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Hydrothelphusa vencesi, a new species of freshwater crab (Brachyura: Potamoidea: Potamonautidae) from southeastern Madagascar.

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Abstract

A new species of freshwater crab of the genus *Hydrothelphusa* A Milne-Edwards, 1872, is described based on specimens collected from a forested region of southeastern Madagascar. *Hydrothelphusa vencesi* **n. sp.** is clearly distinguished from its congeners by its distinctive first gonopod (G1) with a terminal article that is in the form of a long straight-sided cone, and by a dorsal membrane at the segment junction of G1 that is broad and diamond-shaped. A key is provided to separate the five species of *Hydrothelphusa*.

Key words: Crustacea, Brachyura, Potamoidea, Potamonautidae, *Hydrothelphusa*, freshwater crab, taxonomy, new species, Madagascar

Introduction

The present work was prompted by the examination of freshwater crabs from a forested area in the mountains of southeastern Madagascar that were collected by Prof. Dr. Miguel Vences and his colleagues and sent to the authors for identification. The specimens were collected from the Vevembe Forest, over 60 km inland from Farafangana in Fianarantsoa Province. The new material included specimens of a taxon that is described here as a new species and assigned to the genus *Hydrothelphusa* A. Milne-Edwards, 1872, based on both morphological evidence and on a molecular study of this Malagasy genus by Thompson (2005).

There are currently 13 species of freshwater crabs in Madagascar assigned to 7 genera (Cumberlidge & Sternberg 2002; Reed & Cumberlidge 2006). The addition of *Hydrothelphusa vencesi* **n. sp.** brings the number of species of Malagasy freshwater crabs to 14, all of which are endemic to the island. The genus *Hydrothelphusa* now includes five species —*H. agilis* A. Milne-Edwards, 1872, *H. madagascariensis* (A. Milne-Edwards, 1872), *H. bombetokensis* Rathbun, 1904, *H. goudoti* (H. Milne Edwards, 1853), and *H. vencesi* **n. sp.** (Bott 1965) (see Cumberlidge & Sternberg 2002; Cumberlidge *et al*. 2004; Cumberlidge *et al*. 2005; Reed & Cumberlidge 2006).

Bott (1965) assigned Malagasy freshwater crabs to two different families, the-then Potamonidae Ortmann, 1897, and the Gecarcinucidae Rathbun, 1904. In contrast, the revision by Cumberlidge and Sternberg (2002) included all of the Malagasy freshwater crab genera in the African family Potamonautidae Bott, 1970, based on shared character states of the mandibular palp, abdomen, and first gonopod, and treated these taxa as a monophyletic group. Recent molecular studies have provided evidence that the Malagasy freshwater crab genera indeed form a monophyletic clade (Thompson 2005; Daniels *et al*. 2006; Klaus *et al*. 2006). However,

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different classifications of the Malagasy freshwater crabs have been proposed (Klaus *et al*. 2006; Cumberlidge *et al*. 2007). Until a new consensus on the higher taxonomy can be reached the classification used here is that of Martin & Davis (2001).

Abbreviations. The following abbreviations are used: 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 above the sternum; fw = front width, the width of the front measured along the anterior margin between the orbits; s = thoracic sternite; e = episternite; s4/s5, s4/s5, s5/s6, s6/s7, s7/s8 = sternal sutures between adjacent thoracic sternites; s4/e4, s5/e5, s6/e6, s7/e7 = episternal sutures between adjacent sternites and episternites; G1 = gonopod 1; G2 = gonopod 2; a1 to a6 = abdominal segments 1 to 6; t = telson of abdomen; p1 to p5 = pereiopods 1 to 5; asl = height in metres above sea level; FMNH = Field Museum of Natural History, Chicago, IL, USA; NMU = Northern Michigan University, Marquette, MI, USA; ZMA = Zoölogisch Museum Amsterdam, The Netherlands.

