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Taxonomic review of the *Ranatra gracilis* group sensu Lansbury, 1972 (Nepomorpha: Nepidae), with descriptions of four new species

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Abstract. The classification of species groups of the Oriental *Ranatra* is re-evaluated, with the establishment of a new group, the *R. bilobata* group. The *Ranatra gracilis* species group sensu Lansbury, 1972 is reviewed. *Ranatra stali* Montandon, 1905 is redescribed, based on the lectotype. Four new species of *Ranatra* in this group are described, all are from the Philippines and related to *R. stali*: *R. bisaya*, *R. bendanilloi*, *R. brevicauda*, and *R. pangantihoni*. A revised key to the species of the *R. gracilis* group is provided. In addition, the female of *R. heoki* Tran & Poggi, 2019 is described for the first time.

Key words. Nepidae, *Ranatra gracilis* group, new species, Philippines, Southeast Asia, taxonomy

INTRODUCTION

The water stick insect genus *Ranatra* Fabricius, 1790, has a worldwide distribution, with about a half of its species richness concentrating in Southeast Asia (D. Polhemus & J. Polhemus, 2013). The latest revision of the Oriental species of *Ranatra* was done by Lansbury (1972), including a provisional classification utilising species groups, which provided the foundation for subsequent studies on the taxonomy of *Ranatra* in the region.

Subsequent descriptions of new *Ranatra* species from Southeast Asia, by Nieser & Chen (1991, 1996), Nieser (1996, 1997), Zettel (1999), Chen et al. (2004), Tran & Polhemus (2012), D. Polhemus & J. Polhemus (2012), Tran & Nguyen (2016), and Tran & Poggi (2019) followed Lansbury's (1972) classification. These subsequent discoveries and distribution records helped to fill gaps in our knowledge of the taxonomy of the genus, and provided further evidence for understanding the relationship among *Ranatra* species in the region. However, with additions of those new species, the key to species by Lansbury (1972) became out-dated, especially the key to the species of the *R. gracilis* and *R. biroi* groups, to which most of species described after 1972 belong. Some other species do not really fit well in this classification at all, i.e., *R. sulawesii* Nieser & Chen, 1991, *R. sterea* Chen, Nieser & Ho, 2004, and *R. bilobata* Tran & Nguyen, 2016.

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It is notable that Lansbury's (1972) classification of six species groups was more for practical reasons, as he stated "to avoid repetition with the descriptions of each species" (Lansbury, 1972: 294), rather than to depict the natural relationship between species, although some species groups may represent distinct phylogenetic lineages. In particular, while the *R. gracilis*, *R. elongata*, *R. varipes*, and *R. malayana* groups can be easily recognised, the distinction between the *R. filiformis* and *R. biroi* groups is not obvious. Because Lansbury's classification has yet been tested by proper phylogenetic analyses including molecular data, all species groups in *Ranatra* proposed to date should be regarded as provisional constructs.

This paper presents the first part of our review of *Ranatra* from Southeast Asia and neighbouring regions. Based on the morphological examination of most species known from South Asia to Australia, we provide revised diagnoses for species groups as already classified by Lansbury (1972). We also propose one new species group, the *R. bilobata* group, to accommodate *R. sulawesii* Nieser & Chen, 1991, *R. sterea* Chen, Nieser & Ho, 2004, and *R. bilobata* Tran & Nguyen, 2016. A key to seven species groups is provided. The *Ranatra gracilis* group is reviewed, including descriptions of four new species and a revised key to species in this group. A subsequent paper will deal with the classification of taxa in the *R. biroi* group (Tran & Zettel, in prep.).

MATERIAL AND METHODS

Specimens examined in this study are deposited in the following collections.

ADMU	Biodiversity Laboratory, Ateneo de Manila University, Manila, the Philippines
KKU	Khon Kaen University, Faculty of Agriculture, Dept. of Entomology, Thailand

NHMW	Natural History Museum Vienna, Austria
UPLB	University of the Philippines Los Baños, Laguna, Philippines
USC	University of San Carlos, Cebu City, the Philippines
NRMS	Swedish Royal Museum of Natural History, Stockholm, Sweden
PNM	National Museum of the Philippines, Museum of Natural History, Manila, Philippines
ViSCA	Leyte State University (formerly Visayas State College of Agriculture)
VPGC	Victor P. Gapud Collection (present depository uncertain)
ZCW	Zettel Collection, Vienna, Austria
ZRC	Zoological Reference Collection, Lee Kong Chian Natural History Museum, National University of Singapore

Terminology follows previous taxonomic works on *Ranatra* by Lansbury (1972), Chen et al. (2004), and D. Polhemus & J. Polhemus (2013). Morphometric measurements are defined as below.
Body length: length from anterior end of head (excluding rostrum) to posterior end of abdominal sternum 7.
Siphon length: length of respiratory siphon distal of flexible (annulate) zone.
Head width: maximum width of head (across eyes).
Interocular width: minimum distance of eyes dorsally.
Eye width = (Head width – Interocular width)/2.
Pronotal length: median length of pronotum.
Anterior pronotal length: maximum length of anterior pronotal lobe from apex to groove at midline.
Posterior pronotal length: maximum length of posterior pronotal lobe from groove at midline to base.
Anterior pronotal width: maximum width of anterior pronotal lobe.
Posterior pronotal width: maximum width of posterior pronotal lobe.
Fore femur length: maximum length of fore femur.
Siphon index: Siphon length relative to combined length of sterna III–V measured ventrally.

All measurements are in millimetres. When measurements are not given as a range, they refer to the holotype, the lectotype, or a randomly selected specimen.

Morphometric measurements were mostly carried out using a Leica MZ6 stereo-microscope. Photographs of specimens were taken with a Leica DFC490 camera attached to Leica Z16 APO lenses. They were stacked with Zerene Stacker 64-bit and then processed with Adobe Photoshop CS3.

TAXONOMY

Ranatra Fabricius, 1790

Ranatra Fabricius, 1790: 227 (type species: *Nepa linearis* Linnaeus, 1758, subsequently designated by Latreille, 1810: 434).

Remarks. Lansbury (1972) arranged the Oriental species of *Ranatra* in six groups: *R. gracilis* group, *R. elongata* group, *R. varipes* group, *R. malayana* group, *R. filiformis* group, and *R. biroi* group. Among these, the *R. malayana* group contained only a single species. Lansbury (1972: 294) stated that the descriptions for species groups were mostly for avoiding repetition in describing the same characters in each species of a group. Besides the key to species, Lansbury (1972) did not provide any discussion on comparative morphology across different groups.

Our comparative morphological study of most known species of *Ranatra* from India to Australia has shown that some characters used in the species group descriptions by Lansbury (1972) are useful for group discrimination, but more often they must be used in combination. These characters include the modification of vertex, the structure of fore femur, the shape of the posterior margin of metasternum, and the relative lengths of the operculum and connexivum of females. The relative lengths of the respiratory siphon and body, and the general form of paramere, are useful additional characters for recognising some species groups (i.e., *R. gracilis*, *R. elongata*, and *R. malayana* groups), but should be used in combination with the other characters listed above. Some additional characters in Lansbury's (1972) group descriptions are not really helpful in defining these groups, e.g., relative heights of lorum and clypeus, relative widths of eye and interocular space, relative length of prothorax and fore coxa, relative length of prothorax and fore femur, the process of second antennal segment, and the relative distances between middle and hind coxae. These characters have turned out to be variable among species of the same group and to overlap across different groups.

Among the six species groups defined by Lansbury (1972), the *R. gracilis*, *R. elongata*, and *R. malayana* groups can be easily recognised as stated in the diagnoses below. In contrast, the distinctions among the remaining groups are not obvious, as there are just few characters separating them. Species of the *R. varipes* group, however, can be separated from *R. filiformis* and *R. biroi* groups by having a relatively shorter anterior lobe of the pronotum, ca. 1.1–1.4× the length of the posterior lobe (in *R. filiformis* group: 1.3–1.7×; in *R. biroi* group 1.3–1.8×), in combination with a broader fore femur with its larger tooth situated equidistant between its two ends (in *R. filiformis* and *R. biroi* groups, fore femur is more slender and its larger ventral tooth is nearer to distal end). Between the *R. filiformis* and *R. biroi* groups, according to descriptions by Lansbury (1972), the only difference is the relative widths of the eye and interocular space. In the *R. filiformis* group, the eye width is clearly less than the interocular width, while in the *R. biroi* group, the eye width is about equal to or greater than the interocular width (with the exception of *R. nieseri*, where the ratio of eye width : interocular width is variable, ranging between 0.9–1.1). It is not very convincing to separate two groups based on such a single character. However, until further evidence, especially molecular data, become available, it is still premature to decide whether taxa of both *R. filiformis* and *R. biroi* groups belong to the same monophyletic group.

We also propose a new group, namely the *R. bilobata* group, to include three species described after Lansbury's (1972) revision: *R. sulawesii* Nieser & Chen, 1991, *R. sterea* Chen, Nieser & Ho, 2004, and *R. bilobata* Tran & Nguyen, 2016. They share some similarities, as stated in the diagnosis below, and do not fall into any of Lansbury's (1972) groups.

Pending further phylogenetic analysis, using both morphological and molecular character systems, to confirm the monophyly of each group, the group classification is still provisional, and it should only be used for the practical purpose of facilitating identification.

Below are diagnoses of the species groups, lists of species held in each group, and a key to the species groups.

Ranatra gracilis group sensu Lansbury, 1972

Diagnosis. Body length: males 25–38, females 29–43; siphon relatively short, ratio of siphon length : body length around 0.2–0.7; vertex in lateral view clearly higher than eye, with prominent tubercle; flexor side of fore femur bearing one broad tooth at distal 0.4–0.5 and a carina just proximal of tooth, a pair of pre-apical teeth on flexor side usually present (except *R. parmata*, *R. gracilis*, *R. lansburyi*, and *R. schuhi*); posterior margin of metasternum distinctly emarginated and usually with a pair of sublateral grooves; operculum of female clearly surpassing connexivum, about 0.3 the length of operculum; male paramere with thick process on ventral side before hook, apical hook usually long.

Species included. *Ranatra gracilis* Dallas, 1850, *R. parmata* Mayr, 1865, *R. stali* Montandon, 1905, *R. distanti* Montandon, 1910a, *R. spinifrons* Montandon, 1910b, *R. odontomeros* Nieser, 1996, *R. lansburyi* Chen, Nieser & Ho, 2004, *R. schuhi* D. Polhemus & J. Polhemus, 2012, *R. heoki* Tran & Poggi, 2019, *R. bisaya*, new species, *R. bendanilloi*, new species, *R. brevicauda*, new species, and *R. pangantihoni*, new species.

Ranatra bilobata group

Diagnosis. Body length: males 34–38, females 32–40; siphon long, ratio of siphon length : body length ca. 0.9–1.1; vertex in lateral view slightly higher than eye, evenly round, tubercle small or absent; process of second antennal segment very long, about equal to third segment; flexor side of fore femur with only one tooth at midlength, without carina, pre-apical teeth absent or only with tooth-like elevation (*R. bilobata*); metasternum with posterior margin deeply emarginated, usually with a pair of sublateral tumescences (except *R. sulawesii*); operculum of female not reaching apex of connexivum; male paramere with finger-like pre-apical process before hook, apical hook with pointed tip.

Species included. *Ranatra sulawesii* Nieser & Chen, 1991, *R. sterea* Chen, Nieser & Ho, 2004, and *R. bilobata* Tran & Nguyen, 2016.

Note. For comparison between these three species, see Tran & Nguyen (2016).

Ranatra elongata group sensu Lansbury, 1972

Diagnosis. Large species, body length: males 37–48, females 39–53; siphon long, ratio of siphon length : body length around 0.7–1.3; vertex in lateral view clearly lower than eye, without tubercle; flexor side of fore femur with a long and narrow tooth at distal 0.3–0.4 and a carina proximal to tooth, a pair of pre-apical teeth usually present (except *R. dispar* and *R. feana*); posterior part of metasternum medially raised, with posterior margin convex; operculum of female clearly surpassing connexivum; connexivum of female produced posteriorly; male paramere with thick process on ventral side before hook, apical hook short and thick.

Species included. *Ranatra chinensis* Mayr, 1865, *R. elongata* Fabricius, 1790, *R. dispar* Montandon, 1903a, *R. feana* Montandon, 1903b, and *R. megalops* Lansbury, 1972.

Note. For comparison between species and also key to species of this group, see Lansbury (1972).

Ranatra malayana group sensu Lansbury, 1972

Diagnosis. Body length: males 26–31, females 30–33; siphon long, ratio of siphon length : body length around 1.0–1.1; vertex in lateral view higher than eye, evenly round, without tubercle; flexor side of fore femur with two teeth at distal 0.4, one much larger than the other, pre-apical teeth absent; metasternum with posterior margin straight or convex; operculum of female at most reaching apex of connexivum; male paramere with pre-apical pointed tooth before hook, apical hook short with blunt tip.

Species included. *Ranatra malayana* Lundblad, 1933 and *R. katsara* Nieser, 1997.

Note. For the difference between these two species, see Nieser (1997).

Ranatra varipes group sensu Lansbury, 1972

Diagnosis. Body length: males 20–32, females 20–34; siphon relatively short, ratio of siphon length : body length around 0.6–0.8; vertex in lateral view higher than eye, evenly round, without tubercle; ratio of anterior pronotal length : posterior pronotal length 1.1–1.4; fore femur relatively broad, flexor side with two teeth, a larger tooth at the middle and a smaller tooth at distal 0.4, pre-apical teeth absent; metasternum with posterior margin convex; operculum of female at most reaching apex of connexivum; male paramere without pre-apical process before hook, apical hook either long and slender (*R. unicolor*, *R. falloui*) or short and truncate (*R. varipes*).

Species included. *Ranatra varipes* Stål, 1861, *R. unicolor* Scott, 1874, and *R. falloui* Montandon, 1907.

Note. For comparison between species and also key to species of this group, see Lansbury (1972).

Ranatra filiformis group sensu Lansbury, 1972

Diagnosis. Smaller species, body length: males 22–27, females 24–30; siphon moderate to long, ratio of siphon length : body length around 0.7–0.9; vertex in lateral view higher than eye, evenly round, without or with very low tubercle; ratio of eye width : interocular width 0.65–0.98; ratio of anterior pronotal length : posterior pronotal length 1.3–1.7; fore femur slender, flexor side with two teeth nearer to distal end, larger one proximal to smaller one, pre-apical teeth absent; metasternum with posterior margin usually convex (sometimes straight or slightly emarginated); operculum of female at most reaching apex of connexivum.

Species included. *Ranatra filiformis* Fabricius, 1790, *R. diminuta* Montandon, 1907, *R. occidentalis* Lansbury, 1972, and *R. akoitachta* Nieser, 1996.

