

## New species of *Rhagovelia* MAYR, 1865 (Hemiptera: Heteroptera: Veliidae) from Northern Luzon, Philippines

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### Abstract

Three new species of the *Rhagovelia cotabatoensis* HUNGERFORD & MATSUDA, 1961 subgroup (*R. papuensis* group) are described from Northern Luzon, Philippines: *Rhagovelia isabela* sp.n. (Isabela Province), *Rhagovelia montana* sp.n. (Benguet and Mountain Province), and *Rhagovelia torosa* sp.n. (Aurora Province). Notes on *Rhagovelia akrita* POLHEMUS, 1976 are added.

**Key words.** Rhagoveliinae, taxonomy, *Rhagovelia cotabatoensis* group, new species description, island endemism.

### Zusammenfassung

Drei Arten aus der Untergruppe der *Rhagovelia cotabatoensis* HUNGERFORD & MATSUDA, 1961 (*R. papuensis*-Gruppe) werden aus dem Nordteil der philippinischen Insel Luzon beschrieben: *Rhagovelia isabela* sp.n. von Isabela Province, *Rhagovelia montana* sp.n. von Benguet und Mountain Province sowie *Rhagovelia torosa* sp.n. von Aurora Province. Notizen zu *Rhagovelia akrita* POLHEMUS, 1976 werden ergänzt.

### Introduction

The Gerromorpha of Luzon Island in the Philippines are comparably well-known (e. g., ZETTEL 2014), but some regions remain poorly known or entirely unstudied. Especially the island's north is dominated by mountain ranges where some species with restricted distribution live. Riffle bugs of the genus *Rhagovelia* MAYR, 1865 (Veliidae) dominate the gerromorphan fauna of Philippine streams in both species and specimen numbers. A revision by the first author (ZETTEL 1994, 1995, 1996) treated most of the species groups in the country, except the *R. agilis* and the *R. cotabatoensis* subgroups, which are the most difficult complexes regarding taxonomy and species discrimination.

Seven previously described species of the Philippines can be assigned to the *R. cotabatoensis* subgroup: *R. cotabatoensis* HUNGERFORD & MATSUDA, 1961 (widespread), *R. lundbladi* HUNGERFORD & MATSUDA, 1961 (Mindanao), *R. akrita* POLHEMUS, 1976 (Northern Luzon), *R. graindli* ZETTEL, 2012 (Camiguin, Mindanao), *R. rigovae* ZETTEL, 2012 (Central Luzon), *R. gapudi* ZETTEL, LACINY & FREITAG, 2020 (Palawan, Busuanga), and *R. borbei* PANGANTIHON & ZETTEL, 2023 (Jolo in the Sulu archipelago). In this study we describe three new species of the *R. cotabatoensis* subgroup from Northern Luzon and include some notes on the rarely collected *R. akrita*, an endemic species of Cordillera Central belonging to the same subgroup.

## Material and methods

### Repositories of specimens

- ADMU Ateneo de Manila University, Biodiversity Laboratory, School of Science & Engineering, Quezon City, Philippines
- NHMW Natural History Museum Vienna, Austria
- PNMNH Philippine National Museum of Natural History, Manila, Philippines
- UPLB Museum of Natural History, University of the Philippines, Los Baños, Laguna, Philippines
- USNM Smithsonian National Museum of Natural History, Washington D.C., U.S.A. (including Carl J. Drake Collection and John T. Polhemus Collection)
- ZCW Zettel Collection, Vienna, Austria

Insects were examined with a Leica Wild M10 binocular microscope (max. 128× magnification). Parameres were studied under an Olympus BX40 compound microscope. Drawings were made with the help of a camera lucida attached to these microscopes.

Stacked digital images were taken with a Leica DFC490 camera attached to a Leica Z16APO optics carrier, using Leica Application Suite V3.8. Images were stacked with ZereneStacker 64-bit and processed with Adobe Photoshop 7.0.

Measurements were performed with a Nikon SMZ1500 binocular microscope at magnifications from 51.2× to 256× and are given in millimetres. They refer to the maximum length or width of the respective structure. Measurements on the body were taken in dorsal view of specimens, except body lengths of winged specimens, which were measured in lateral view excluding wings.

Terminology largely follows POLHEMUS & POLHEMUS (1988) and subsequent publications on taxonomy of Oriental *Rhagovelia* (e.g., ZETTEL 1996, 2012, NIESER et al. 1997, ZETTEL et al. 2020).