Systematic account

Family Potamonautidae Bott, 1970

Genus *Hydrothelphusa* A. Milne-Edwards, 1872

Hydrothelphusa vencesi n. sp.

(Figs. 1–17)

Type material examined: MADAGASCAR: adult male, holotype (designated here, cw 52, cl 40.5, ch 19.5, fw 16.5 mm), Fianarantsoa Province: region of Vondrozo near village of Vevembe (22º47'44"S, 47º11'19"E), Ramanara River, tributary of Sahampindra River, Mananara River drainage basin, 66.6 km inland from Farafangana, in a forested area in the mountains of southeastern Madagascar (M. Vences) (ZMA De. 205976).

Additional material examined: MADAGASCAR: FMNH 5730, Sahavatov River, basin of Manampatrana River, Andringita Camp II, 1,390m asl (20-Nov-93); FMNH 5748, Sahambano River, Mananara-sud River drainage basin, Madagascar, 570 m asl, 25-May-95.

Diagnosis. Terminal article of G1 long (ratio of length of terminal article to subterminal segment 0.3), straight-sided cone, bent outward at 45° to longitudinal axis of gonopod, evenly-tapering to pointed tip; broad, diamond-shaped dorsal membrane at segment junction. Palm of propodus of major cheliped enlarged, dactylus slightly arched, enclosing long narrow interspace; propodus, and dactylus of major cheliped serrated, lined by small teeth interspersed by larger rounded teeth, with fused cluster of several small low teeth, tips pointed.

Description of holotype. Carapace moderately wide (cw/fw 3.2) moderately high (ch/fw 1.2); anterolateral, posterolateral regions of carapace distinctly granular, with short carinae (Figs. 1, 16). Epigastric crests raised, anterior margins straight, positioned anterior to postorbital crests; mid-groove between epigastric crests broad, shallow; distinct gap between epigastric, postorbital crests; postorbital crests ending well before meeting anterolateral margins (Figs. 1, 2, 16). Semi-circular groove shallow, faint; urogastric, cardiac grooves shallow; cervical grooves long, ending before meeting postorbital crests (Figs. 1, 16). Front horizontal (not deflexed) leaving antennulular fossae exposed; upper edge of frontal margin granular, distinctly indented, lower edge V-shaped, broadest in middle, narrowest at sides; frontal margin of carapace approximately one-third cw (0.32) (Figs. 1, 2, 16, 17). Exorbital, epibranchial teeth large, pointed, directed forward, outer margins granular. Anterolateral margin between exorbital, epibranchial teeth lacking intermediate tooth (Figs. 1, 2, 16, 17). Anterolateral margin posterior to epibranchial tooth raised, with small teeth grading into heavy granules (Figs. 1, 16). Suborbital margin raised, heavily granulated (Figs. 2, 17). Suborbital, pterygomial regions of carapace sidewall heavily granulated, subhepatic region with carinae (Figs. 2, 17). Mandibular palp