Note. For comparison between species of this group, see Lansbury (1972) and Nieser (1996).

Ranatra biroi group sensu Lansbury, 1972

Diagnosis. Smaller species, body length: males 19–27, females 21–29; siphon moderate to long, ratio of siphon length : body length around 0.6–1.05; vertex in lateral view higher than eye, evenly round, without or with very low tubercle; ratio of eye width : interocular width 0.9–1.3; ratio of anterior pronotal length : posterior pronotal length 1.3–1.8; fore femur slender, flexor side with two teeth nearer to distal end, larger one proximal to smaller one, pre-apical teeth absent; metasternum with posterior margin usually convex (sometimes straight or slightly emarginated); operculum of female at most reaching apex of connexivum.

Species included. *Ranatra longipes* Stål, 1861, *R. biroi* Lundblad, 1933, *R. digitata* Hafiz & Pradhan, 1949, *R. natunaensis* Lansbury, 1972, *R. longipes celebensis* Lansbury, 1972, *R. thai* Lansbury, 1972, *R. flagellata* Lansbury, 1972, *R. libera* Zettel, 1999, *R. incisa* Chen, Nieser & Ho, 2004, *R. recta* Chen, Nieser & Ho, 2004, *R. rafflesi* Tran & D. Polhemus, 2012, *R. nieseri* Tran & Nguyen, 2016, *R. cardamomensis* Zettel, Phauk, Kheam & Freitag, 2017, and at least two undescribed species (Tran & Zettel, in prep.).

Key to species groups of Oriental *Ranatra* Fabricius, 1790

1. Posterior margin of metasternum clearly emarginated 2
– Posterior margin of metasternum convex, or straight or only slightly emarginated 3
2. Vertex with prominent tubercle between eyes; siphon relatively short, ratio of siphon length : body length around 0.2–0.7; fore femur at mid-length of flexor side with one tooth and a carina, or bi-dentate..... *R. gracilis* group
– Vertex with small tubercle or evenly round without tubercle; siphon long, ratio of siphon length : body length around 0.9–1.1; fore femur at mid-length of flexor side with one median tooth, without carina..... *R. bilobata* group
3. Large species, body length at least 37 mm; vertex lower than eye, no tubercle; fore femur at distal 0.3–0.4 of flexor side with one long, narrow tooth; operculum of female clearly surpassing apex of connexivum..... *R. elongata* group
– Smaller species, body length at most 34 mm; vertex higher than eye, with small tubercle or without tubercle; flexor side of fore femur bidentate; operculum of female at most reaching apex of connexivum.....4
4. Flexor side of fore femur with one tooth much larger than the other one; siphon long, at least equal to body length..... .....*R. malayana* group
– Flexor side of fore femur with one tooth slightly larger than the other one; siphon shorter, at most equal to body length... 5
5. Fore femur relatively broad, with larger tooth situated at mid-length of flexor side.....*R. varipes* group
– Fore femur slender, with larger tooth clearly situated nearer to distal end of flexor side 6
6. Eye width clearly less than interocular width..... .....*R. filiformis* group
– Eye width about subequal to or greater than interocular width.....*R. biroi* group

Ranatra gracilis group sensu Lansbury, 1972

Remarks. D. Polhemus & J. Polhemus (2012) provided a key to the species of the *R. gracilis* group, but did not include *R. odontomeros* Nieser, 1996, and *R. spinifrons* Montandon, 1910 within their concept of this group. With an addition of four new species from the Philippines, we now interpret this species group to contain 13 species.

Revised key to species of the *Ranatra gracilis* group

(adopted from Lansbury, 1972; D. Polhemus & J. Polhemus, 2012)

1. Fore femur bidentate near mid-length.....*R. distanti*
– Fore femur near mid-length with only one tooth and a carina 2
2. Posterior part of metasternum with distinct, wide sublateral grooves, posterior margin angularly emarginated; flexor side of fore femur with a pair of pre-apical teeth 3
– Posterior part of metasternum with very narrow or indistinct sublateral grooves, posterior margin roundly emarginated; flexor side of fore femur without pre-apical tooth 10
3. Tubercle on vertex about as high as eye width in lateral view; respiratory siphon about 0.67× body length and at least 1.6× combined length of sterna III–V.....*R. spinifrons*
– Tubercle on vertex distinct, but lower than eye width in lateral view; respiratory siphon shorter, at most 0.55× body length and 1.35× combined length of sterna III–V 4
4. Respiratory siphon about 0.50–0.55× body length; lorum lower than clypeus, dorsal margin round and without nodule.....5
– Respiratory siphon at most about 0.4× body length; lorum higher than clypeus, dorsal margin angular, with distinct nodule 6
5. Respiratory siphon about 1.55× combined length of sterna III–V; clypeus with a small conical tubercle anteriorly; tubercle on vertex about 0.5× height of eye in lateral view; ventral side of paramere with a small sub-triangular process before apical hook ..... *R. heoki*
– Respiratory siphon about 1.30–1.35× combined length of sterna III–V; clypeus without tubercle; tubercle on vertex very low, less than 0.2× height of eye in lateral view; ventral side of paramere with a large triangular process before apical hook (Fig. 9).....*R. odontomeros*

6. Respiratory siphon about 1.0–1.2× combined length of sterna III–V; hind femur of male reaching posterior margin of sternum VI; paramere with distal third distinctly bent downwards (Fig. 2H) ..... *R. stali*
– Respiratory siphon at most 1.0× combined length of sterna III–V; hind femur of male at most reaching about anterior two-thirds of sternum VI; distal third of paramere not bent downwards 7
7. Fore femur more slender, ratio of length : width = 12.0–13.8 (males), 11.3–12.6 (females), at flexor side carina and tooth situated nearer to apex than to the base of femur (on ca. distal 0.4 of femur); hind femur of male reaching half way of sternum VI or beyond 8
– Fore femur more robust, ratio of length : width = 10.4–11.5 (males), 9.8–11.1 (females), at flexor side carina and tooth situated at mid-length of femur; hind femur of male only reaching anterior third of sternum VI..... 9
8. Paramere with apical hook short and stout, tip of hook blunt, pre-apical process short, sub-triangular (Fig. 3G, H); hind femur of female reaching half way of sternum VI..... ..... *R. bisaya*, new species
– Paramere with apical hook long and slender, tip of hook narrowly rounded, pre-apical process longer, acute trapezoidal (Fig. 8); hind femur of female shorter, only to anterior third of sternum V ..... *R. pangantihoni*, new species
9. Paramere: pre-apical process sub-triangular, broader than gap between apical hook and pre-apical process; dorsal margin of paramere almost straight, only slightly concave at same section with ventral pre-apical process (Fig. 4G, I); hemelytra covering half of tergum VI; hind femur of female longer, slightly surpassing posterior margin of sternum VI..... ..... *R. bendanilloi*, new species
– Paramere: pre-apical process acute trapezoidal, narrower than gap between apical hook and pre-apical process; dorsal margin paramere sinuate (degree of sinuosity varying among populations) (Fig. 6); hemelytra shorter, covering anterior third of tergum VI; hind femur of female only reaching posterior margin of sternum V ..... *R. brevicauda*, new species
10. Posterior width of pronotum at least 1.4× anterior width; ventral margin of paramere with a smaller, round pre-apical process; apical hook of paramere long and broadly curved ... *R. schuhi*
– Posterior width of pronotum about 1.20–1.25× anterior width; ventral margin of paramere with a prominent pre-apical process (either bi-lobed or with a single tooth-like elevation); apical hook of paramere shorter 11
11. Ventral margin of paramere with bi-lobed pre-apical process; tip of apical hook truncate ..... *R. lansburyi*
– Pre-apical process on ventral margin of paramere with a small tooth-like elevation; tip of apical hook acute..... 12
12. Prosternum with a longitudinal keel extending from between fore coxae along its entire length; mid-tibia slightly longer than mid-femur; paramere with more open gap between pre-apical process and apical hook ..... *R. gracilis*
– Prosternum with a longitudinal keel distinct only between fore coxae and becoming indistinct posteriorly; mid-tibia shorter than mid-femur; male paramere with very narrow gap between pre-apical process and apical hook, tooth-like elevation of pre-apical process touching inner curve of apical hook..... ..... *R. parmata*

Ranatra distanti Montandon, 1910

Ranatra distanti Montandon, 1910a: 652–653 (type locality: Nicobar Islands). — Lansbury, 1972: 296 (redescription). — J. Polhemus & Starmühlner, 1990: 44 (record Andaman Islands). — D. Polhemus & J. Polhemus, 2012: 247–249 (redescription, description of male).
[no material available]

Diagnosis (based on descriptions by Lansbury, 1972, D. Polhemus & J. Polhemus, 2012). Body length: male 30.5, females 34; ratio of siphon length : body length ca. 0.3; lorum lower than clypeus and without nodule dorsally; ratio of eye width : interocular width ca. 0.6–0.65; pronotal length ca. 1.9× fore coxa length; hemelytra reaching about mid-length of abdominal tergum VI; posterior margin of metasternum angularly emarginated, with sublateral grooves; fore femur ventrally with two median teeth and a pre-apical small tooth; hind femur, when folded back parallel to body at most reaching anterior half of abdominal sternum VI (in males) or about only to posterior margin of sternum V (in females); paramere with narrow, acute trapezoidal process on ventral side before apical hook, hook relatively short, with blunt tip.

Remarks. The holotype of this species is a female specimen from Nicobar Islands. The description of the paramere was provided by D. Polhemus & J. Polhemus (2012), based on specimens collected from the Andaman Islands. The paramere of *R. distanti* is very similar to that of *R. stali*, but *R. distanti* can be easily distinguished from the latter by the medially bi-dentate fore femur.

Distribution. Nicobar Islands, Andaman Islands (Montandon, 1910a; D. Polhemus & J. Polhemus, 2012).

Ranatra stali Montandon, 1905
(Figs. 1A, 2)

Ranatra parmata Stål, 1870: 707 (misidentification).
Ranatra stali Montandon, 1905: 390–391 (type locality: Mindanao, Philippines). — Lansbury, 1972: 296–298 (redescription).

Type material examined. Lectotype (female, NRMS, designated by Lansbury, 1972): “Mindanao.”, “collectio\ Haglund”, “Type.”, “Typus” [red label], “Ranatra\ Ståli Montandon\ Type 1903.” [handwritten, last line in red ink], “480\ 62” [red label, last line handwritten] , “51\ 67” [red label, last line handwritten], “Naturhistoriska\ Rijksmuseet\ Stockholm\ Loan no 251/01”, “14”.

Additional material examined. PHILIPPINES (NHMW, UPLB, USC, ZCW, ZRC): **Mindanao:** 4 males, Bukidnon Province, Malaybalay, Kaamulan Site, 650 m a.s.l.; 2 females, Agusan del Sur Province, San Francisco, Bayogan, Tagkunayai creek, 8°27′24″N, 125°58′12″E, 54 m a.s.l. **Samar:** 4 males, 2 females, Northern Samar Province, Veriato, El Amigo, Veriato Falls; 1 male, Northern Samar Province, San Joaquin, stream near sea; 1 female, Western Samar Province, E Basey, Sohoton NP, creek; 2 males, Western Samar, Basey.

Description of lectotype. Colour uniformly light brown, probably faded by light.

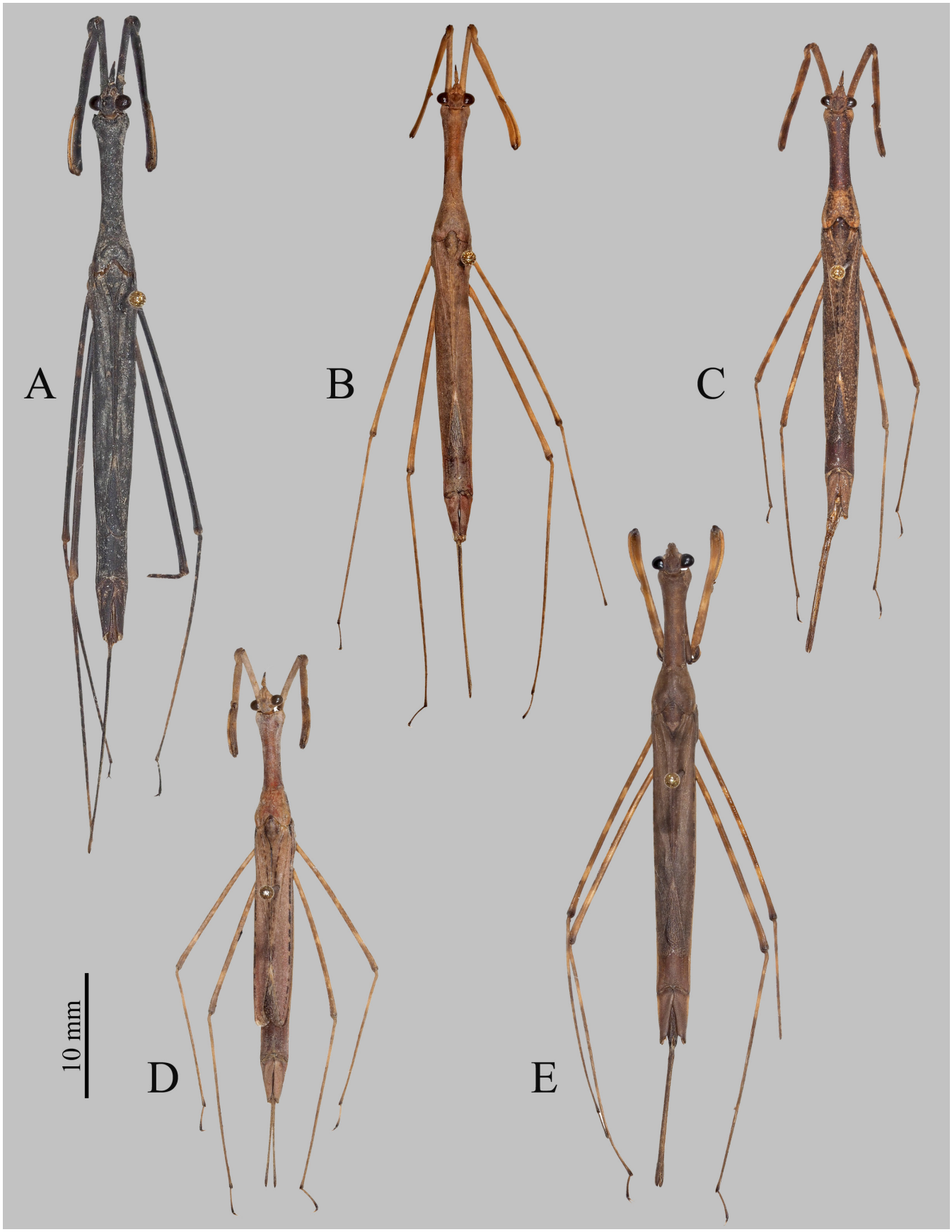

Fig. 1. Habitus of *Ranatra* spp., all males. A, *R. stali* Montandon, 1905; B, *R. bisaya*, new species; C, *R. bendanilloi*, new species; D, *R. brevicauda*, new species; E, *R. pangantihoni*, new species (all of same scale).