## Taxonomy

### The *Rhagovelia papuensis* group

**Diagnosis** (modified from ZETTEL et al. 2020). Body usually slender, very variable in size (length ca. 3–6 mm in Philippine species). Body black, brown, orange or yellowish; dark species usually with rich yellow or orange markings, at least anterior part of pronotum medially and connexival margins yellowish. Antennae and legs black, bases largely yellow. Metafemur of male usually strongly enlarged, with rich dentition on flexor side; of female more slender and with reduced dentition. Paramere of male variable in size, shape, and pilosity. – Apterous morph. Pronotum with long pronotal lobe, covering mesonotum (almost) completely. – Macropterous morph common in most species: wings blackish, usually with whitish or yellow streaks. Forewing with three or four closed cells reaching distal third; cells without pilosity. Dealate morph unknown. Abdominal carina reaching at least mediotergite 3.

**Notes.** Although a phylogeny of *Rhagovelia* is not yet available, and therefore the status of individual characters uncertain, the *R. papuensis* group appears to be chiefly defined

by plesiomorphic characters, like the pronounced pronotal lobe in the apterous morph, the long abdominal (tergal) carinae in the macropterous morph, the extended forewing venation, or the absence of dealatation. Although *R. papuensis* group was defined for species of Southeast Asia and the West Pacific realm (POLHEMUS & POLHEMUS 1988), species from other biogeographical regions seem to fit its definition, e.g., from India, Madagascar, and the Neotropical Region.

### The *Rhagovelia cotabatoensis* subgroup

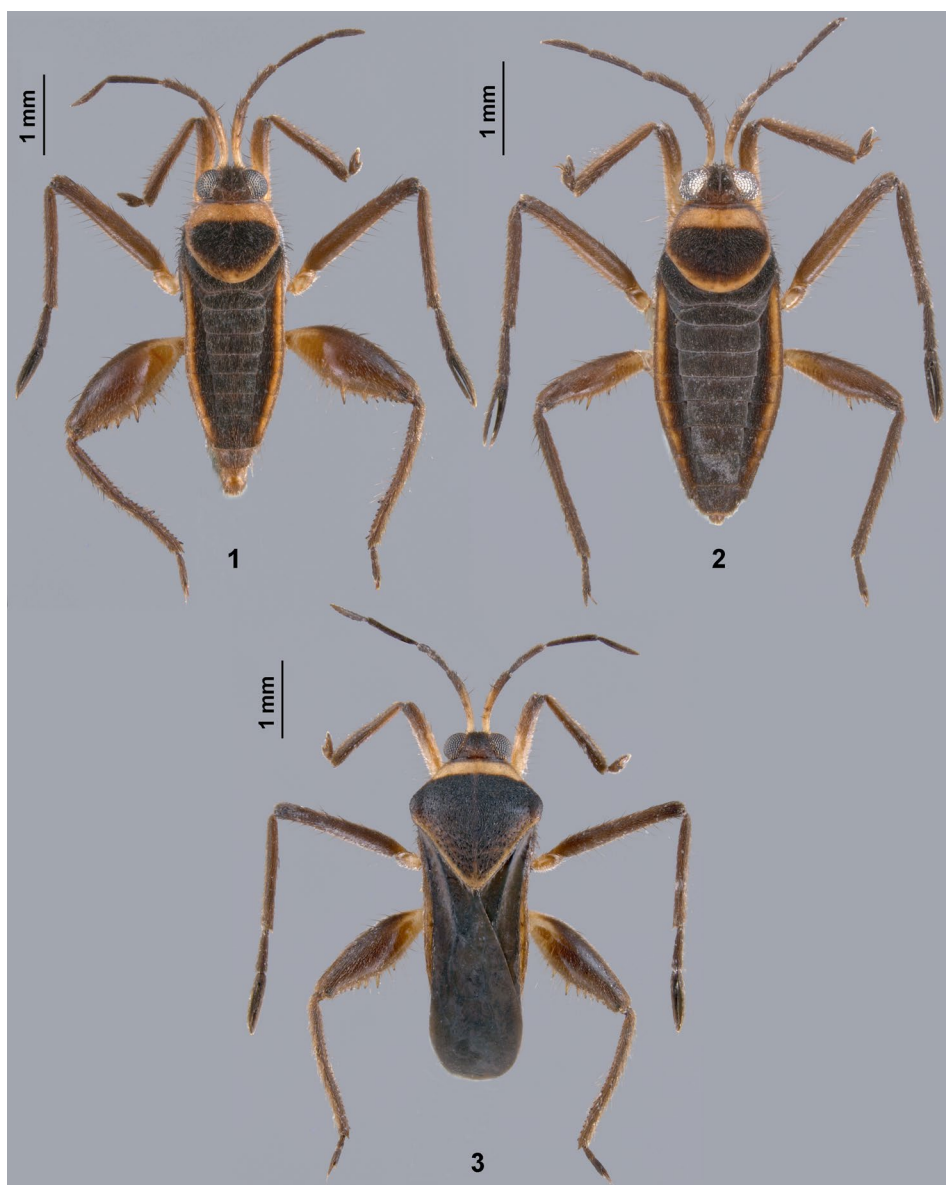
**Diagnosis** (extracted and modified from the key in ZETTEL 1996). Variable in size (body length 3.4–5.6 mm) and colour. Jugal and proepisterna usually with numerous black spiculae (exceptions: sparse in *R. akrita* – see below; absent in an undescribed species from Mindanao). – Male. Metafemur at base with straight row of small, black denticles, distally with several, usually irregular rows of teeth. Metatibia either straight or almost evenly curved (as an exception, slightly S-shaped in *R. montana* sp.n.). Mediotergite 7 shorter than length of mediotergites 5 and 6 combined. Segment 8 short, weakly curved ventrad. Paramere small, with dorsal incision separating a proximal from a distal part; distal part straight, with apex curved to a ventrad lobe or hook (e.g., Figs 22–24). – Female. In apterous morph, connexiva of several species strongly convergent posteriorly; sternum 7 upcurved and partly covering mediotergite 7. Mediotergite 8 and proctiger directed posteriorly. Gonocoxa 1 visible (not retracted into sternum 7; Figs 16–18).