two-segmented, bilobed, with medium-sized anterior process (about one-third size of terminal segment). Ischium of third maxilliped with deep vertical sulcus (Fig. 17), exopod of third maxilliped with long flagellum (Fig. 7). Sternal sulci s2/s3, s3/s4 completely crossing sternum, s3/s4 slightly V-shaped, not meeting anterior margin of sterno-abdominal cavity on sternite 4 (Fig. 8). Episternal sulci s4/e4, s5/e5, s6/e6, s7/e7 all smooth lacking visible groove (Fig. 8). Palm of propodus of major (left) cheliped enlarged, dactylus slightly arched, enclosing long rectangular interspace; fingers of major cheliped lined by small even teeth interspersed by large rounded teeth, propodus with fused cluster of three or four small low teeth (Figs. 3, 4). Walking legs (p2–p5) of medium size (ratio of length of merus of p5 to cw 0.40–0.45) (Fig. 16). Anterior inferior margin of ischium of pereiopod 1 granular; medial inferior margin of merus of pereiopod 1 heavily granulated, lateral inferior margin with several small teeth; distal meral tooth reduced to granule; superior surface of merus roughly granulated (Fig. 6). Inner margin of carpus of cheliped with two large, pointed carpal teeth, first tooth spine-like, second tooth one-third size of first, margin behind