal article. Suture marking junction between terminal article and subterminal segment of gonopod 1 distinct on dorsal side but barely visible on ventral side. Wide dorsal membrane on dorsal side of junction between terminal article and subterminal segment of gonopod 1. Gonopod 2 longer than gonopod 1; gonopod 2 terminal article flagellum with rounded tip, shorter than subterminal segment, ratio length terminal article to subterminal segment 0.7.

Dactylus of right, left chelipeds relatively narrow (one-quarter height of palm), straight, upper margin granulated; finger of propodus one-third height of palm, lower margin of propodus of cheliped slightly indented. Fingers of propodus with four large teeth interspersed by series of smaller teeth, closed fingers enclosing long interspace. Anterior, posterior inferior margins of ischium of pereiopod 1 smooth. Inferior margins of merus of pereiopod 1 each lined by row of small rounded teeth; single large meral tooth on distal margin; superior surface of merus rough, finely granulated. Inner margin of carpus of pereiopod 1 with two pointed teeth: first carpal tooth large, second carpal about half as large as first carpal tooth. Inner margins of propodi of P2 to P5 smooth with tufts of hair. Merus, carpus, propodus, dactylus of P2 to P5 elongated, walking legs long, slender: ratio of total length of P2/cw to P5/cw 1.22, 1.57, 1.92, 1.20 respectively. Outer margins of dactylus, propodus of P2 to P5 with thick covering of velvet-like hair.

Size. Largest specimen is an ovigerous female, cw 27.5 mm.

Colour. Frontal region of carapace chocolate brown, gastric, hepatic regions of carapace dark red-purple, branchial regions lilac, cardiac region gray, intestinal region gray-purple; anterolateral margin teeth pale orange-tan; orbital, anterior margins dark orange. Cornea black, eyestalk dark red-brown. Dorsal surface of dactylus of cheliped deep red-brown, becoming pale orange ventrally, lateral surface of dactylus pale orange-tan; fixed finger of cheliped pale orange-tan; dorsal surface of merus dark orange/red-brown, grading to pale orange/yellow ventrally; carpus dark orange/red-brown, lateral and dorsal surface of merus mottled tan to

red-purple; all tubercles on cheliped pale tan. Walking legs brown-lavender, dactyli dark brown-orange distally. Colour varies noticeably with size. Carapace, pereiopods of smallest specimen gray-violet; dactyli of walking legs yellow, propodus yellow distally, grading into gray-violet; dactylus and propodus of cheliped uniform brilliant yellow. Chelipeds of medium sized specimens with regions of pale orange which become rich mahogany in large specimens.

Distribution. Madagascar. *Gecarcinautes goodmani* is found at different elevations, always in association with *Pandanus* leaf axils. The exact nature of the distribution of this species on the island remains unknown, because *Pandanus* habitats have not been well sampled over the whole of Madagascar.

Type locality. Station Forestière de Tampolo, Province de Toamasina, Madagascar (17°17′2″S, 49°24′5″E), 10 m elevation, in leaf axils of *Pandanus*.

Sympatric taxa. One male (cl 36.0 mm) and four females (cl 18.8–24.8 mm) (FMNH 4652) of *Gecarcinautes* cf. *goudoti* (H. Milne Edwards 1853) were collected from pitfall traps close to the type locality of *G. goodmani*. *Gecarcinautes goodmani* is therefore sympatric with *G.* cf. *goudoti* in at least part of its range, although these two species do not appear to share the same ecological niche.

Diagnosis. Epigastric crests posterior to supraorbital margins, separated by narrow midgroove; outer margins of dactylus, propodus of walking legs with thick covering of velvet-like hair; inner margin of propodus of walking legs smooth, with tufts of hair.

Comparisons. *Gecarcinautes goodmani* can be distinguished from *Marojejy longimerus* by the suite of generic-level characters described above under *Marojejy*. *Gecarcinautes goodmani* was collected in the same locality and the same habitat as *G.* cf. *goudoti*, but the larger body size, highly inflated, smooth carapace, smooth anterolateral carapace margins, smooth dactyli of P2–P5, and normal sized walking legs of *G.* cf. *goudoti* immediately distinguish it from *G. goodmani*.

Gecarcinautes goodmani resembles *G. antongilensis* in its heart-shaped carapace, narrow front, anterior process on the terminal segment of the mandibular palp, and extremely long walking legs. In addition to the nominate subspecies, Bott (1965) erected the taxon *G. antongilensis vondrozi*, which he considered to have a smaller, flatter, less grooved carapace, a wider front, less well defined epigastric crests, and smaller teeth on the anterolateral margin of the carapace compared to the nominate form. During the present study, we examined the male holotype of *G. antongilensis* from Baie d'Antongil, Madagascar (MNHN BP 5033), as well as the male holotype of *G. a. vondrozi* from Vondrozo, at an elevation of 100–800 m, pointe de Farafangana, Madagascar (MNHN BP 5038) collected by M. Decary, ix.1926. Characters of the first and second gonopods, mandibles, sternum, abdomen, dorsal carapace, carapace sidewalls, chelipeds and walking legs of *G. a. vondrozi* correspond well with the type of *G. antongilensis*, and set this specimen apart from *G. goodmani*. The differences between *G. a. vondrozi* and the nominal species that were cited by Bott (1965) as justification for the establishment of a new taxon are well within the range of intraspecific variation and do not, in themselves, warrant the recognition of a separate taxon. Therefore *G. a. vondrozi* is considered here to be a junior objective synonym of *Gecarcinautes antongilensis* (new synonymy).