Fig. 2. *Ranatra stali* Montandon, 1905, male. A, antenna; B, C, head and prothorax, lateral and dorsal views; D, E, fore femur, lateral and mesal views; F, metasternum; G, operculum; H, paramere; lateral view; I, apical part of paramere, inner view. (B, C same scale; D, E same scale; F, G same scale, H, I same scale).

Measurements. Body length 39.6; respiratory siphon > 9.0 (apex broken); width of head 3.27; width of eye 1.05; interocular width 1.17; rostral segment 3: 0.72, segment 4: 0.52; anterior width of pronotum 2.75; posterior width of pronotum 3.40; length of pronotum 9.90; length of anterior lobe of pronotum 7.6; length of posterior lobe 3.5. Length of distal part of fore femur 4.0; proximal part of fore femur 6.1. Maximum width of fore femur at basal part 0.94, at median tooth 0.92. Lengths of leg segments: fore leg: coxa 6.7, femur 10.1, tibia 3.9, tarsus 0.8; middle leg: femur 16.8, tibia 15.6, tarsus broken off; hind leg: femur 16.7, tibia 19.6, tarsus 2.4.

Structural characteristics. Clypeus as high as lorum, clypeoloral sulcus shallow; vertex with prominent, high tubercle. Eye slightly narrower than interocular space. Anterior collar of pronotum raised to paired tubercles. Anterior lobe of pronotum 2.2× as long as posterior lobe, sublateral swellings caudally on pronotum distinct. Mesoscutellum 1.9× as long as broad, dorsal surface smooth, with paired grooves on caudal half. Prosternum with paired broad, shallow longitudinal depressions separated by low and blunt median carina; median carina rather indistinct on posterior half. Mesosternum invisible in lectotype. Metasternum anteromedially depressed, posterior two-thirds with low median carina, posterior margin angularly emarginated, with sublateral grooves. Smallest distance between hind coxae ca. 0.8× distance between middle coxae. Hemelytra posteriorly reaching to anterior third of abdominal tergum VI. Hind femur not reaching operculum. Operculum projecting beyond apex of abdomen.

Measurement of additional specimens. Males: body length 35–38; length of siphon 12.9–15.9; width of head 3.00–3.41; interocular width 1.04–1.27; width of eye 0.97–1.07; pronotal length 9.12, anterior pronotal length 7.3; posterior pronotal length 3.0; anterior width of pronotum 2.49; posterior width of pronotum 2.91. Females: body length 39–43; length of siphon 14.1–15.2.

Diagnosis. Body length: males 35–38, females 39–43; ratio of siphon length : body length ca. 0.35–0.42; lorum higher than clypeus and with a nodule dorsally; ratio of eye width : interocular width ca. 0.84–1.00; pronotal length ca. 1.34–1.52× fore coxa length; hemelytra reaching about anterior third of abdominal tergum VI; posterior margin of metasternum angularly emarginated, with sublateral grooves (Fig. 2F); flexor side of fore femur with a tooth and a carina at ca. 0.4 distal part, pre-apical part with a pair of small teeth on either side of flexor side (Fig. 2D, E); hind femur, when folded back parallel to body at most reaching posterior margin of abdominal sternum VI (in males) or just surpassing mid-length of sternum VI (in females). Male paramere: thickest at basal third, constricted at ca. distal third, distal third bent downwards; ventral margin gradually tapering from middle part towards the constricted part, then followed by a small, obtuse, trapezoidal process bearing tuft of setae; from inner view, pre-apical process appearing sub-rectangular due to a small round projection shorter than tuft of setae; apical hook thick, curved with rounded tip; gap between hook and pre-apical hook narrow (Fig. 2H, I).

Remarks. Montandon (1905) noted that the "*Ranatra parmata*" from the Philippines reported by Stål (1870) was actually a new species and described it as *Ranatra stali*. He also included two specimens from Borneo and from Moluccas as *Ranatra stali*, but subsequently, he separated those as another taxon, *Ranatra spinifrons* (see Montandon, 1910b, 1914, also see Tran & Poggi, 2019 for further discussion).

The identity of *Ranatra stali* was fixed by Lansbury (1972), who designated a female syntype from Mindanao as the lectotype and described it (the interpretation of *R. stali* is based on this specimen; see description above and Figs. 1A, 2). Lansbury (1972) also included and treated specimens from Zamboanga (western Mindanao), Leyte, and northern Luzon (Mountain Province) as conspecific to *R stali*. Subsequently, J. Polhemus & Reisen (1976) also reported *R. stali* from Luzon, but based on only nymphs. After comparative study of numerous specimens from various major islands of the Philippines, we recognise five distinct and related species. One is *Ranatra stali*, with its distribution restricted to the biogeographic subregion of Greater Mindanao (records from Mindanao and Samar). The other four are new to science. Based on extensive samples from major islands of the Philippines, we conclude that the specimens from Luzon studied by Lansbury (1972) and Polhemus & Reisen (1976) were not *R. stali*, but a new species.

Lansbury (1972) noted that *R. stali* was rarely represented in collections. The main reason seems to be that in earlier times more attention was paid to collecting in stagnant water bodies than in streams. However, all species of the *R. stali* complex live at the edges of lentic sections of running waters. Rarely, specimens are also found in pools of intermittent streams, too. Shaded habitats are generally preferred. Often specimens sit hidden at undercuts of banks or between the roots of trees hanging into the water (Zettel, pers. obs.).

For further comparative notes, see Remarks under *R. pangantihoni*, new species.

Distribution. Philippines: Greater Mindanao Region: Mindanao and Samar. Lansbury's (1972) record from Leyte needs verification.

Ranatra bisaya, new species

(Figs. 1B, 3)

Material examined. Holotype (male): "Philippines: Masbate Isl.\ 3.5 km SE Masbate, Tugbo\ Tugbo River, \ leg. H. Zettel" (PNM). **Paratypes** (NHMW, UPLB, ZCW, ZRC): PHILIPPINES: **Masbate:** 2 males, 1 female, same collection data as holotype; 1 male, 5 females, 3.5 km SE Masbate, Tugbo, Tugbo River. **Ticao:** 2 males, 1 female, Monreal, Real, Matang, Tubig Spring; 1 female, W San Fernando, Mag-Kaipit Spring. **Guimaras:** 1 male, Jordan, San Miguel, Mococo Falls.

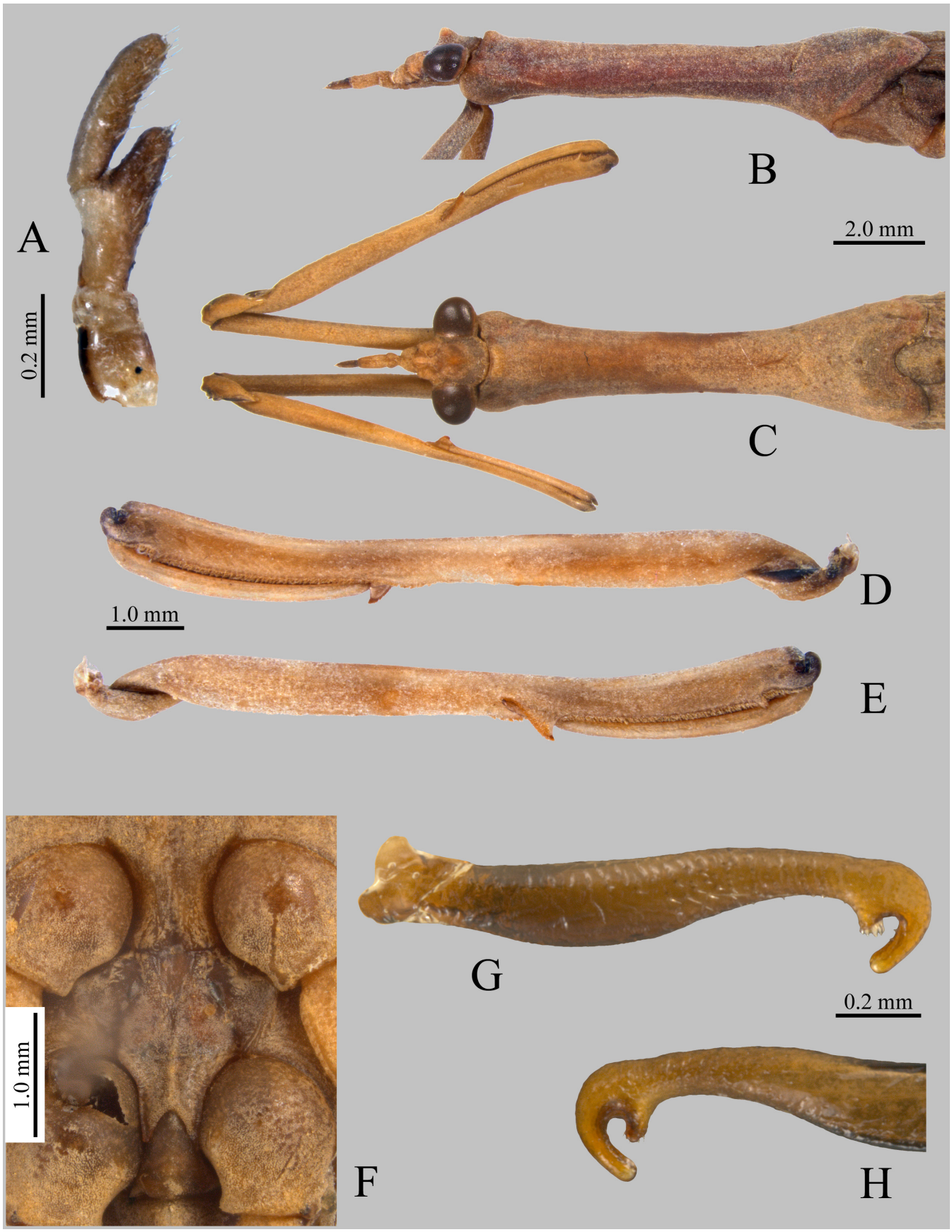

Fig. 3. *Ranatra bisaya*, new species, male. A, antenna. B, C; head and prothorax, lateral and dorsal views; D, E, fore femur, lateral and mesal views; F, metasternum; G, paramere, lateral view; H, apical part of paramere, inner view. (B, C same scale; D, E same scale; G, H same scale).

Description. General colouration: mostly light brown to brown; eyes dark brown; all coxae brown; fore femur light brown to brown; fore tibia and tarsus yellowish, tip of tarsus brown; middle and hind femora and tibiae weakly annulated brown and yellow; apices of middle and hind tibiae, middle and hind tarsi dark brown. Hemelytra brown, uniformly textured.

Measurements. Males: body length 33–35 (holotype: 34); length of siphon 10.9–12.6 (holotype: 12.3); width of head 2.84–2.97 (holotype: 2.91); interocular width 1.04–1.07 (holotype: 1.05); width of eye 0.89–0.96 (holotype: 0.93); pronotal length 9.35, anterior pronotal length 7.5; posterior pronotal length 3.2; anterior width of pronotum 2.31; posterior width of pronotum 2.91; lengths of leg segments: fore leg: coxa 6.00, femur 9.66, tibia 3.50, tarsus 0.75; middle leg: femur 14.2, tibia 14.5, tarsus 2.02; hind leg: femur 14.5, tibia 17.8, tarsus 2.12.

Females: body length 39.0; length of siphon 12.4–12.8; width of head 3.12–3.18; interocular width 1.10–1.13; width of eye 1.01–1.03; pronotal length 10.1, anterior pronotal length 8.0; posterior pronotal length 3.5; anterior width of pronotum 2.49; posterior width of pronotum 3.07; lengths of leg segments: fore leg: coxa 6.42, femur 10.09, tibia 3.67, tarsus 0.8; middle leg: femur 15.3, tibia 14.6, tarsus 2.18; hind leg: femur 15.2, tibia 17.7, tarsus 2.28.

Head (Fig. 3B, C): Vertex raised above eyes with an acute tubercle, narrow in dorsal view; width of eye clearly less than interocular width; clypeus smooth and convex, in lateral view about as high as lora and slightly surpassing lora anteriorly; lora swollen, with a small, but distinct dorsal nodule, bearing sparse, long, pale setae along dorsal side, similar setae also on vertex. Antenna (Fig. 3A): finger-like projection of second antennal segment about 0.4× the length of third segment.

Thorax (in both sexes): Prothorax distinctly longer than fore coxa (about 1.5× the length of fore coxa) and subequal to or slightly shorter than fore femur (0.96–1.01× the length of fore femur); anterior lobe about 2.1–2.4× as long as posterior lobe; anterior collar of pronotum distinctly raised and bituberculate; ratio of posterior width / anterior width 1.18–1.26; posterior lobe with humeri broadly rounded, on each sublateral side with two swellings separated by a longitudinal groove (Fig. 3B, C). Scutellum with length ca. 1.91–2.19× width, usually swollen at midpoint, then transversely depressed before posterior third, apex pointed. Prosternum with paired broad, shallow longitudinal depressions separated by low and blunt median carina; median carina rather indistinct on posterior half. Mesosternum with pair of low tubercles on anterior margin, posterior half with distinct longitudinal groove. Metasternum with anterior part grooved along midline, posterior part distinctly raised along midline and grooved sublaterally; posterior margin angularly emarginated (Fig. 3F). Space between middle coxae subequal to or slightly greater than that between hind coxae. Hemelytra: membrane reaching about mid-length of abdominal tergum VI.

Legs: Fore femur (Fig. 3D, E): in both sexes relatively slender (ratio of length / maximum width of femur: 11.3–12.8, holotype 12.4), widest at basal part, ratio of maximum width at basal part / maximum width at distal part in males: 1.22–1.31 (holotype 1.25), in females: 1.31–1.41; flexor side with a carina at ca. 0.4 distal part of femur, bearing dense short setae and a tooth on mesal (= anterior) surface situated distally of carina; distal part with a pair of small teeth on either side of flexor side, proximal to sinuous pre-apical ventral margin, distal teeth clearly longer than surrounding setae on flexor side of femur (more prominent in females); ratio of width of femur across median tooth (excluding tuft of setae) / width of femur at basal part: 1.00–1.08 (holotype 1.05); ratio of width of femur across median carina (excluding setae) / width of femur at basal part: 0.72–0.86 (holotype: 0.83). Middle femur slightly shorter than hind femur. Hind femur, when folded back parallel to body at most reaching posterior third of abdominal sternum VI (in males) or about middle of sternum VI (in females). Middle tibia in males, slightly longer than middle femur, in females slightly shorter than middle femur; hind tibia in both sexes longer than hind femur; middle and hind tibiae both bearing dense fringes of long hairs on posterior margins along their distal two-thirds.