second tooth with small tooth (Fig. 5). Male abdomen long, slim, triangular (a3 widest, a6 shorter than width of distal margin of a6), telson (a7) bell-shaped with indented sides. Terminal article of G1 long (ratio of length of terminal article to subterminal segment 0.3), straight-sided cone, bent outward at 45° to longitudinal axis of gonopod, evenly-tapering to pointed tip (Figs. 9–15); no visible groove between terminal article and subterminal segment on ventral side (Figs. 9, 10); dorsal side with broad, diamond-shaped dorsal membrane at segment junction (Figs. 11, 14). Ventral side of subterminal segment of G1 with long lateral flap folded inward; medial part of dorsal face of subterminal segment of G1 flat with distinct disto-medial triangular shoulder, and large rounded baso-lateral projection (Fig. 10). G2 longer than G1; terminal article of G2 long flagellum, ratio length terminal article to subterminal segment 0.8 (Fig. 9).

Size. The largest specimen known is the holotype, an adult male, cw 52 mm.

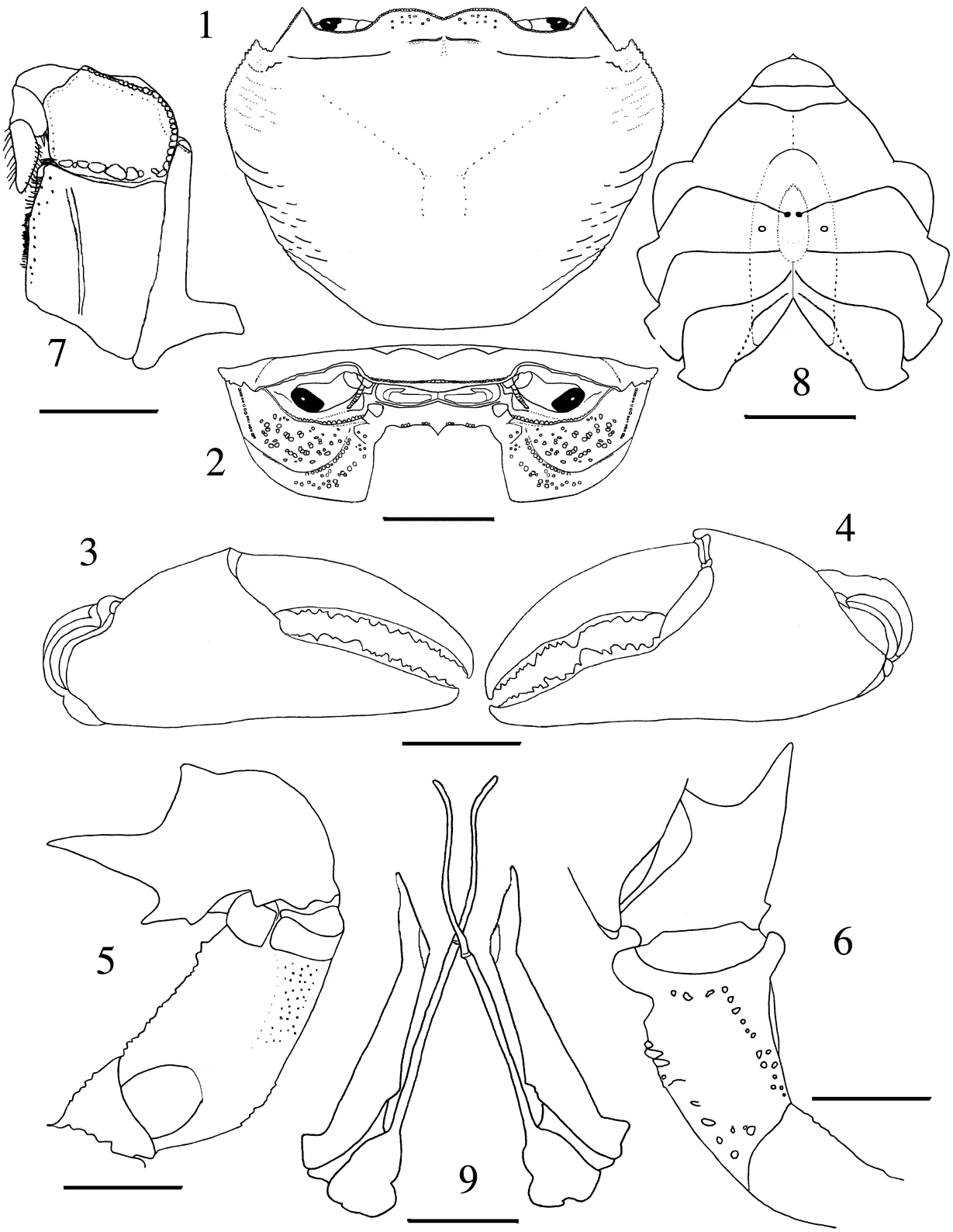
Color. In life, carapace purple-brown, lacking stains or spots, tips of chelipeds and pereiopods lighter shade of brown, granules on suborbital and pterygostomial regions of carapace sidewall beige.