Gecarcinautes goodmani can be distinguished from *G. antongilensis* as follows. In *G. antongilensis*, the epigastric crests are advanced and lie in line with the supraorbital margins and are separated by a wide midgroove; the inner margin of the propodus of pereiopods P2–P5 is distinctly toothed; and the outer margins of the dactylus

and propodus of P2–P5 lack the thick covering of velvet-like hair characteristic of *G. goodmani.*

Remarks. It is difficult to reach conclusions regarding the range of this species on the island because our specimens of *G. goodmani* were collected from two geographically distinct regions and two different elevations. Some species of freshwater crabs from West Africa (*Globonautes macropus,* Cumberlidge, 1991 Cumberlidge and Sachs, 1991) and Sri Lanka (*Ceylonthelphusa scansor,* Ng, 1995) have been reported to be able to climb trees and to utilize unusual habitats in the rain forest such as tree holes. It would therefore be extremely interesting to evaluate the ecological relationships between *G. goodmani* and *Pandanus* palms, because this interesting ecological specialization has not been reported before for any species of freshwater crab.

Etymology. The new species has been named for Dr Steven M. Goodman of the Department of Zoology, Field Museum of Natural History, Chicago, USA, to recognize his extensive and diverse contributions to the conservation of the biodiversity of Madagascar.

Biological and ecological notes

The colour of the eggs of freshwater crabs changes from bright orange when the eggs are freshly laid, to dark grey when they are close to hatching (Cumberlidge, 1999). The 25 large orange eggs (diameter 2.3 mm) found on the pleopods of the ovigerous female of *M. longimerus* (AMNH 17831) were presumably freshly laid and in the early stages of development. The 30 large purple eggs (diameter 2.1 mm) found in the abdominal pouch of the female of *G. goodmani* (AMNH 17830) were presumably close to full development. The exact duration of the breeding period of these crabs is unknown, but ovigerous females of *G. goodmani* (AMNH 17530a, 17830) were collected in April and October, while the ovigerous female (AMNH 17831) of *M. longimerus* was collected in November.

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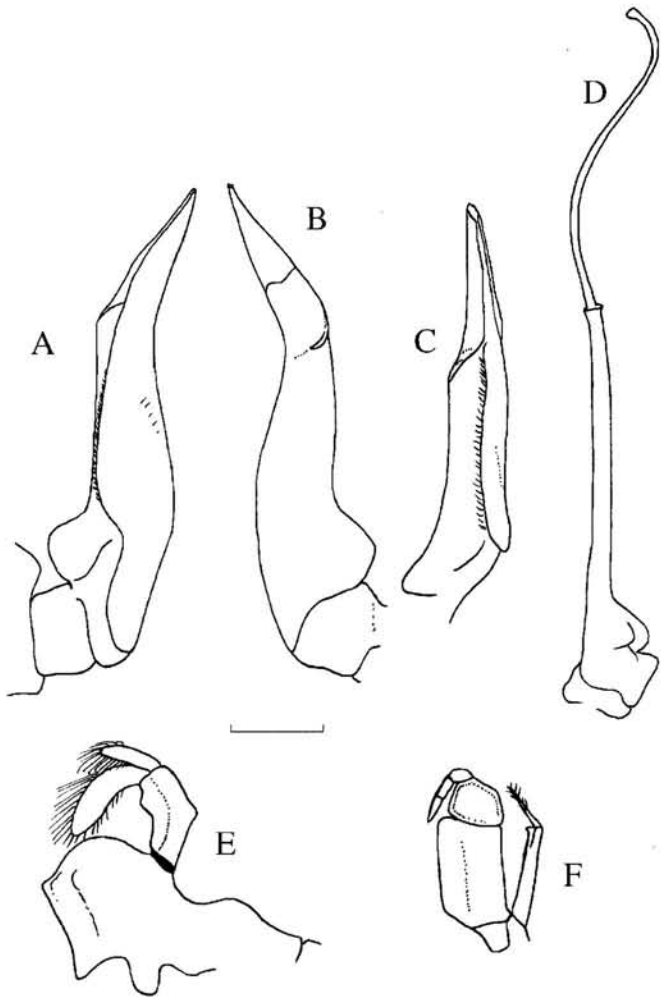

FIG. 6. *Gecarcinautes goodmani*, new species, from Madagascar, male, holotype, carapace width = 23.5 mm: (A) right gonopod 1, ventral aspect; (B) right gonopod 1, dorsal aspect; (C) right gonopod 1 turned to show longitudinal groove; (D) right gonopod 2, ventral aspect; (E) left mandible showing details of palp; (F) left third maxilliped, frontal aspect. Scale bar equals 2.0 mm (A–E), 5.0 mm (F).

sharply deflexed, almost vertical, meeting lower margins of antennulular fossae; frontal margin indented, margin thin, smooth, raised; front very narrow, about one-fifth cw (fw/cw 0.2). Exorbital, epibranchial teeth distinct, triangular, pointed; epibranchial tooth about half as large as exorbital tooth; anterolateral margin between exorbital, epibranchial teeth short, lacking intermediate tooth; anterolateral margin with seven small pointed teeth behind epibranchial tooth, posterior end of anterolateral margin of carapace continuous with posterolateral margin. Eyestalk normal width, length (not reduced), cornea normal size (not reduced); suborbital margin raised, granulated. Suborbital, subhepatic regions of carapace sidewalls smooth, pterygostomial region, anterior sternum, third maxilliped smooth, with short, sparse hairs under magnification. Vertical sulcus on sidewall granular, running