**Notes.** The four morphologically distinct Philippine subgroups of the *R. papuensis* group were defined by ZETTEL (1996). All subsequently described species clearly fit into these subgroups. The *R. cotabatoensis* subgroup clearly differs from the other three by the structure of the paramere: In the *R. cotabatoensis* subgroup a dorsal incision separates a distal part that directs straight caudad and possesses a downcurved apical hook or lobe (in some species strongly reduced), see e.g., Figs 22–24; in the other three subgroups the distal part is distinctly upcurved. Further characters, like the distribution of spiculae on jugal and episterna, and the often similar dentition of the metafemur in males, support the hypothesis of a monophyletic group. In some species that are probably more closely related to *R. cotabatoensis*, apterous females share a posteriorly strongly convergent abdomen; but some other species lack this character. Species of the *R. cotabatoensis* subgroup can be found in the Philippines (ten species including the new species) and on the Togian Islands, Indonesia (*R. achna* NIESER, ZETTEL & CHEN, 1997).

### *Rhagovelia montana* sp.n. (Figs 1–3, 9, 12, 16, 19, 22)

**Type locality.** Luzon Island, Mountain Province, south of Sagada, Bagnen, slopes of Mount Polis, N 17°01', E 120°53', ca. 1550 m a. s. l.

**Type material.** Holotypus (apterous male, PNMNH): Philippines, Luzon, Mountain Province, S of Sagada, Bagnen, slopes of Mt. Polis, ca. 1550 m a.s.l., 26.II.1999, leg. H. Zettel. Paratypes (NHMW, UPLB, ZCW): 5 ♂♂, 7 ♀♀ (apterous), same locality data; 2 ♂♂ (macropterous), nearby, ca. 1600 m a.s.l.; 2 ♂♂ (apterous), 5 ♂♂, 2 ♀♀ (macropterous), Philippines, Luzon, Mountain Province, Sagada, Echo Valley, Underground River, ca. 1500 m a.s.l., 23–24.II.1999, leg. H. Zettel; 5 ♂♂, 6 ♀♀ (apterous), 1 ♀ (macropterous), Philippines, Luzon, Mountain Province, Sagada, Banga'an, Bomod-ok Waterfalls, ca. 1500 m a.s.l., 22.II.1999, leg. H. Zettel; 5 ♂♂, 10 ♀♀ (apterous), 3 ♀♀ (macropterous), Philippines, Luzon, Mountain Province, Gonogon, Chico River, ca. 1100 m a.s.l., 21.II.1999, leg. H. Zettel; 3 ♀♀ (apterous), 2 ♂♂, 1 ♀ (macropterous), Philippines, Luzon, Benguet Province, W of Baguio, Asin Road at km 7, 17.II.1999, leg. H. Zettel; 1 ♂, 1 ♀ (macropterous), Philippines, Luzon, Benguet Province, Baguio, 2 km below Camp John Hay, 18.II.1999, leg. H. Zettel.