Type locality. Madagascar, Vevembe Forest (22º47'44"S, 47º11'19"E), 66.6 km inland from Farafangana in Fianarantsoa Province in a forested area in the mountains of southeastern Madagascar.

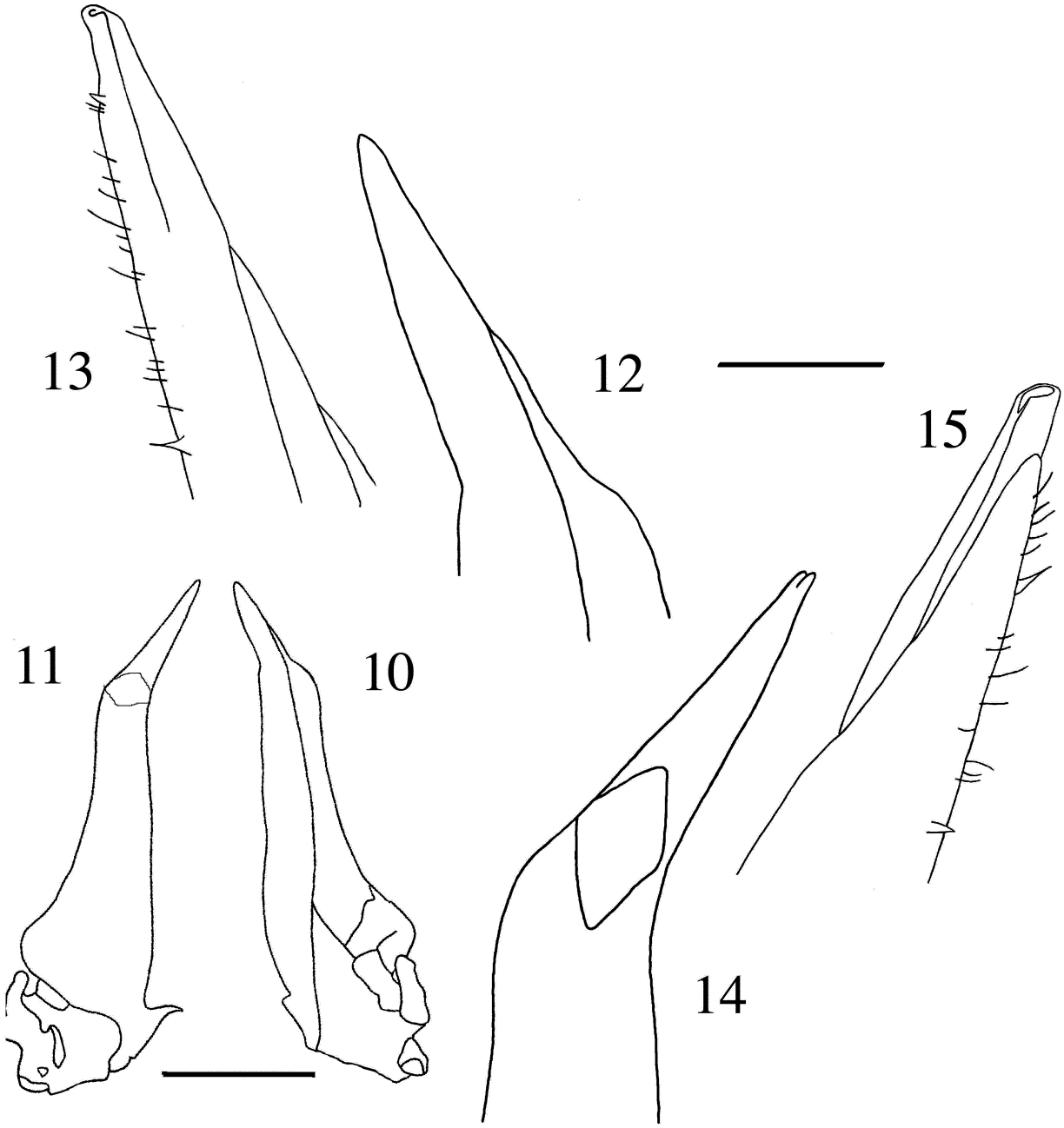
Distribution. Endemic to Madagascar. *Hydrothelphusa vencesi* is known from three localities in southeastern Madagascar, two of them in the Mananara River drainage basin. The type locality is in the Vevembe Forest near the village of Vevembe in the region of Vondrozo in Fianarantsoa Province. This species is also found in the Sahavatov River which is part of the drainage basin of the Manampatrana River (Andringita Camp II, 1,390 m asl), and at 570 m asl in the Sahambano River in the basin of the Mananara-sud River.

Remarks. The following morphological characters justify including *H. vencesi* in *Hydrothelphusa* (Cumberlidge & Sternberg 2002: 47; Thompson 2005). The carapace outline is transversely oval with wide frontal and posterior margins (each approximately one-third carapace width); the mandibular palp is two-segmented with a lobe-like, medium-sized anterior process (about one-third the size of the terminal segment) at the junction between the segments; the ischium of the third maxilliped has a deep vertical sulcus, and the exopod of the third maxilliped has a long flagellum; sternal sulcus s2/s3 is deep and horizontal, and sternal sulcus s3/s4 is shallow and V-shaped; episternal sulci s4/e4, s5/e5, s6/e6, s7/e7 are smooth and not visible; walking legs (p2–p5) are neither shortened nor elongated, with the ratio of the length of the merus of p5 to the cw of 0.40–0.45; the male abdomen is long, slim, and triangular, with a bell-shaped telson whose sides are indented; the terminal article of G1 is long (with a ratio of the length of the terminal article to the subterminal segment of 0.3); the subterminal segment of G1 has a distinct disto-lateral triangular shoulder-like projection at the junction of the segments; and G2 is longer than G1 with a terminal article that has a long flagellum (the ratio of the length of the terminal article to the subterminal segment is approximately 0.8).

Etymology. The species is named for Prof. Dr. Miguel Vences in recognition of his important contributions to our knowledge of the diversity, evolution, and natural history of Madgascar's endemic fauna.