Abdomen: Operculum of male slightly shorter than connexivum, medially keeled, apex pointed. Sternum VI of female with median keel distinctly raised at posterior half. Operculum of female clearly longer than connexivum, surpassing the apex of connexivum of about a quarter to a third the length of operculum. Respiratory siphon about equal to or slightly shorter (0.91–1.03×) than the length of sterna III–V combined, with sparse long, thin hairs along its length, denser towards apical end of siphon.

Male genitalia: Paramere (Fig. 3G, H): thickest at basal half, constricted at ca. distal third; ventral margin gradually tapering from middle part towards the constricted part, then followed by a small, sub-triangular process bearing tuft of setae; from inner view, pre-apical process appearing sub-rectangular due to a small round projection shorter than the tuft of setae; apical hook short and stout, nearly straight with rounded tip; dorsal surface of paramere slightly convex at distal third. Phallotheca strongly sclerotised.

Etymology. The epithet "bisaya" means "inhabitant of the Visayas" in the Visayan language; it is a noun in apposition.

Remarks. The general shape and structures of this new species are relatively similar to those of *R. stali*, particularly the apex of the paramere, including its pre-apical tooth and apical hook. However, detailed studies on the structures of the paramere show distinct differences. In *R. stali*, the paramere is dorso-ventrally thicker, with the dorsal margin straight basally, the distal part curved more downwards, and with a narrower gap between the apical hook and pre-apical process. In *R. bisaya*, new species, the paramere is more slender, with the dorsal margin slightly more sinuate on the basal two-thirds, and with the distal part nearly straight.

Other structural differences between *R. bisaya*, new species, and *R. stali* are as follows. The respiratory siphon of *R. bisaya* is slightly shorter, at most 1.0× combined length of sterna III–V (1.0–1.2× in *R. stali*). *Ranatra bisaya* has greater relative lengths of the pronotal length vs. fore coxa length (1.56–1.57 in *R. bisaya*, new species; 1.34–1.52 in *R. stali*). In *R. bisaya*, the hind femur of the male is at most reaching two-thirds of the distance along sternum VI (in *R. stali*, the hind femur of the male reaches to the posterior margin of sternum VI). *Ranatra bisaya* has longer hemelytra, reaching to about middle of abdominal tergum VI, while those of *R. stali* only reach to the anterior third of tergum VI. In addition, the fore femur of *R. bisaya* is slightly more robust than that of *R. stali*, with the ratio of fore femur length to width being about 12.1–12.8 (in males), 11.3–11.6 (in females) in *R. bisaya* (in *R. stali*: 12.7–13.3 in males, 11.4–12.2 in females).

For further comparative notes, see Remarks under *R. pangantihoni*, new species.

Distribution. Philippines: Greater Visayas region: Masbate, Ticao, Guimaras.

***Ranatra bendanilloi*, new species**
(Figs. 1C, 4)

Material examined. Holotype (male): "Philippines: Negros Or.\ Valencia, Apolong,\ Banica River\ leg. Fidel Bendanillo" (USC). **Paratypes** (NHMW, UPLB, USC, ZCW, ZRC): PHILIPPINES: **Negros:** Negros Oriental Province, 1 male, same collection data as holotype; 5 males, 5 females, Negros Oriental Province, Valencia, Apolong, Banica River. **Masbate:** 6 males, 4 females, Masbate Island, 3.5 km SE Masbate, Tugbo, Tugbo River.

Description. General colouration: mostly light brown to brown; eyes dark brown; all coxae brown; all femora and tibiae usually distinctly annulated brown and yellow; fore tarsus mostly yellowish with dark brown apex; apices of middle and hind tibiae, middle and hind tarsi dark brown. Hemelytra mostly light coloured, usually with mottled greyish corium.

Measurements. Males: body length 31–32 (holotype: 32); length of siphon 8.7–9.3 (holotype: 9.0); width of head 2.65–2.73 (holotype: 2.71); interocular width 1.09–1.13 (holotype: 1.12); width of eye 0.76–0.81 (holotype: 0.79); pronotal length 7.8, anterior pronotal length 5.9; posterior pronotal length 3.3; anterior width of pronotum 2.30; posterior width of pronotum 2.98; lengths of leg segments: fore leg: coxa 4.8, femur 8.23, tibia 3.58, tarsus 0.75; middle leg: femur 11.2, tibia 10.0, tarsus 1.42; hind leg: femur 11.5, tibia 12.7, tarsus 1.84.

Females: body length 32–38; length of siphon 8.4–9.3; width of head 2.68–3.04; interocular width 1.10–1.22; width of eye 0.79–0.92; pronotal length 8.06, anterior pronotal length 6.1; posterior pronotal length 3.5; anterior width of pronotum 2.48; posterior width of pronotum 3.2; lengths of leg segments: fore leg: coxa 5.25, femur 8.61, tibia 3.67, tarsus 0.76; middle leg: femur 11.7, tibia 10.25, tarsus 1.81; hind leg: femur 12.0, tibia 13.3, tarsus 2.02.

Head (Fig. 4B, C): Vertex above eyes with an obtuse tubercle, narrow in dorsal view; width of eye clearly less than interocular width; clypeus smooth and convex, in lateral view about as high as or slightly higher than lora and slightly surpassing lora anteriorly; lora swollen, with a small, but distinct dorsal nodule, usually bearing few sparse, long, pale setae along dorsal side. Antenna (Fig. 4A): finger-like projection of second antennal segment very short, about 0.2× the length of third segment.

Thorax: Prothorax in lateral view distinctly longer than fore coxa (about 1.5–1.6× the length of fore coxa) and subequal to or slightly shorter than fore femur (0.92–0.99× the length of fore femur); anterior lobe about 1.7–1.9× as long as posterior lobe; anterior collar of pronotum distinctly raised when viewed laterally; ratio of posterior width / anterior width 1.25–1.36; posterior lobe with humeri broadly rounded, on each sublateral side with two swellings separated by a longitudinal groove (Fig. 4B, C). Scutellum with length ca. 1.8–2.1× width, usually swollen at midpoint followed by a transverse depression before posterior third, apex pointed. Prosternum with paired broad, shallow longitudinal depressions separated by low and blunt median carina; median carina rather indistinct in posterior half. Mesosternum with slightly raised anterolateral margin, posterior projection between middle coxae truncate, weakly grooved along midline. Metasternum with anterior part grooved along midline, posterior part distinctly raised along midline and grooved sublaterally, posterior margin angularly emarginated (Fig. 4F). Space between middle coxae about same as or slightly greater than that between hind coxae. Hemelytra: membrane only reaching mid-length of abdominal tergum VI.

Legs: Fore femur (Fig. 4D, E): in both sexes relatively thick (ratio of length / maximum width of femur: 9.8–11.0, holotype 10.4), widest at basal part, distal part nearly as wide as basal part, ratio in males: 1.13–1.17 (holotype 1.17), in females: 1.13–1.19; flexor side with a median carina bearing dense, short setae and a tooth on mesal (anterior) surface situated distally to median carina; distal part with a pair of small teeth on lateral (posterior) surface flexor side, proximal to sinuous pre-apical ventral margin; distal teeth slightly longer than surrounding setae on flexor side of femur (more prominent in female); ratio of width of femur across median tooth (excluding tuft of setae) / width of femur at basal part: 1.07–1.14 (holotype 1.07); ratio of width of femur across median carina (excluding setae, on proximal side of median tooth) / width of femur at basal part: 0.97–1.02 (holotype: 1.00). Middle femur slightly shorter than hind femur; hind femur, when folded back parallel to body only reaching to anterior third of abdominal sternum VI (in males) or slightly surpassing anterior margin of sternum VI (in females). Middle tibia shorter than middle femur; hind tibia longer than hind femur; middle and hind tibiae both bearing dense fringes of long hairs on posterior margins along their distal two-thirds.

Fig. 4. *Ranatra bendanilloi*, new species, male. A, antenna; B, C, head and prothorax, lateral and dorsal views; D, E, fore femur, lateral and mesal views; F, metasternum; G, paramere, lateral view; H, I, apical part of paramere, sub-caudal and inner views. (B, C same scale; D, E same scale; G–I same scale).

Abdomen: Operculum of male slightly shorter than connexivum, medially keeled, apex pointed. Sternum VI of female with median keel distinctly raised on posterior half. Operculum of female clearly longer than connexivum, surpassing the apex of connexivum of about one third the length of operculum. Respiratory siphon clearly shorter (0.70–0.82×) than the length of sterna III–V combined, with sparse long, thin hairs along its length, more on apical part.

Male genitalia: Paramere (Fig. 4G–I): thickest at basal third, constricted at distal quarter; ventral margin gradually tapering from middle part towards the constricted part, then followed by a large sub-triangular process bearing tuft of setae; on inner face, pre-apical process bearing a pointed projection slightly shorter than tuft of setae; apical hook long, slender with narrow, rounded tip; dorsal margin of paramere almost straight, slightly concave at same section with ventral, pre-apical process (ca. at distal fifth). Phallotheca strongly sclerotised.

Etymology. This new species is dedicated to the entomologist and curator Mr. Fidel E. Bendanillo MSc from the University of San Carlos (Cebu City) who collected the holotype.

Remarks. For comparative notes, see Remarks under *R. pangantihoni*, new species.

Distribution. Philippines: Greater Visayas region: Negros and Masbate.

Ranatra brevicauda, new species

(Figs. 1D, 5, 6)

Material examined. Holotype (male): "Philippines: Leyte\ Hilusig, rivers\ leg. H. Zettel" (PNM).

Paratypes (NHMW, UPLB, ViSCA, ZCW, ZRC): PHILIPPINES: **Leyte:** 10 males, 9 females, Leyte Province, same collecting data as holotype; 1 male, Leyte Province, east of Ormoc, Lake Danao; 1 male, 1 female, Leyte Province, Makinhas, river; 2 males, 3 females, Leyte Province, Makinhas, Pacdanganan River; 1 female, Leyte Province, rivers at Hilusig; 3 males, 2 females, Leyte Province, Hilusig, Mahaplag; 1 male, Leyte Province, Baybay, ViSCA, 50 m a.s.l., stream near Forestry; 1 male, Southern Leyte Province, east of Sogod, large stream; 1 male, 2 females, Southern Leyte Province, north of Maasin, small stream east of Lonoy; 1 male, Southern Leyte Province, Amparo, Amparo River near bridge. **Biliran:** 1 female, Biliran Province, Caibiran, road to Naval, Mainit, stream. **Samar:** 2 males, Northern Samar Province, Veriato, El Amigo, Veriato Falls. **Luzon:** 1 male, Sorsogon Province, Ticol, west of Sorsogon City; 10 males, 6 females, Albay Province, 40 km N Legaspi, 1 km W Malilipot, Busai Falls; 1 male, Camarines Sur Province, 20 km east of Naga, 3 km east of Carolina, Mainit Spring (at "Hydro"); 1 male, 1 female, Camarines Sur Province, Lagonoy, 1 km west of San Sebastian, Kinayangan River; 1 female, Camarines Sur Province, Lupi, Sooc, near Bicol NP; 1 male, 1 female, Camarines Sur Province, Lupi, Sooc, creek near dam; 1 female, Camarines Sur Province, Lupi, Sooc.

Description. General colouration: mostly light brown to brown; eyes dark brown; all coxae brown; all femora and tibiae usually distinctly annulated brown and yellow; fore tarsus yellowish brown, darker at apex; apices of middle and hind tibiae, middle and hind tarsi dark brown. Hemelytra uniformly textured, light coloured or brown.

Measurements. Males: body length 29–33 (holotype: 32); length of siphon 7.1–9.7 (holotype: 8.9); width of head 2.53–2.77 (holotype: 2.72); interocular width 0.95–1.07 (holotype: 1.04); width of eye 0.78–0.89 (holotype: 0.84); pronotal length 8.08, anterior pronotal length 6.67; posterior pronotal length 2.92; anterior width of pronotum 2.41; posterior width of pronotum 2.95; lengths of leg segments: fore leg: coxa 5.17, femur 8.33, tibia 3.67, tarsus 0.74; middle leg: femur 11.7, tibia 10.7, tarsus 1.92; hind leg: femur 12.1, tibia 13.4, tarsus 1.87.

Females: body length 35–40; length of siphon 8.3–11.3; width of head 2.64–3.02; interocular width 1.04–1.20; width of eye 0.80–0.97; pronotal length 8.42, anterior pronotal length 6.75; posterior pronotal length 3.33; anterior width of pronotum 2.51; posterior width of pronotum 3.16; lengths of leg segments: fore leg: coxa 5.33, femur 8.83, tibia 3.92, tarsus 0.98; middle leg: femur 12.3, tibia 11.4, tarsus 1.92; hind leg: femur 12.7, tibia 14.25, tarsus 2.12.

Head (Fig. 5B, C): Vertex above eyes with an obtuse tubercle, narrow in dorsal view; width of eye clearly less than interocular width; clypeus smooth and convex, in lateral view slightly lower than lora and slightly surpassing lora anteriorly; lora swollen, with a small, but distinct dorsal nodule, bearing very few sparse, long, pale setae along dorsal side (nodule less distinct in some samples). Antenna (Fig. 5A): finger-like projection of second antennal segment about one third the length of third segment.

Thorax: Prothorax in lateral view distinctly longer than fore coxa (about 1.5–1.7× the length of fore coxa) and about 0.9–1.1× the length of fore femur; anterior lobe about 1.86–2.28× as long as posterior lobe; anterior collar of pronotum distinctly raised and bituberculate; ratio of posterior width / anterior width 1.17–1.29; posterior lobe with humeri broadly rounded, on each sublateral side with two swellings separated by a longitudinal groove (Fig. 5B, C). Scutellum with length ca. 1.83–2.14× width, usually swollen at midpoint followed by a transverse depression before posterior third, apex pointed. Prosternum with paired broad, shallow longitudinal depressions separated by low and blunt median carina; median carina rather indistinct in posterior half. Mesosternum slightly raised on anterolateral margin, posterior projection between middle coxae truncate, weakly grooved along midline. Metasternum with anterior part grooved along midline, posterior part distinctly raised along midline and grooved sublaterally, posterior margin angularly emarginated (Fig. 5F). Space between middle coxae subequal to or slightly greater than that between hind coxae. Hemelytra: membrane only reaching anterior third of abdominal tergum VI.