Figs 1–3. Habitus of *Rhagovelia montana* sp.n. (1) Apterous male; (2) apterous female; (3) macropterous male. © Alice Laciny / NHMW.

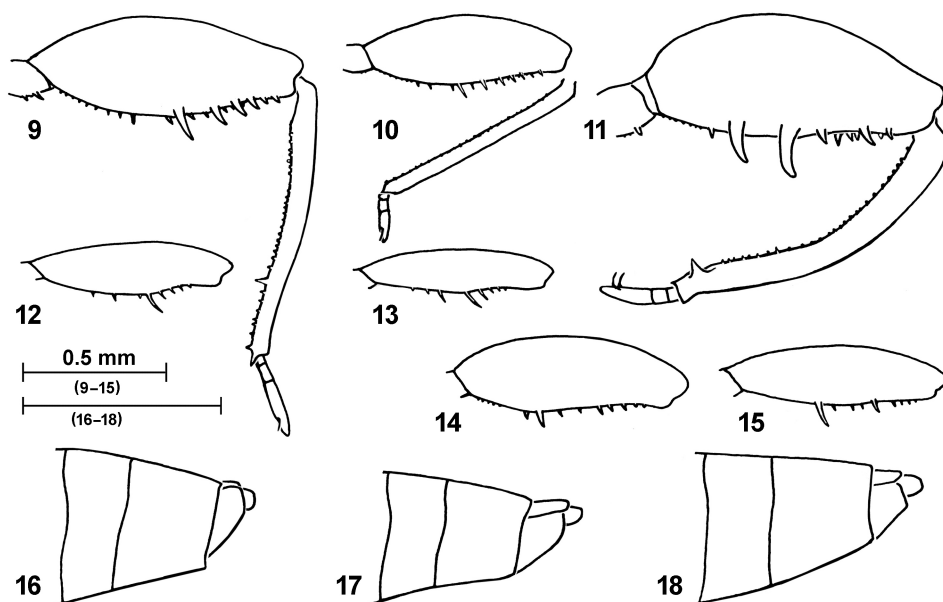


Figs 4–6. Habitus of *Rhagovelia isabela* sp.n.: (4) Apterous male; (5) macropterous male; (6) apterous female. © Alice Laciny / NHMW.





Figs 7–8. Habitus of *Rhagovelia torosa* sp.n.: (7) Apterous male; (8) apterous female. © Alice Lacity / NHMW.