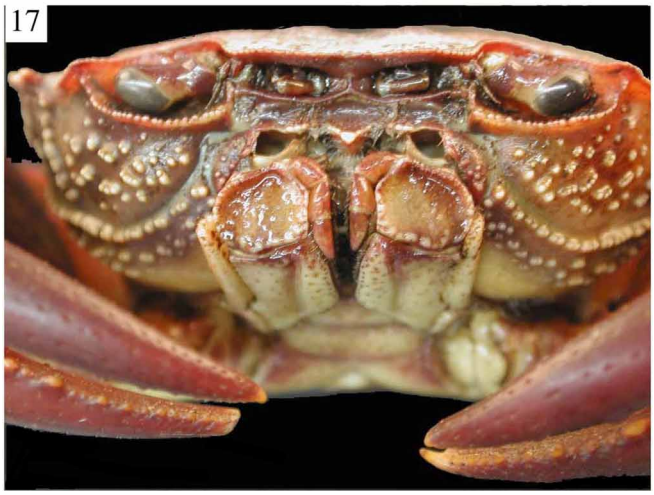


FIGURES 1–9. *Hydrothelphsua vencesi* **n. sp.**, adult male holotype (cw 52 mm, ZMA De. 205976) from Vevembe, Fianarantsoa Province, Madagascar. 1, carapace and eyes, dorsal view; 2, cephalothorax, carapace and eyes, frontal view; 3, right cheliped, frontal view; 4, left cheliped, frontal view; 5, carpus and merus of right cheliped, dorsal view; 6, merus of right cheliped, inferior view; 7, left third maxilliped; 8, sternum and abdomen; 9, abdomen pulled back to show first and second gonopods. Scale = 13 mm (1,2, 8, 9); 7 mm (3–7).



FIGURES 10–15. *Hydrothelphsua vencesi* **n. sp.**, adult male holotype (cw 52 mm, ZMA De. 205976) from Vevembe, Fianarantsoa Province, Madagascar. 10, right G1, ventral view; 11, right G1, dorsal view; 12, terminal article of right G1, dorsal view; 13, detail of tip of terminal article of right G1, dorsal view; 14, detail of tip of terminal article of right G1, dorsal view; 15, right first gonopod turned to show detail of tip of terminal article. Scale = 7 mm (10, 11); 2 mm (12–15).

Comparisons. *Hydrothelphusa vencesi* can be distinguished from other species of *Hydrothelphsua* (and indeed from all other Malagasy brachyurans) by examination of G1 morphology (Figs. 10–15). The terminal article of G1 of *H. vencesi* is a long straight-sided cone that tapers evenly to a pointed tip and lacks a pronounced raised mid section; in addition there is a broad diamond-shaped dorsal membrane at the segment junction on its dorsal side. These characters are unique to *H. vencesi* and set this taxon apart from the other species assigned to this genus (see below) (Cumberlidge & Sternberg 2002: 48–59, fig. 9A–Q).



FIGURES 16–17. *Hydrothelphsua vencesi* **n. sp.**, adult male holotype (cw 52 mm, ZMA De. 205976) from Vevembe, Fianarantsoa Province, Madagascar. 16, whole animal dorsal view; 17, detail of eyes and mouthparts, frontal view.

Hydrothelphusa vencesi most closely resembles *H. madagascariensis* because these two large species share the following characters. The frontal margin, front behind the margin, and the suborbital, subhepatic, and pterygostomial regions of the carapace sidewall are all distinctly granulated, the exorbital and epibranchial teeth are both large and pointed, and the anterolateral margin behind the epibranchial tooth is either heavily granulated or toothed; the suborbital margin, the ischium of pereiopod 1, and the inferior margins of merus of pereiopod 1 are also granulated. *Hydrothelphusa vencesi* differs from *H. madagascariensis* in that the G1 terminal article of *H. vencesi* is a long straight-sided evenly-tapering cone that lacks the pronounced raised mid-section seen in *H. madagascariensis* (Figs. 10–15; Cumberlidge & Sternberg 2002: figs. 9E–I).