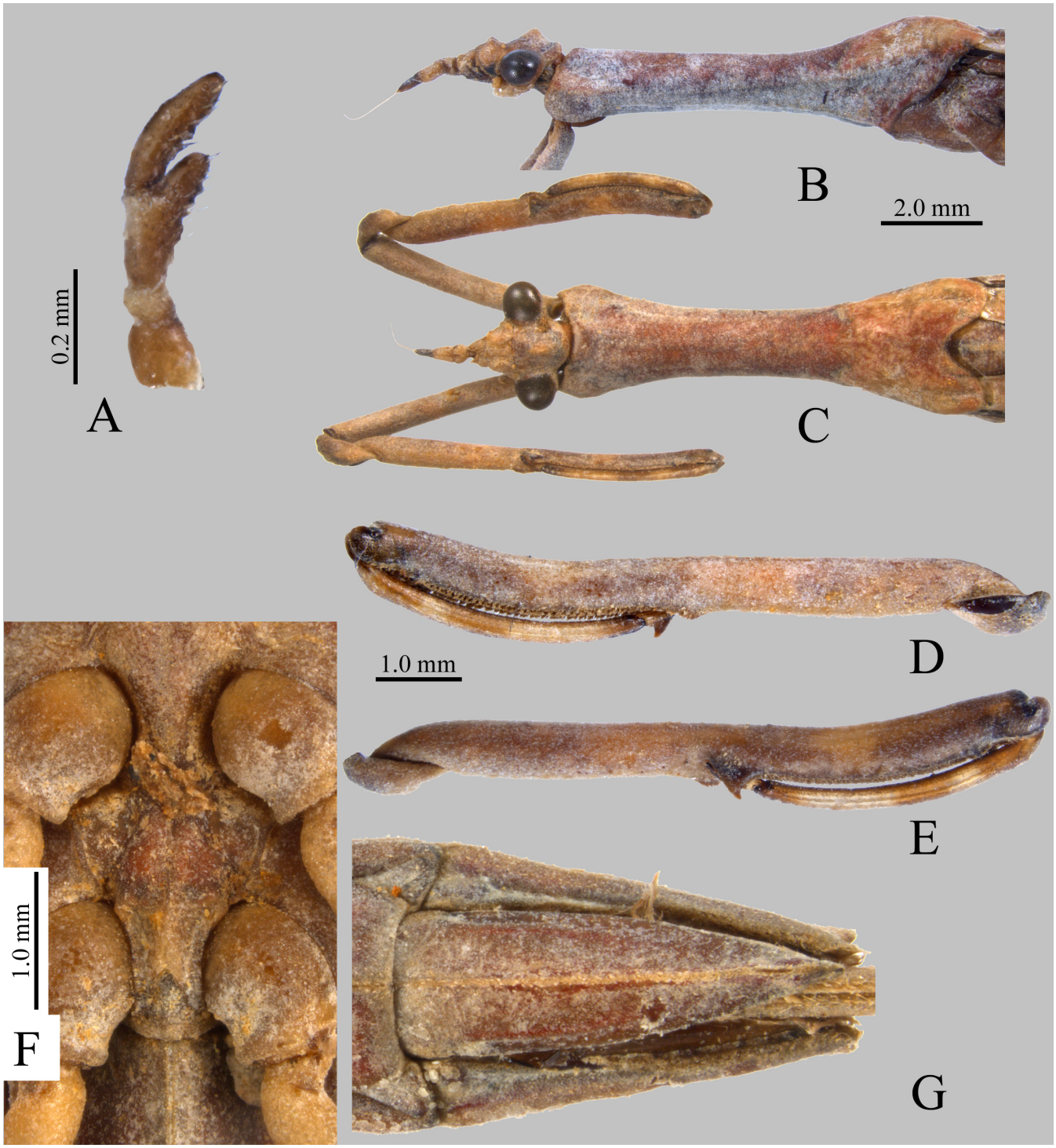

Fig. 5. *Ranatra brevicauda*, new species, male. A, antenna; B, C, head and prothorax, lateral and dorsal views; D, E, fore femur, lateral and mesal views; F, metasternum; G, operculum. (B, C same scale; D, E same scale; F, G same scale).

Legs: Fore femur (Fig. 5D, E): in both sexes relatively thick (ratio of length / maximum width of femur: 9.9–11.5, holotype 10.7), widest at basal part, distal part nearly as wide as basal part, ratio of maximum width at basal part / maximum width at distal part in males: 1.07–1.17 (holotype 1.11), in females: 1.09–1.42; flexor side with a median carina bearing dense short setae and a tooth on mesal (anterior) surface situated distally to median carina; distal part with a pair of small teeth on lateral (posterior) surface of flexor side, proximal to sinuous pre-apical margin; distal teeth slightly longer than surrounding setae on flexor side of femur (more prominent in female); ratio of width of femur across median tooth (excluding tuft of setae) / width of femur at basal part: 0.97–1.16 (holotype 1.05); ratio of width of femur across median carina (excluding setae) / width of femur at basal part: 0.78–1.00 (holotype 0.95). Middle femur slightly shorter than hind femur; hind femur, when folded back parallel to body at most reaching to anterior third of abdominal sternum VI (in males) or at most slightly surpassing posterior margin of sternum V (in females). Middle tibia shorter than middle

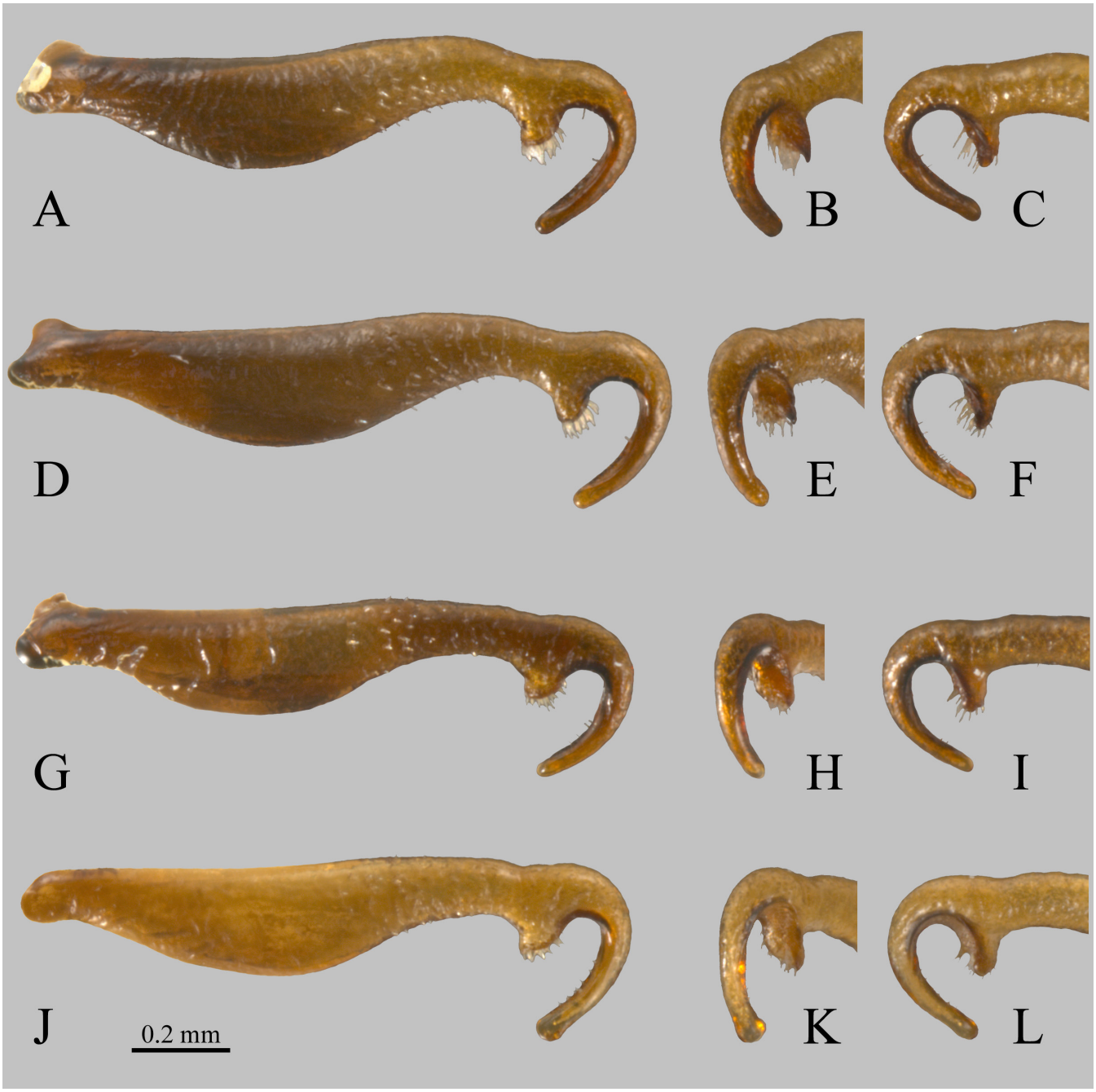

Fig. 6. Parameres of *Ranatra brevicauda*, new species, of specimens from various localities. A–C, from Leyte; D–F, from Samar; G–I, from Sorsogon; J–L, from Albay. A, D, G, J, lateral view; B, E, H, K, apical part, sub-caudal view; C, F, I, L, apical part, inner view (all of same scale).

femur; hind tibia longer than hind femur; middle and hind tibiae both bearing dense fringes of long hairs on posterior margins along their distal two-thirds.

Abdomen: Operculum of male (Fig. 5G) slightly shorter than connexivum, sometimes reaching end of connexivum, medially keeled, apex pointed. Sternum VI of female with median keel distinctly raised at posterior half. Operculum of female clearly longer than connexivum, surpassing the apex of connexivum of about one third the length of operculum. Respiratory siphon clearly shorter (0.65–0.91×) than the length of sterna III–V combined, with sparse long, thin hairs along its length, more on apical part.

Male genitalia: Paramere (Fig. 6): dorso-ventrally strongly thickened at basal third, constricted at distal third; ventral margin gradually tapering from basal third towards the constricted part, then followed by a large, acute trapezoidal process bearing tuft of setae; on inner face, pre-apical process bearing a pointed projection slightly shorter than tuft of setae; apical hook long, slender, broadly curved with narrow, rounded tip; dorsal margin of paramere sinuate, degree of sinuosity varying among populations, from slightly convex to strongly convex at constricted distal section of the paramere (Fig. 6A, D, G, J). Phallotheca strongly sclerotised.

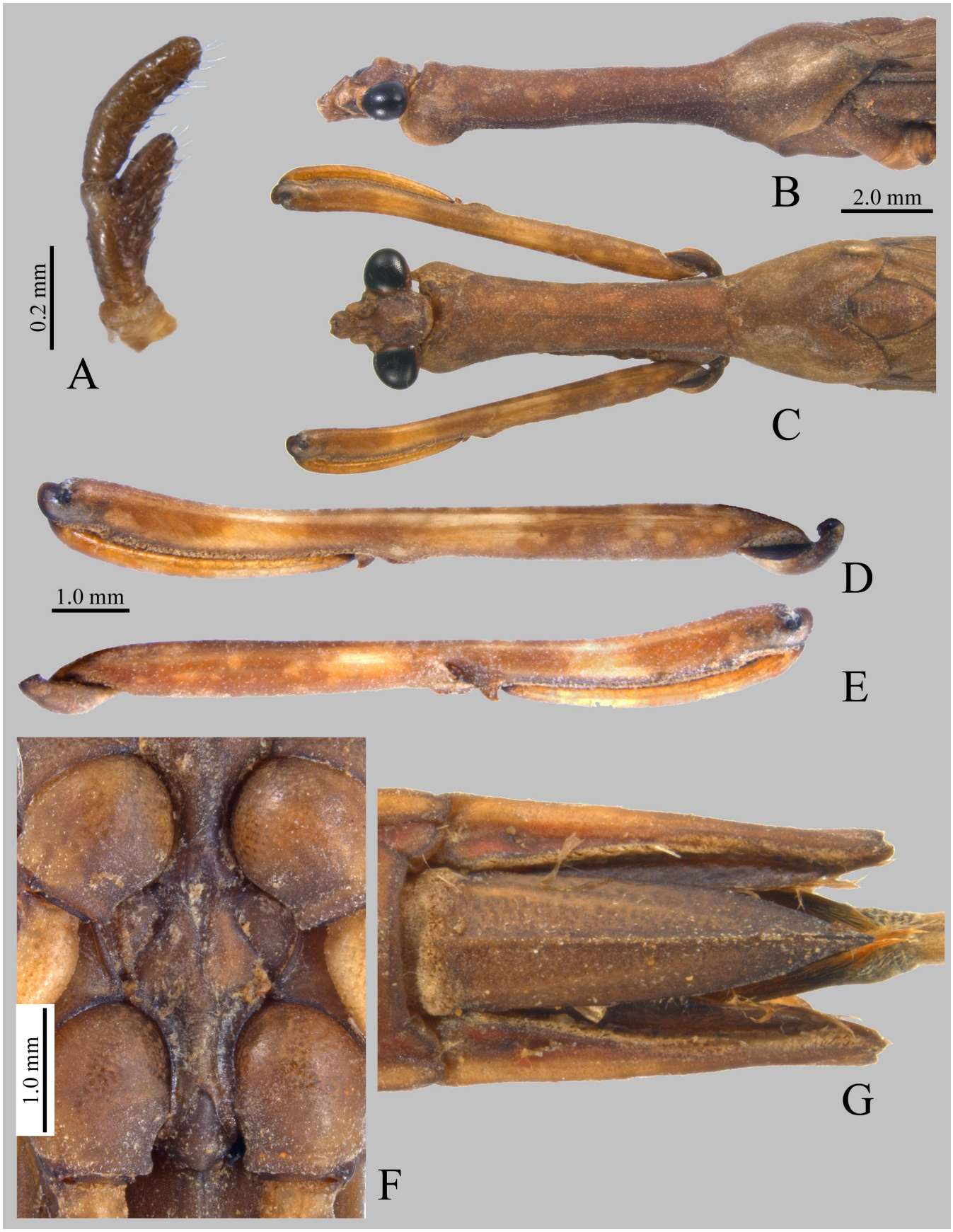

Fig. 7. *Ranatra pangantihoni*, new species, male. A, antenna; B, C, head and prothorax, lateral and dorsal views; D, E, fore femur, lateral and mesal views; F, metasternum; G, operculum. (B, C same scale; D, E same scale; F, G same scale).

Etymology. The species epithet is composed of the Latin adjective *brevis* (= short) and the Latin noun *cauda* (= tail) and refers to the short siphon of this species.