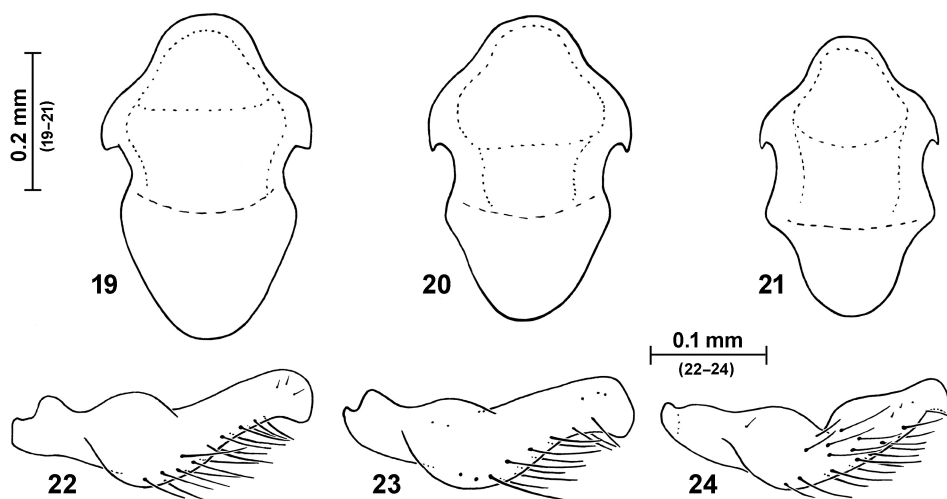


Figs 9–18. (9–11) Hind legs of apterous male of (9) *Rhagovelia montana* sp.n., (10) *R. isabela* sp.n., (11) *R. torosa* sp.n. (12–15) Metafemora of apterous morphs of (12) *R. montana* sp.n., female; (13) *R. isabela* sp.n., female; (14) *R. torosa* sp.n., small male; (15) *R. torosa* sp.n., female. (16–18) Apex of abdomen of apterous female, lateral view, of (16) *R. montana* sp.n., (17) *R. isabela* sp.n., (18) *R. torosa* sp.n. Pilosity omitted. © Herbert Zettel / NHMW.

**Description of apterous male.** Measurements of holotype. Body length 3.94; maximum body width (at metapleura) 1.38. Head length 0.50, width 0.88; minimum eye distance 0.26. Pronotum length 1.03, width 1.06. Lengths of antennomeres: I 0.96, II 0.62, III 0.73, IV 0.38. Lengths of leg segments: profemur 1.16, protibia 1.31, protarsus 0.05 + 0.05 + 0.35, mesofemur 1.88, mesotibia 1.50, mesotarsus 0.11 + 0.55 + 0.81, metafemur 2.19, metatibia 2.06, metatarsus 0.09 + 0.15 + 0.46. Measurements of paratypes (n = 10). Body length 3.50–4.31; maximum body width (at metapleura) 1.19–1.44. Head width 0.81–0.88; Pronotum length 0.94–1.09, width 1.06–1.25.

**Colour.** Body in dorsal view black, with anterior part of pronotum entirely yellow or interrupted with brown areas behind eyes; pronotal lobe with narrow yellow margin; lateral parts of laterotergites also yellow; in lateral view chiefly black, except yellow propleuron, acetabula, occasionally also ventral part of mesopleura, and lateral parts of sterna; in ventral view chiefly yellow to pale brown, except black labrum and metasternum. Antenna black, except basal ca. two-thirds of first antennomere yellow. On legs coxae, trochanters, anterior and flexor face of femora, as well as bases of pro- and metafemora posteriorly yellow; anterior (ventral) sides of tibiae and tarsi yellowish brown; other parts brownish black.

**Pilosity.** Most body parts (but not pronotal lobe) with long, standing or oblique, black setae, longest on head dorsum along eye margins, propleuron and mesopleuron, antennae, and femora. Appressed pilosity of dorsum greyish.



Figs 19–24. Genital structures of males. (19–21) Proctiger, dorsal view, of (19) *Rhagovelia montana* sp.n., (20) *R. isabela* sp.n., (21) *R. torosa* sp.n. Pilosity omitted. (22–24) Left paramere, lateral view, of (22) *R. montana* sp.n., (23) *R. isabela* sp.n., (24) *R. torosa* sp.n. © Herbert Zettl / NHMW.

Structures. Head width subequal to anterior width of pronotum. Jugal flat, strongly inclined, moderately broad, posteriorly with black spiculae. Pronotum long, along midline about 2.7 times as long as head. Mesonotum not visible, or, rarely, as a very narrow stripe. Proepisterna bearing small black spiculae mesally, area with spiculae not extended to propleuron. Pleura with variable numbers and distribution of pits, fewest on metapleuron.

Profemur on extensor side with indistinct concavity in second fourth. Coxae and trochanters lacking black spiculae. Hind leg (Fig. 9): Metatrochanter with one small subapical tooth and very few minute granules or minute teeth. Metafemur strongly or very strongly enlarged, dentition on flexor side rich: basal row consisting of ca. 9–13, not very densely set granules and (distally) short teeth, the most distal one slightly larger and in some specimens a bit distant from others; posterior distal row consisting of ca. 4–7 teeth, the first one very long, in some large specimens slightly distant from others and slightly shifted posteriorly, the others strongly decreasing in length; anterior distal row either consisting of 4–8 much shorter teeth, or rather irregular and confluent with an area of short teeth and granules that are dispersed over the entire anterior zone of flexor side. Metatibia slightly S-curved (more weakly in small males), with rich dentition on flexor side, basally with granules, distally with short teeth, including one larger tooth approximately at distal fourth; apex always with two spines.