Hydrothelphusa vencesi shares the following characters with *H. bombetokensis*. The exorbital and epibranchial teeth are both large and pointed and the first carpal tooth on the carpus of pereiopod 1 is a long, slender spine. *Hydrothelphusa vencesi* can be distinguished from *H. bombetokensis* as follows. The inferior margins of the merus of pereiopod 1 of *H. bombetokensis* are granular (whereas these margins in *H. vencesi* have several large and pointed teeth); the anterior carapace of *H. bombetokensis* is smooth (whereas that of *H. vencesi* is heavily granulated in the anterolateral corners and the frontal region); and the G1 terminal article of *H. bombetokensis* is slim and distinctly raised in the mid-section (the result of a higher medial fold) ending in an upcurved tip (Cumberlidge & Sternberg 2002: figs. 9J–M), whereas that of *P. vencesi* is a long straight-sided evenly-tapering cone that lacks the pronounced raised mid-section (Figs. 10–15).

Hydrothelphusa vencesi is similar to *H. agilis* in that the frontal margin of both of these large species is noticeably indented in the middle. *Hydrothelphusa vencesi* can be distinguished from *H. agilis* as follows. The

frontal margin is distinctly toothed in *H. agilis* but granular in *H. vencesi*; the inferior margin of the merus of pereiopod 1 of *H. agilis* has several large and pointed teeth, while these margins in *H. vencesi* are granular but not toothed; the suborbital margin and the p1 ischium of *H. agilis* are both distinctly toothed, whereas these structures are granular in *H. vencesi*; and the terminal article of G1 of *H. agilis* is slim and evenly proportioned along its entire length, ending in an upcurved tip (Cumberlidge & Sternberg 2002: figs. 9A–D), whereas that of *P. vencesi* is a long straight-sided evenly-tapering cone (Figs. 10–15).

Hydrothelphusa vencesi can be distinguished from *H. goudoti* as follows. The carapace of *H. goudoti* is wider (cw/fw 3.9) and more arched (ch/fw 1.6) than that of *H. vencesi* (cw/fw 3.2, ch/fw 1.2); the exorbital and epibranchial teeth of *H. goudoti* are both small and blunt, whereas these teeth in *H. vencesi* are large and pointed; the postfrontal crest of *H. goudoti* is incomplete (wherein epibranchial crests and postorbital crests are separate), whereas in *H. vencesi* the postfrontal crest is complete; and the terminal article of G1 of *H. goudoti* is slim with a raised and rounded mesial lobe, ending in a broad straight tip (Cumberlidge & Sternberg 2002: figs. 9N–Q), whereas that of *P. vencesi* is a long straight-sided evenly-tapering cone (Figs. 10–15).

Key to the species of *Hydrothelphusa*

1 Inferior margins of merus of pereiopod 1 with either large teeth or large granules; anterior carapace texture distinctly granular with short carinae. **2**
- Inferior margins of merus of pereiopod 1 either smooth or faintly granular; anterior carapace texture completely smooth..... **4**
2 Frontal margin clearly toothed; front horizontal (not deflexed); suborbital margin with large pointed teeth; suborbital region of carapace sidewall smooth (Cumberlidge & Sternberg 2002: Fig. 1A). .... ***H. agilis***
- Frontal margin granular; front moderately deflexed; suborbital margin granular; suborbital region of carapace sidewall granular. **3**
3 Subhepatic regions of carapace sidewall heavily granulated. ..... ***H. madagascariensis***
- Subhepatic region of carapace sidewall smooth. ..... ***H. vencesi***
4 Exorbital, epibranchial teeth both slim, long, pointed; distinct gap between epigastric, postorbital crests (Cumberlidge & Sternberg 2002: Fig. 1C). ..... ***H. bombetokensis***
- Exorbital, epibranchial teeth both low, blunt; epigastric, postorbital crests fused forming horizontal postfrontal crest (Cumberlidge & Sternberg 2002: Fig. 1D). ..... ***H. goudoti***

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