Remarks. The paramere is similar to that of *R. bendanilloi*, new species. See also Remarks under *R. pangantihoni*, new species.

Distribution. Philippines: Greater Mindanao region: Leyte, Biliran, Samar; extending northwards to Greater Luzon region: Southern Luzon (Camarines Sur, Albay, Sorsogon).

***Ranatra pangantihoni*, new species**
(Figs. 1E, 7, 8)

Material examined. Holotype (male): "Philippines: Nueva Viscaya\ Santa Fe, Imugan, stream \ at Imugan Falls, 1000m / leg. H. Zettel" (PNM).

Paratypes (ADMU, NHMW, UPLB, VPGC, ZCW, ZRC): PHILIPPINES: **Luzon:** 4 males, 2 females, Nueva Viscaya Province, same locality data as holotype; 4 males, 3 females, Ilocos Norte Province, Carasi, Cura River; 1 male, 1 female, Ilocos Norte Province, Carasi, Nagoboban Creek, in forest; 4 males, 1 female, Ilocos Norte Province, Solsona, stream below waterfall; 1 male, Ilocos Norte Province, Solsona, Gasgas River; 1 male, La Union Province, Bacnotan, Don Mariano Marcos Memorial State University, NARTDI Falls; 1 male, 3 females, Nueva Viscaya Province, Santa Fe, Malico, Inacio, Inacio River, 1,200 m a.s.l.; 3 males, 1 female, Nueva Viscaya Province, Santa Fe, Malico, Dulipay River; 1 male, Nueva Viscaya Province, Santa Fe, Malico, small creek; 1 male, Nueva Viscaya Province, Imugan, Maliko River; 1 male, Kalinga Province, Balbala, 1 km northwest of Balbalasang, Ibong River, 950 m a.s.l., 17°29′N, 121°02′E; 2 males, 2 females, Isabela Province, San Mariano, Catalangan, River, Digsinan; 3 males, 1 female, Zambales Province, Subic Bay, "Aeta Village"; 1 female, Zambales Province, Olongapo, Subic Base, near Riding Stable; 1 male, Zambales Province, Olongapo, Subic Base, at JEST ("Jungle Survival"); 4 males, 4 females, Laguna Province, Los Baños, Rest Area, creek below Tampalit Falls; 1 male, Laguna Province, Los Baños, Mount Makiling, Flat Stones; 1 female, Languna Province, river at Cavinti, near Pagsanjan; 2 males, 1 female, Laguna Province, Los Baños, Mount Makiling, Molawin Creek at College of Forestry; 4 males, 4 females, Laguna, Mount Makiling at Central Forest Experimental Station, near Thermal Spring; 1 female, Cavite Province, Alfonso, Pajo; 1 male, Batangas Province, Bauan, Santa Maria; 1 male, 1 female, Quezon Province, Pagbilao, Iringan; 1 male, Quezon Province, Atimonan, Quezon NP, Old Zigzag Road. **Marinduque:** 3 females, Marinduque Province, northeast of Boac, 7 km southeast of Mogpog, Bocboc, Paadyan Falls. **Mindoro:** 1 male, 1 female, Oriental Mindoro, Roxas, San Vicente, Quirao, Hinundugan tributary, Quirao na Balete Creek, 12°35′36″N, 121°23′36″E, 230 m a.s.l.; 2 males, Oriental Mindoro, Puerto Galera, Tagbinai Malaki River, small river in secondary vegetation; 13°28′57″N, 120°57′34″E, c. 10 m a.s.l.; 1 female, Oriental Mindoro, Baco, rural road side, residual pools of small intermittent river in secondary vegetation; 13°21′49″N, 121°05′30″E, c. 26 m a.s.l. **Sibuyan:** 4 males, 1 female, Romblon Province, Sibuyan Island, San Fernando, España.

Description. General colouration: mostly light brown to brown; eyes dark brown; all coxae brown; all femora and tibiae usually annulated brown and yellow; fore tarsus yellowish brown, with brown apex; apices of middle and hind tibiae, middle and hind tarsi dark brown. Hemelytra uniformly textured, light coloured or brown.

Measurements: Males: body length 33–38 (holotype: 37); length of siphon 9.3–12.7 (holotype: 11.3); width of head 2.79–3.25 (holotype: 3.25); interocular width 1.02–1.25 (holotype: 1.20); width of eye 0.89–1.03 (holotype: 1.03); pronotal length 9.31, anterior pronotal length 7.10; posterior pronotal length 3.60; anterior width of pronotum 2.47; posterior width of pronotum 3.33; lengths of leg segments: fore leg: coxa 6.60, femur 10.5, tibia 5.33, tarsus 0.84; middle leg: femur 15.4, tibia 15.8, tarsus 2.07; hind leg: femur 15.3, tibia 19.2, tarsus 2.28.

Females: body length 38–43; length of siphon 10.1–13.0; width of head 2.96–3.49; interocular width 1.08–1.29; width of eye 0.94–1.11; pronotal length 9.82, anterior pronotal length 7.50; posterior pronotal length 3.70; anterior width of pronotum 2.69; posterior width of pronotum 3.47; lengths of leg segments: fore leg: coxa 6.70, femur 10.6, tibia 4.17, tarsus 0.91; middle leg: femur 16.6, tibia 16.4, tarsus 2.15; hind leg: femur 16.2, tibia 18.8, tarsus 2.20.

Head (Fig. 7B, C): Vertex above eyes with an obtuse tubercle, narrow in dorsal view; width of eye clearly less than interocular width; clypeus smooth and convex, in lateral view about as high as or slightly higher than lora and slightly surpassing lora anteriorly; lora swollen, with a small, but distinct dorsal nodule, bearing very few sparse, long, pale setae along dorsal side (nodule less distinct in some samples). Antenna (Fig. 7A): finger-like projection of second antennal segment about 0.4× the length of third segment.

Thorax: Prothorax in lateral view distinctly longer than fore coxa (about 1.3–1.5× the length of fore coxa) and about 0.85–1.08× the length of fore femur; anterior lobe about 1.82–2.18× as long as posterior lobe; anterior collar of pronotum distinctly raised and bituberculate; ratio of posterior width / anterior width 1.18–1.42; posterior lobe with humeri broadly rounded, on each sublateral side with two swellings separated by a longitudinal groove (Fig. 7B, C). Scutellum with length ca. 1.81–2.04× width, usually swollen at midpoint followed by a transverse depression before posterior third, apex pointed. Prosternum with paired broad, shallow longitudinal depressions separated by a low and blunt median carina; median carina rather indistinct in posterior half. Mesosternum with slightly raised anterolateral margin, posterior projection between middle coxae truncate, weakly grooved along midline. Metasternum with anterior part grooved along midline, posterior part distinctly raised along midline and grooved sublaterally, posterior margin angularly emarginated (Fig. 7F). Space between middle

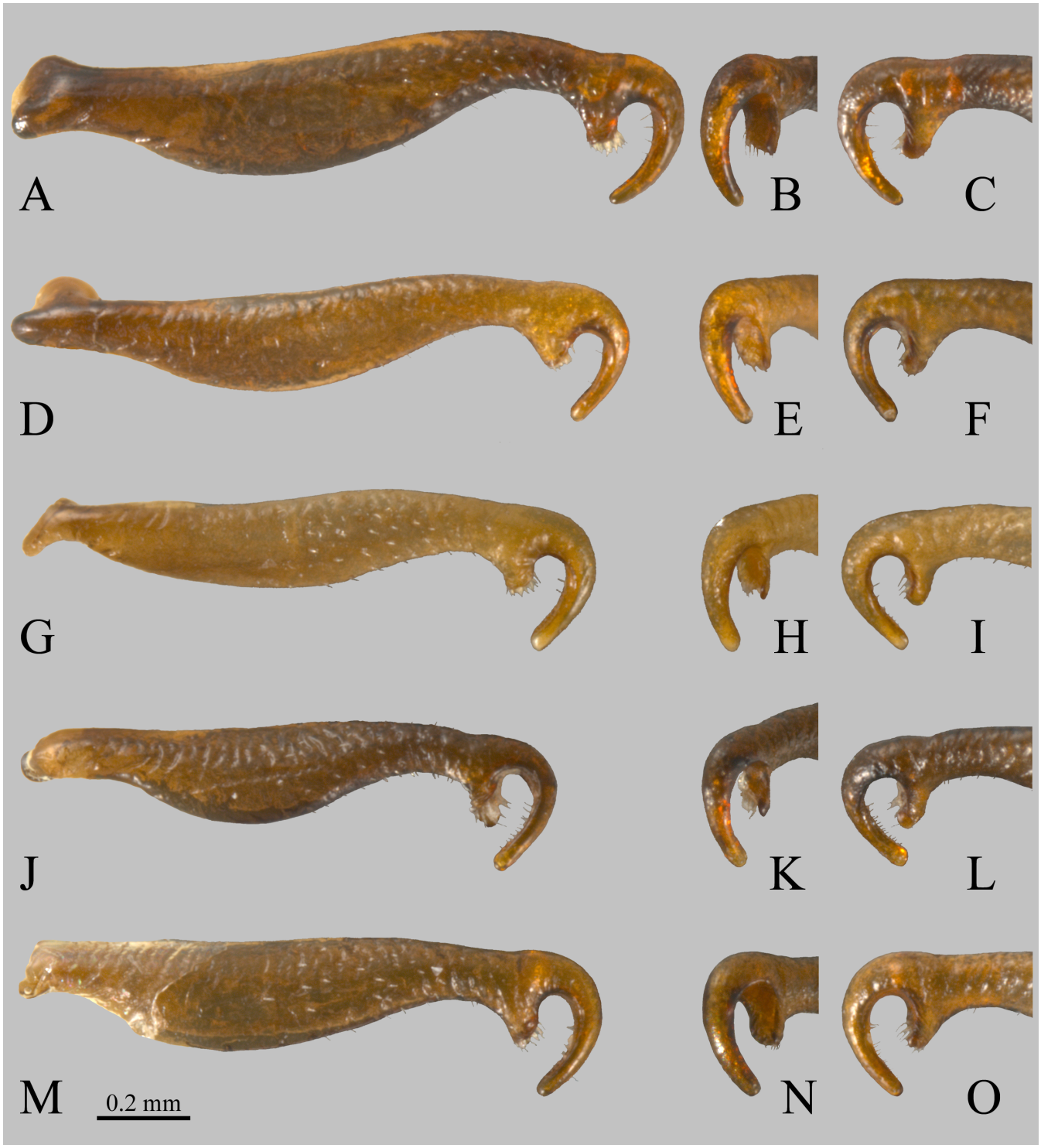

Fig. 8. Parameres of *Ranatra pangantihoni*, new species, of specimens from various localities. A–C, from Nueva Viscaya; D–F, from Ilocos; G–I, from Laguna (Mount Makiling); J–L, from Laguna (Tampalit Falls); M–O, from Romblon. A, D, G, J, M, lateral view; B, E, H, K, N, apical part, sub-caudal view; C, F, I, L, O, apical part, inner view (all of same scale).

coxae subequal to or slightly greater than that between hind coxae. Hemelytra: membrane only reaching anterior third of abdominal tergum VI.

Legs: Fore femur (Fig. 7D, E): in both sexes relatively slender (ratio of length / maximum width of femur: 12.0–13.8, holotype 13.6), widest at basal part, ratio of maximum width at basal part / maximum width at distal part in males: 1.09–1.23 (holotype 1.15), in females: 1.13–1.20; flexor side with a carina at ca. 0.4; distal part of femur bearing dense short setae and a tooth on mesal (anterior) surface situated distally to median carina; distal part with a pair of small teeth on lateral surface of margin, proximal to sinuous pre-apical margin; distal teeth slightly longer than surrounding setae on ventral side of femur (more prominent in females); ratio of width of femur across median tooth (excluding tuft of setae) / width of femur at basal part: 1.00–1.15 (holotype: 1.12); ratio of width of femur across median carina (excluding setae)

/ width of femur at basal part: 0.86–0.92 (holotype: 0.90). Middle femur slightly longer than hind femur; hind femur, when folded back parallel to body reaching to about anterior half of abdominal sternum VI (in males) and reaching about anterior third of sternum VI (in females). Middle tibia in males, slightly longer than middle femur, in females slightly shorter than middle femur; hind tibia in both sexes longer than hind femur; middle and hind tibiae both bearing dense fringes of long hairs on posterior margins along their distal two-thirds.

Abdomen: Operculum of male (Fig. 7G) about equal to connexivum, medially keeled, apex pointed. Sternum VI of female with median keel distinctly raised at posterior half. Operculum of female clearly longer than connexivum, surpassing the apex of connexivum of about one third the length of operculum. Respiratory siphon clearly shorter than or subequal to (0.71–0.98×) the length of sterna III–V combined, with few sparse long, thin hairs along its length.

Male genitalia: Paramere (Fig. 8): dorso-ventrally thickened at basal third, constricted at distal quarter; distal quarter directed downwards; ventral margin gradually tapering from near middle part towards the constricted part, then followed by an acute trapezoidal process bearing tuft of setae; on inner face, pre-apical process bearing a rounded projection slightly shorter than tuft of setae (except in some specimens from Laguna, projection more prominent, see Fig. 8H, I, K, L); apical hook slender with narrow, rounded tip; dorsal margin of paramere nearly straight at basal two-thirds, convex at distal third and slightly concave at same section with pre-apical process (samples from Laguna, Quezon, and Romblon with slight variations in the thicker basal half of paramere, while the curvature of the apical hook and the gap between pre-apical process and apical hook are consistent among populations). Phallotheca strongly sclerotised.

Etymology. This species is dedicated to the entomologist Clister V. Pangantihon from the Ateneo de Manila University who found this species on the island of Mindoro.

Distribution. Philippines: Greater Luzon region: Northern and Central Luzon (Ilocos, Nueva Viscaya, Zambales/Bataan, Laguna, Cavite, Batangas, Quezon), Marinduque; Greater Mindoro region: Mindoro; Sibuyan (region).

Remarks. In the *R. gracilis* group, five species from the Philippines, *R. stali* and the four new species, may form a monophyletic clade as they share nearly identical characteristics in regard to the structure of their thoracic sterna (especially the posterior margin of metasternum), the presence of nodules on the lora, the laterally narrow tubercle on the vertex, the distinctly raised posterior half of sternum VI in the female (in lateral view), and the relatively short siphon (not longer than 0.4× the body length). The comparative character states separating these species are summarised in Table 1.

Ranatra stali can be easily separated from the remaining species of the *R. gracilis* group in the Philippines by having the siphon about equal to or longer than the combined length of sterna III–V, the distal part of paramere clearly curved ventrad, and a narrower space between apical hook and pre-apical process of the paramere.