Laterotergites moderately inclined to almost flat. Mediotergites slightly convex; mediotergite 7 about 1.5 times as long as mediotergite 6, and 0.9 times as long as broad. Abdominal venter simple, without modifications, anteriorly roof-like, but without sharp carina. Proctiger (Fig. 19) slender; lateral wings only slightly protruding, but terminating angularly. Paramere (Fig. 22) small, elongated, with distal part straight and apically downcurved; apex rounded.



**Description of apterous female.** Measurements ( $n = 10$ ). Body length 3.63–4.13; maximum body width (at metapleura) 1.22–1.47. Head width 0.81–0.88. Pronotum length 0.91–1.06, width 1.13–1.25.

Colour similar as in apterous male.

Pilosity as in apterous male, except setae on abdomen less conspicuous, especially on sterna distinctly shorter. Apex of abdomen without special pilosity. Mediotergite 8 and corner of sternum 7 with a few thin, dark hairs. Gonocoxa with oblique, short, yellow setae.

**Structures.** Head and thorax similar to those in apterous male. Fore and middle leg (including mesofemur) unmodified. Metatrochanter without or with one small spine only. Metafemur (Fig. 12) much more slender than in male; basal row of spinules reduced to 1–2 most distal teeth (rarely with another 1–2 granules); dentition of posterodistal row consisting of 3–6 teeth, shorter than in male; anterodistal row consisting of 0–4 granules. Metatibia straight, dentition on flexor side weak, only distally visible; no large tooth.

Abdomen (Figs 2, 16) relatively broad. Connexival margins slightly convex all over length and apices widely separated. Laterotergites moderately steep. Sternum 7 not visibly in dorsal view. Mediotergites 1–7 convex; mediotergite 8 flat, directed posteriorly; mediotergite 7 about 1.2 times as long as mediotergite 6 and about 0.8 times as long as anteriorly wide; mediotergite 8 about 0.9 times as long as 7; mediotergites 7 and 8 without shiny areas. Posterodorsal corner of sternum 7 forming a minute, acute tip. Gonocoxa large, ventral margin straight. Proctiger small, narrow, knob-like.

**Description of macropterous male.** Measurements ( $n = 9$ ). Body length 4.00–4.44; maximum body width (at pronotum) 1.63–1.84. Head width 0.84–0.91. Pronotum length 1.66–1.91.

Colour similar as in apterous male. Meso- and metapleuron usually yellowish brown. Forewing blackish, with brownish grey, relatively indistinct streak at base. Mediotergites (under wings) orange-brown.

Pilosity. Basal and lateral (anterior) veins of forewing with rows of rather short, black setae. Mediotergites and laterotergites bare.

**Structures.** Pronotum large, with protruding humeri. Forewing with four closed cells reaching distal fourth; dealate specimens unknown. Metafemur on average more slender when compared to apterous male; dentition similar. Metatibia less strongly S-curved, almost straight and with reduced tooth at apical fourth in some smaller specimens. Abdominal carinae reaching base of mediotergite 4. Mediotergites flat, shiny.

**Description of macropterous female.** Measurements ( $n = 7$ ). Body length 4.13–4.56; maximum body width (at pronotum) 1.59–1.73. Head width 0.84–0.88. Pronotum length 1.63–1.75.

Colour similar as in macropterous male.

Pilosity similar as in macropterous male. Apex of abdomen as in apterous female.

**Structures.** Pronotum and forewings as in macropterous male. Hindleg structures approximately as in apterous female. Abdomen broad; connexival margins subparallel. Mediotergite 8, gonocoxa, and proctiger as in apterous female.

**Comparative notes.** The new species belongs to the *R. cotabatoensis* group sensu ZETTEL (1996) with seven previously described species in the Philippines. Three of them have been previously recorded from Luzon: Whereas *R. cotabatoensis* is known as a species of the lowlands and has a wide distribution in the Philippine archipelago (but not present in the southwest), *R. akrita* and *R. rigovae* have restricted distributions in the mountains of Northern and Central Luzon, respectively. *Rhagovelia cotabatoensis* is a small and gracile species; the abdomen of apterous females is strongly convergent posteriorly. *Rhagovelia rigovae* differs clearly from the new species by the narrow, acute apex of the paramere (ZETTEL 2012). *Rhagovelia akrita*, a rarely collected species, has a similar scattered distribution as *R. montana* sp.n. – possibly at slightly higher altitudes (ca. 1600–2300 m a.s.l.) – and is easily distinguished by large, yellow areas on mediotergites, broad, contrasting black lateral stripes on laterotergites, and a fine median carina on sterna; it is very large (4.9–5.6 mm) and the abdomen of both sexes is slightly more slender, in the female its sides more converging than in *R. montana* sp.n. See also comparative notes of the following two species. Males differ by the slightly S-curved metatibia from other species of the subgroup.

**Distribution.** Northern Luzon, Benguet and Mountain Province.

**Etymology.** The Latin adjective *montanus* refers to the localities in mountainous regions.

***Rhagovelia isabela* sp.n.** (Figs 4–6, 10, 13, 17, 20, 23)

**Type locality.** Luzon Island, Isabela Province, San Mariano, Catalangan River, ca. N 16°59', E 122°06'. [We could not locate “Diginan” and check the elevation, but the whole area is lowland.]

**Type material.** Holotypus (apterous male, PNMNH): Philippines, Luzon, Isabela Province, San Mariano, Catalangan River, “Diginan”, 1–4.VII.2000, leg. V.P. Gapud. Paratypes (NHMW, UPLB): 1 ♂, 3 ♀♀ (apterous), 1 ♀ (macropterous), same locality data.

**Description of apterous male.** Measurements of holotype. Body length 3.44; maximum body width (at metapleura) 1.19. Head length 0.47, width 0.81; minimum eye distance 0.22. Pronotum length 0.88, width 1.03. Lengths of antennomeres: I 0.83, II 0.53, III 0.65, IV 0.54. Lengths of leg segments: profemur 1.00, protibia 1.06, protarsus 0.04 + 0.05 + 0.30, mesofemur 1.63, mesotibia 1.28, mesotarsus 0.08 + 0.44 + 0.70, metafemur 1.53, metatibia 1.56, metatarsus 0.05 + 0.05 + 0.40. Measurements of paratype (n = 1). Body length 3.28; maximum body width (at metapleura) 1.19. Head width 0.80. Pronotum length 0.88, width 1.03.

**Colour.** Chiefly pale yellow to yellowish brown. Pronotal lobe with a pair of large, medially narrowly separated blackish brown patches. Metanotum, all mediotergites including dorsal face of segment 8, and medial half of each laterotergite blackish. Antenna blackish brown from distal third of antennomere 1 till apex. Legs pale yellow to light brownish; infuscated are foreleg from apex of femur to tarsus; middle leg from base of femur to tarsus; hindleg on extensor side of femur.

**Pilosity.** Dorsum of head and thoracic nota with moderately long standing to oblique setae. Propleuron and mesopleuron with a few long setae. Abdomen with numerous oblique setae, shortest on posterior mediotergites; each laterotergite with one longer seta at hind corner. Dorsal surface of thoracic nota and abdominal mediotergites with appressed greyish to pale yellowish pilosity.

**Structures.** Head broader than anterior margin of pronotum. Juga flat, strongly inclined, moderately broad, with black spiculae posteriorly. Pronotum long, along midline about 2.4 times as long as head. Mesonotum not visible or as a very narrow stripe. Proepisterna anteriorly with numerous black spiculae; zone of spiculae extending laterally until middle of eye margin. Propleuron with row of black pits near hind margin; mesopleuron and metapleuron with similar scattered pits.

Profemur on extensor side lacking concavity. Coxae and trochanters lacking black spiculae. Hind leg (Fig. 10): Metatrochanter with a few minute granules. Metafemur strongly enlarged, dentition on flexor side rich: basal row consisting of ca. 12 minute granules and ending in 1–2 short teeth; it reaches the anterior distal row that consists of 9–10 short teeth or granules; posterior distal row most prominent, consisting of 6 teeth of strongly decreasing length; towards anterior face of femur with some scattered denticles, chiefly in basal half. Metatibia hardly curved; dentition consisting of granules and very short teeth, rather uniform.

Laterotergites steeply inclined. Mediotergites moderately convex, mediotergite 7 about 1.6 times as long as mediotergite 6, and 0.9 times as long as broad. Abdominal venter simple, without modifications. Proctiger (Fig. 20) slender; lateral wings only slightly protruding, but terminating in sharp angles. Paramere (Fig. 23) small, elongated, with almost straight distal part bearing a small, ventrally-directed apical lobe; apex rounded.