Among species of the *R. gracilis* group, *R. pangantihoni*, new species, is most similar to *R. bisaya*, new species. Both species have a relatively wide head (ratio of head width to anterior width of pronotum about 1.2–1.3), a more robust fore femur (fore femur length is about equal to or greater than 12.0× width in males, equal to or greater than 11.3× width in females), and an acute trapezoidal pre-apical process ventrally on the paramere. However, the shape of the paramere and its apical hook easily serve to separate these two species.

Ranatra bendanilloi, new species, is most similar to *R. brevicauda*, new species, in having a more slender fore femur (fore femur length is about equal to or less than 11.5× width in males, equal to or less than 11.1× width in females), relatively narrower head (ratio of head width to anterior width of pronotum about 1.1–1.2), and a long, slender apical hook on the paramere. The dorsal margin of the paramere (nearly straight in *R. bendanilloi*, sinuate in *R. brevicauda*), the shape of pre-apical process of the paramere (broader and sub-triangular in *R. bendanilloi*, narrower and acute trapezoidal in *R. brevicauda*) also serve to separate these two species.

The general form of paramere of *R. bendanilloi*, new species, and *R. brevicauda*, new species, somewhat resembles that of *R. spinifrons* from Borneo. However, in both *R. bendanilloi* and *R. brevicauda*, the paramere is strongly constricted at the distal third (while in *R. spinifrons*, it is constricted at distal half) and the apical hook of the paramere is evenly thick throughout its length (in *R. spinifrons*, it is tapering towards its narrowly rounded tip).

There are also substantial differences between *R. spinifrons* and all five Philippine species of the *R. gracilis* group (*R. stali*, *R. bisaya*, *R. bendanilloi*, *R. brevicauda*, and *R. pangantihoni*). *Ranatra spinifrons* has a longer siphon (about two-thirds of body length and clearly longer than the abdomen), a more prominent tubercle on its vertex (its height greater than eye width in lateral view), a simple lorum without a tubercle, and a longer finger-like projection on the second antennal segment (about two-thirds to three quarters of the length of the third antennal segment). In addition, the female of *R. spinifrons* has the midline of sternum VI almost straight in lateral view, and a shorter operculum (surpassing the apex of connexivum of about one fifth the length of operculum). In contrast, *Ranatra stali* and its related species from the Philippines have a much shorter respiratory siphon (clearly shorter than the abdomen, only slightly longer than sterna IV–V combined), a lower tubercle on the vertex (with height about half eye width in lateral view), a more swollen lorum with a small, but distinct dorsal tubercle, and a shorter finger-like projection on the second antennal segment (about 0.2–0.4× the length of the third segment). Female specimens of these five species have the posterior

Table 1. Comparative morphology between the Philippine species of the *Ranatra gracilis* group.

Characteristics	***R. stali***	***R. bisaya*, new species**	***R. bendanilloi*, new species**	***R. brevicauda*, new species**	***R. pangantihoni*, new species**
siphon length : combined length of sterna III–V	1.01–1.20	0.91–1.03	0.70–0.82	0.65–0.91	0.71–0.98
head width : anterior width of pronotum	1.19–1.34	1.24–1.28	1.11–1.21	mostly 1.11–1.24, up to 1.31	1.21–1.32
pronotal length : fore coxa length	1.34–1.52	1.56–1.57	1.56–1.65	1.49–1.69	1.31–1.54
fore femur length : width (male)	12.7–13.3	12.1–12.8	10.4–11.0	10.7–11.5	12.0–13.8
fore femur length : width (female)	11.4–12.2	11.3–11.6	9.8–10.1	9.9–11.1	12.1–12.6
apex of hemelytra	reaching anterior third of tergum VI	reaching middle of tergum VI	reaching middle of tergum VI	reaching anterior third of tergum VI	reaching anterior third of tergum VI
space btw. mid coxae : space btw. hind coxae	ca. 1.25	ca. 1.0 or slightly more	ca. 1.0 or slightly more	ca. 1.0 or slightly more	ca. 1.0 or slightly more
hind femur vs. abdomen (male)	to posterior margin of sternum VI	to posterior third of sternum VI	to anterior third of sternum VI	to anterior third of sternum VI	to mid-length of sternum VI
hind femur vs. abdomen (female)	just beyond mid-length of sternum VI	to mid-length of sternum VI	slightly surpassing anterior margin of sternum VI	slightly surpassing anterior margin of sternum VI	to anterior third sternum VI
paramere	- basal part strongly thickened; - dorsal margin at distal part bent downwards; - pre-apical process small, obtuse trapezoidal; - apical hook short and thick; - gap between process and hook narrow.	- basal part more slender; - dorsal margin nearly straight; - pre-apical process small, sub-triangular; - apical hook short and thick; - gap between process and hook moderately open.	- basal part strongly thickened; - dorsal margin almost straight; - pre-apical process large, sub-triangular; - apical hook long, slender - gap between process and hook wide.	- basal part strongly thickened; - dorsal margin sinuate; - pre-apical process large, acute trapezoidal; - apical hook long, slender; - gap between process and hook wide.	- basal part strongly thickened; - dorsal margin convex distally; - pre-apical process small, acute trapezoidal; - apical hook slender, moderately long; - gap between process and hook moderately wide.

half of sternum VI distinctly raised in lateral view, and a longer operculum (surpassing the apex of connexivum of about one third the length of operculum).

Ranatra spinifrons Montandon, 1910

Ranatra stali Montandon, 1905: 390–391 (in part).
Ranatra stali var. *spinifrons* Montandon, 1910b: 166 (type locality: Sarawak, Borneo).
Ranatra spinifrons Montandon, 1910b. — Montandon, 1914: 124–125 (elevated to species rank). — Lansbury, 1972: 339 (notes). — Tran & Poggi, 2019: 237–241 (lectotype designation, redescription).

Additional material examined. BRUNEI: 2 females (ZRC.6.18816), Belait District, Sg. Sepan (tributary to Sg. Ingei), in Kerangas forest, coll. Tan H.H., 11 May 1996, THH9621; 1 female (NHMW), Belait District, Sungai Ingei, forest pool near Base Camp, 04°09′15″N, 114°43′04″E, coll. Mayyer Ling, 14 June 2010 (34).

Diagnosis. Body length: males 30–33, females 33–36; ratio of siphon length : body length ca. 0.67; siphon index ca. 1.65×; lorum lower and clypeus without nodule dorsally; vertex with very prominent tubercle, height of tubercle about equal to eye size in lateral view; ratio of eye width : interocular width ca 1.1; hemelytra reaching mid-length

of abdominal tergum VI; posterior margin of metasternum angularly emarginated, with sublateral grooves; fore femur on flexor side with a median tooth and a median carina, and with one small pre-apical tooth (in males) or a pair of small pre-apical teeth (in females); hind femur, when folded back parallel to body surpassing anterior half but not reaching posterior margin of abdominal sternum VI (in both sexes); paramere: strongly constricted at distal half before a broadly curved and slender apical hook, apex of hook narrowly rounded, ventral side before apical hook with large, sub-triangular process.

Remarks. The fore femur of males has one small but distinct pre-apical tooth, while that of females has a pair of small pre-apical teeth. This character in female specimens was overlooked in Tran & Poggi (2019). For other comparative notes, see Remarks under *R. pangantihoni*, new species. The syntype of *R. spinifrons* from Ternate and specimens from Peninsular Malaysia identified as *R. spinifrons* by D. Polhemus & J. Polhemus (2012) belong to separate unknown taxa, as already discussed in Tran & Poggi (2019: 241).

Distribution. Borneo: Sarawak and Brunei (Tran & Poggi, 2019).

Ranatra parmata Mayr, 1865

Ranatra parmata Mayr, 1865: 446 (type locality: Java). — Lansbury, 1972: 298–299 (redescription). — D. Polhemus & J. Polhemus, 2013: 33–34 (diagnosis, distribution records).

Type material examined. Holotype (female, NHMW), "Novara Exp / Jawa." (hand-writing label, also with labels showing it was det. by Mayr and det. by Lansbury).

Additional material examined. MYANMAR: 1 female (NHMW), Sagaing Division, Alaungdaw Katthapa National Park, Pagoda Stream, 400 m a.s.l., 22°18′33.6″N, 94°27′40.74″E, coll. D. Boukal et al., 6 May 2003.

THAILAND: 1 male (ZRC), Narathiwat Province, Nam Tok Sipo, downstream, coll. H.H. Tan et al., 24 October 1998, THH9891/LHK407; 1 female (ZRC), Phuket, Nam Tok Kathun, coll. P.K.L. Ng & H.H. Tan, 8 April 1999, THH9917; 1 male, 2 females (NHMW), Sakhon Nakhon Province, Phu Pan N.P., 480–520 m a.s.l., coll. P. Schwendinger, 7–8 December 1995; 2 females (NHMW), Phetchabun Province, 36 km SE Sila, N Ban Nam Nao, Ban Pala Yai, coll. H. Zettel, 25 November 1995; 1 female (NHMW), Phrae Province, 50 km NE Phrae, Huai Kaet, Kaet river, coll. H. Zettel, 17–18 November 1995; 1 male (NHMW), Chiang Mai Province, Chiang Dao, Ban Yang Thung Pong, 500 m a.s.l., coll. H. Zettel, 8 November 1995; 3 males, 1 female (NHMW), Chonburi, Ko Chang, 12°02′N, 102°18′E, coll. F. Seyfert, 26 October–3 November 2002; 4 males, 2 females (NHMW), Khon Kaen Province, Nam Phong N.P., Huai Khae, stream, 250 m a.s.l., coll. H. Zettel & N. Tubtim, 9 January 2009; 1 male (NHMW), Khon Kaen Province, Phu Wiang N.P., Huai Bong, stream, pools, 260 m a.s.l., coll. H. Zettel & N. Tubtim, 11 January 2009; 1 male (NHMW), Khon Kaen Province, Phu Wiang N.P., Tad Fa Waterfall, stream, 540 m a.s.l., coll. H. Zettel & N. Tubtim, 11 January 2009.

MALAYSIA (West): **Kedah:** 1 male, 1 female (NHMW), Central Langkawi, Air Tejun, near Kampung Buku, small stream, coll. H. Zettel, 22 November 2006 [published in Zettel & Tran, 2009]. **Perlis:** 1 male (ZRC), Perlis, Kg. Wang Kelian, Sg. Burma, coll. H.K. Lua, 20 December 2000, LHK0439. **Selangor:** 1 male, 1 female (ZRC), Selangor, Ulu Yam, in stream, coll. T.M. Leong & G. Lim, 20 September 2002; 2 males, 1 female, 1 nymph (ZRC), Selangor, Ulu Gombak, upland pond nr. send bridge, coll. C.M. Yang et al., 16 November 1995, YCM87; 1 male (ZRC), Selangor, Sg. Gombak tributary, Ulu Gombak, coll. H.K. Lua et al., 5 May 1996, LHK0303; 1 male (ZRC), Selangor, Ulu Gombak, coll. H.K. Lua et al., 6 May 1996, LHK0304.

MALAYSIA (East): **Sarawak:** 1 male, 1 female (ZRC), Sarawak, Ulu Katibas, coll. Y.Y. Goh, 14 November 1997, GYY027; 3 males, 3 females (ZRC), Sarawak, Sg. Engkabang?, coll. Y.Y. Goh, 17 & 19 November 1997, GYY034; 1 male (ZRC), Sarawak, Sg. Menyarin, coll. Y.Y. Goh, 15 November 1997, GYY028; 1 male (NHMW), ca 40 km SE Kapit, Rumah Ugap Ng, marating bene Kapit Sut, coll. J. Kodada, 3 April 1994; 1 female (NHMW), Kelabit Highlands, 5 km E Bareo, Pa Ukat, c. 1,000 m a.s.l., river, coll. M. Jäch, 1 March 1993. **Sabah:** 2 males (ZRC), Danum, coll. H.H. Tan, 2 October 1996, THH96123; 1 female (ZRC), Maliau Basin, Heath forest stream, coll. T.B. Lim & K.L. Yeo, 22 May 1996; 1 male (ZRC), Sandakan, Sepilok, Sepilok-Kabili Forest Reserve, Rainforest Discovery Centre, Sungei "Kingfisher" cascade, coll. H.H. Tan, 14 May 2019, THH19-19.

INDONESIA: **East Kalimantan:** 2 males (ZRC), Mahakam basin, Sg. Lorni, coll. H.H. Tan, 24 March 2000, THH0016; 1 female (ZRC), Mahakam basin, feeder to Sg. Hajuq, coll. H.H. Tan, 29 March 2000, THH0022; 1 male (ZRC), Kayan basin, Sg. I'sau, coll. H.H. Tan, 26 November 1999, THH99102; 1 female (ZRC), Kalimantan Timur, Makaham subdistrict, Sg. Lomi and feeder streams, coll. H.H. Tan, 22 March 2000, THH0011. **Nias:** 1 female (NHMW), South Nias, Lahusa, Gomo, 0–300 m a.s.l., coll. M. Jäch, 9–11 February 1990. **Java:** 1 female (NHMW), Badang, [18]96, Cons. Schild. **Bali:** 2 females (NHMW), Baturiti, coll. M. Jäch, 1 February 1988. **Lombok:** 1 female (NHMW), Pemenang, coll. M. Jäch, 19 February 1988.

Diagnosis. Body length: males 30–33, females 34–37; ratio of siphon length : body length ca. 0.3–0.35; lorum lower than clypeus and without nodule dorsally; ratio of eye width : interocular width ca. 0.7; posterior width of pronotum ca. 1.25× anterior width; pronotal length ca. 1.7× fore coxa length; hemelytra reaching posterior margin of abdominal tergum VI; posterior margin of metasternum emarginated, with very narrow sublateral grooves, sometimes indistinct; fore femur on flexor side with a median tooth and a median carina, without pre-apical tooth; hind femur, when folded back parallel to body reaching about mid-length of abdominal sternum VI (in both sexes); paramere: ventral side before

apical hook with large process bearing pointed tip nearly touching apical hook, hook relatively short with pointed tip.

Distribution. Thailand, Laos, Vietnam, China (Hainan), Andaman Islands, Langkawi Island, Peninsular Malaysia, Borneo (Sabah, East Kalimantan), Nias, Sumatra, Java, Lombok, Sumbawa, Sumba (Lansbury, 1972; J. Polhemus & Starmühlner, 1990; Zettel & Tran, 2009; D. Polhemus & J. Polhemus, 2013; Tran & Nguyen, 2016; Tran & Poggi, 2019). First records for Sarawak (Borneo) and Bali.

Ranatra gracilis Dallas, 1850

Ranatra gracilis Dallas, 1850: 10 (type locality: Bhutan). — Lansbury, 1972 (redescription). — D. Polhemus & J. Polhemus, 2013: 34 (diagnosis, records Laos and Vietnam).
[no material available]

Diagnosis (based on description by Lansbury, 1972). Body length: males 28–29, females 29–30; ratio of siphon length : body length ca. 0.30–0.35; lorum lower clypeus and without nodule dorsally; ratio of eye width : interocular width ca. 0.8; posterior width of pronotum ca. 1.2× anterior width; hemelytra slightly surpassing posterior margin of abdominal tergum VI; posterior margin of metasternum emarginated, with very narrow or indistinct sublateral grooves; fore femur on flexor side with a median tooth and a median carina, without pre-apical tooth; hind femur, when folded back parallel to body not reaching posterior margin of abdominal sternum VI (in both sexes); paramere: ventral side before apical hook with large, truncate process separated by a distinct gap from apical hook, hook with pointed tip.

Distribution. Bhutan, India (Assam), northern Thailand, Laos, northern Vietnam, Peninsular Malaysia (D. Polhemus & J. Polhemus, 2013).

Ranatra lansburyi Chen, Nieser & Ho, 2004

Ranatra lansburyi Chen, Nieser & Ho, 2004: 89 (type locality: Chiang Mai, Thailand). — D. Polhemus & J. Polhemus, 2012: 247 (record Myanmar).

Material examined. THAILAND: 1 male, 1 female (NHMW, previously det. as *R. parmata* by N. Nieser), Chiang Mai Province, W Mae Rim, Mae Sa N.P., Mae Sa Falls, coll. H. Zettel, 30–31 October 1995.

Diagnosis. Body length: males 27–31, females 31–34; ratio of siphon length : body length ca. 0.4; lorum lower clypeus and without nodule dorsally; ratio of eye width : interocular width ca. 0.8; posterior width of pronotum ca. 1.25× anterior width; pronotal length ca. 1.5× fore coxa length; hemelytra reaching posterior margin of abdominal tergum VI; posterior margin of metasternum roundly emarginated, with very narrow or indistinct sublateral grooves; fore femur on flexor side with a median tooth and a median carina, without pre-apical tooth; hind femur, when folded back parallel to body reaching anterior quarter of operculum (in males) or only slightly surpassing mid-length of abdominal sternum VI (in females); paramere: ventral side before apical hook with large, bi-lobed process, hook with truncate tip.

Distribution. Myanmar, North Thailand (Chiang Mai), Southwestern China (Yunnan) (Chen et al., 2004; D. Polhemus & J. Polhemus, 2012).

Ranatra schuhi D. Polhemus & J. Polhemus, 2012

Ranatra schuhi D. Polhemus & J. Polhemus, 2012: 243–247 (type locality: Mandalay, Myanmar).
[no material available]

Diagnosis (based on description by D. Polhemus & J. Polhemus, 2012). Body length: males 32.5, females 35.5; ratio of siphon length : body length ca. 0.4; lorum lower clypeus and without nodule dorsally; ratio of eye width : interocular width ca. 0.8; posterior width of pronotum ca. 1.4–1.45× anterior width; pronotal length ca. 1.8× fore coxa length; hemelytra reaching posterior margin of abdominal tergum VI; posterior margin of metasternum roundly emarginated, with very narrow sublateral grooves; fore femur on flexor side with a median tooth and a median carina, without pre-apical tooth, distal part of femur slightly broader than basal part; hind femur, when folded back parallel to body reaching posterior margin of abdominal sternum VI (in males) or just surpassing mid-length of abdominal sternum VI (in females); paramere: ventral side before apical hook with a nearly round process, apical hook long and broadly curved, tip of hook pointed.

Distribution. Myanmar (D. Polhemus & J. Polhemus, 2012).

Ranatra heoki Tran & Poggi, 2019

Ranatra heoki Tran & Poggi, 2019: 241–244 (type locality: Sarawak, Borneo).

Additional material examined. BRUNEI: 4 males, 1 female (ZRC.6.18837, NHMW), Tutong District, Logon Uluh Boyoh (pool) and Bawang Ulop (stream), coll. Tan H.H., 17 May 1996, THH9633. INDONESIA: **Bintan:** 1 male (ZRC), Pulau Bintan North, swamp forest at Tanjung Bintan end, east of Pasir Panjang beach, ca. 100–200 m from sea, coll. H.H. Tan, 27 June 1995, THH9529.

Diagnosis. Body length: males 25–26, female 29; ratio of siphon length : body length ca. 0.55; siphon index ca. 1.55×; lorum lower clypeus and without nodule dorsally; clypeus with a small conical tubercle anteriorly; ratio of eye width : interocular width ca. 1.0; posterior width of pronotum ca. 1.15× anterior width; pronotal length ca. 1.55× fore coxa length; hemelytra reaching mid-length of abdominal tergum VI; posterior margin of metasternum angularly emarginated, with sublateral grooves; fore femur on flexor side with a median tooth and a median carina, and with one small pre-apical tooth; hind femur of male, when folded back parallel to body just surpassing mid-length of abdominal sternum VI; in female slightly shorter; paramere: ventral side before apical hook with a small sub-triangular process, apical hook relatively short, tip of hook pointed.

Description of female. Colouration similar to males.

Body length 29; length of siphon 14.2; width of head 2.47; interocular width 0.76; width of eye 0.83; pronotal length 7.36, anterior pronotal length 5.80; posterior pronotal length 2.85; anterior width of pronotum 2.05; posterior width of pronotum 2.63; lengths of leg segments: fore leg: coxa 4.55, femur 7.82, tibia 3.17, tarsi 0.68; middle leg: femur 10.90, tibia 9.75, tarsi 1.80; hind leg: femur 11.75, tibia 13.65, tarsi 1.96. Hind femur, when folded back parallel to body, just not reaching middle of abdominal sternum VI. Operculum slightly longer than connexivum, surpassing the apex of connexivum by about one-tenth the length of operculum. Respiratory siphon about 1.4× the length of sterna III–V combined.

Other characteristics similar to males.

Distribution. Borneo: Malaysia: Sarawak (Tran & Poggi, 2019), Brunei (first record). Indonesia: Pulau Bintan (first record).

Ranatra odontomeros **Nieser, 1996**
(Fig. 9)

Ranatra odontomeros Nieser, 1996: 349–351 (type locality: Nam Nao, Thailand).

Material examined. Holotype (male) and **allotype** (female), "Thailand, Phetchabun Prov. / Nam Nao NP, Huai Ya Krua / nr. Headquarter, 24.11. / 1995, leg. H. Zettel (23)" (NHMW). **Paratype:** 1 female, locality label in Thai script: "Site: Nam Nao / Date: 17 June. 1979 / Collector: Uthai" and with hand-written label "Ranatra / odontomeros / Nieser / paratype ♀" (KKU) [currently in NHMW; in original description by Nieser, 1996, the specimen was reported being a male].

Diagnosis. Body length: male 37, female 42; ratio of siphon length : body length ca. 0.5–0.55; siphon index ca. 1.30–1.35×; lorum lower clypeus and without nodule dorsally; ratio of eye width : interocular width ca. 0.75–0.85; posterior width of pronotum ca. 1.4–1.5× anterior width; pronotal length ca. 1.3–1.4× fore coxa length; hemelytra reaching or slightly surpassing posterior margin of abdominal tergum VI; posterior margin of metasternum angularly emarginated, with sublateral grooves; fore femur on flexor side with a median tooth and a median carina, and with a pair of small pre-apical teeth; hind femur, when folded back parallel to body reaching anterior third of operculum (in both sexes); paramere: ventral side before apical hook with a large sub-triangular process, apical hook relatively short, tip of hook pointed.

Remarks. Fore femora of type specimens possess a pair of pre-apical teeth, which are more prominent in female specimens. In the original description, Nieser (1996) mentioned only one "apical tooth" on the fore femur. The drawings of the paramere presented in Nieser (1996) were not accurate, thus we provide here a photograph of the paramere of the holotype (Fig. 9).

Fig. 9. Paramere of *Ranatra odontomeros* Nieser, 1996, holotype.

D. Polhemus & J. Polhemus (2012) and Tran & Poggi (2019) did not include this species in their respective concepts of the *R. gracilis* group, although Nieser (1996) already pointed out some characters that fit the definition of the group by Lansbury (1972). After examining the type specimens and diagnostic features, we agree with Nieser (1996) that this species should be included in the *R. gracilis* group.

Distribution. Thailand (Nieser, 1996).

DISCUSSION

Species diversity of *Ranatra*. In his revision of Oriental-West Malesian *Ranatra*, Lansbury (1972) recognised 21 species in six species groups and two species not assigned into any group. After several taxonomic additions (Nieser & Chen, 1991, 1996; Nieser, 1996, 1997; Zettel, 1999; Chen et al., 2004; D. Polhemus & J. Polhemus, 2012; Tran & Polhemus, 2012; Tran & Nguyen, 2016; Tran & Poggi, 2019; and this paper) the number of species in the region raised to 43 in seven groups. The species number per group are very uneven, from two (the *R. malayana* group) to 13 (the *R. gracilis* group). The majority of *Ranatra* species inhabit still waters with little stability, which requires good dispersal abilities for aquatic insects (May, 2019). The shift to a life at the edges of more stable running waters may have reduced dispersal in the *R. gracilis* group and, by that, accelerated the allopatric diversification. The *R. biroi* group (presently 12 species and 1 subspecies), whose species generally inhabit stagnant waters, may overtake the *R. gracilis* group in terms of total number of species after descriptions of further new species (Tran & Zettel, in prep.).

Zoogeographic patterns in the Philippines. The distribution of terrestrial and limnic plants and animals largely follow a basic pattern of biogeographical subregions that was elaborated on the results of numerous botanists and zoologists (Ong et al., 2002). The extent of the subregions follows the limits of the islands during Pleistocene glaciation (e.g., "Greater Luzon", "Greater Mindanao" in Fig. 10A) when the sea level has dropped for ca. 120 m and smaller islands fused with the main islands (see Voris, 2000: fig. 1). However, the distribution of the individual species may deviate from

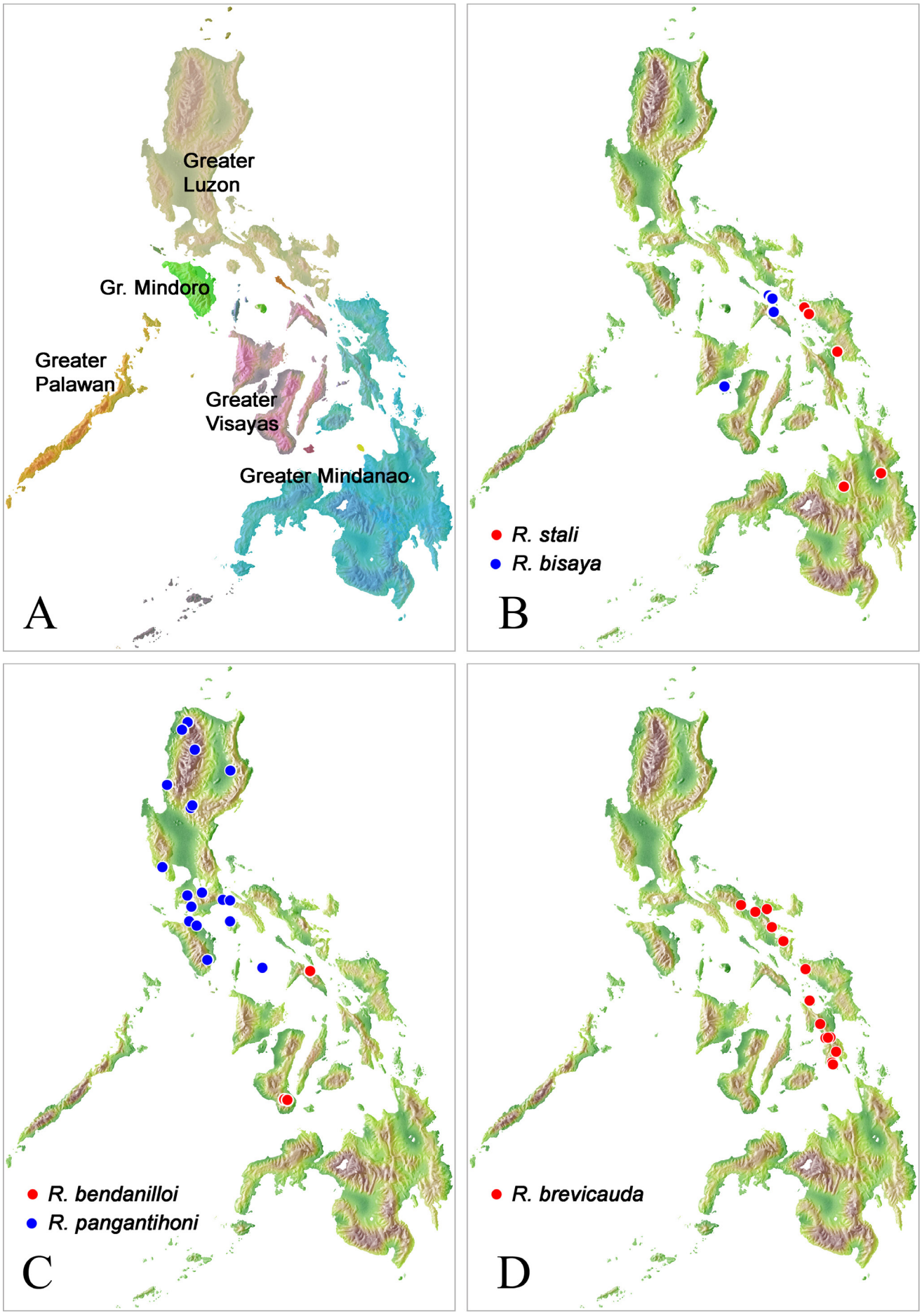

Fig. 10. A, the biogeographical regions of the Philippines (after Ong et al., 2002); B–D, distribution of species of the *Ranatra gracilis* group in the Philippines.

such exact pattern. This is also observed in the species of the *Ranatra gracilis* group. While *R. stali*, *R. bisaya*, new species, and *R. bendanilloi*, new species (Fig. 10B, C) are limited to one Pleistocene island complex (Greater Mindanao and Greater Visayas, respectively), the other two species were able to extend their distribution: *R. pangantihoni*, new species, from Greater Luzon southwards to Mindoro and Sibuyan (Fig. 10C), *R. brevicauda*, new species, from Greater Mindanao northwards to southern Luzon (Fig. 10D). The close relationships of the five species might be explained with a common ancestor that has diversified in the Philippine archipelago. Molecular data may corroborate or refute this hypothesis and may give a more accurate picture of the relationships on island population level than morphology alone can do.

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