**Description of apterous female.** Measurements ( $n = 3$ ). Body length 3.31–3.69; maximum body width (at metapleura) 1.16–1.25. Head width 0.78–0.81. Pronotum length 0.84–0.88, width 1.06–1.13.

Colour similar as in apterous male, except yellowish brown colour of medial parts of abdominal sterna much more extended anteriorly.

**Pilosity.** Pilosity of thorax similar to that of male. Only mediotergites 1–2 with rows of rather short, subdecumbent setae; all mediotergites with dense appressed pilosity. Laterotergites with some oblique, rather short setae at margins, similar as in male. Sides of mediotergite 8, connexival corners, and gonocoxae only with short, pale, inconspicuous setae.

**Structures.** Head and thorax similar to those of apterous male. Fore and middle leg (including mesofemur) unmodified. Metatrochanter without spine. Metafemur (Fig. 13) more slender than in male, its dentition reduced; basal row consisting of 1–3 spines, the last near mid-length distinctly longer than the others; posterodistal row consisting of 4–5 teeth of strongly decreasing length; anterodistal row consisting of 4–5 short denticles. Metatibia straight, dentition on flexor side weaker than in male.

Abdomen (Figs 6, 17) moderately elongated. Connexival margins almost straight, steadily converging posteriorly, apices widely distant. Laterotergites steep, almost vertical. Mediotergites 1–4 slightly convex, 5–8 flat; mediotergite 7 relatively short and broad, about 1.1 times as long as mediotergite 6 and about 0.7 times as long as anteriorly wide. Mediotergite 8 hardly shorter than 7, both without shiny area. Connexival corner rectangular. Gonocoxa large, ventral margin straight. Proctiger small, narrow, knob-like.

**Description of macropterous female.** Measurements ( $n = 1$ ). Body length 3.56; maximum body width (at pronotum) 1.44. Head width 0.77. Pronotum length 1.34.

Colour similar as in apterous female, laterally slightly darker. Pronotal lobe with a single large mark on disk, medially not interrupted. Forewing blackish, with pale ivory to yellowish streak at base.

Pilosity similar as in apterous female, but laterotergites and mediotergites bare. Only lateral (anterior) vein of forewing with short setae.

Structures. Pronotum large, with protruding humeri and angular posterior corner. Forewing with four closed cells reaching distal third. Metafemur slightly more slender when compared to apterous female, dentition similar. Metatibia straight. Abdominal carinae reaching mediotergite 4.

Comparative notes. This new species has a strong external similarity with *R. agilis* POLHEMUS, 1976, but the presence of black spiculae on juga and proepisterna, as well as the shape of the paramere of male clearly classify it as a member of the *R. cotabatoensis* group sensu ZETTEL (1996). *Rhagovelia isabela* sp.n. differs from other species from Luzon either by much smaller size (from *R. akrita*, *R. rigovae*, and *R. montana* sp.n.) or simply structured abdomen of the apterous female (from *R. cotabatoensis*). The apex of the paramere is less strongly modified than in the other two new species.

Distribution. Northern Luzon, Isabela Province.

Etymology. The name refers to Isabela Province, the epithet is used as a noun in apposition.

***Rhagovelia torosa* sp.n.** (Figs 7–8, 11, 14, 15, 18, 21, 24)

Type locality. Luzon Island, Aurora Province, Baler, east of Bongabon, N 15°40.5', E 121°18.3', ca. 660 m a. s. l.

Type material. Holotypus (apterous male, PNMNH): Philippines: Luzon, Aurora Province, Baler, N 15°40.5', E 121°18.3' 660 m a.s.l., 3.II., leg. C. V. Pangantihon. Paratypes (ADMU, NHMW, CZW): 13 ♂♂, 17 ♀♀ (apterous), same locality data, various collectors.

Description of apterous male. Measurements of holotype. Body length 3.63; maximum body width (at metapleura) 1.31. Head length 0.47, width 0.84; minimum eye distance 0.19. Pronotum length 0.88, width 1.19. Lengths of antennomeres: I 1.03, II 0.58, III 0.71, IV 0.45. Lengths of leg segments: profemur 1.09, protibia 1.22, protarsus 0.03 + 0.03 + 0.31, mesofemur 1.78, mesotibia 0.72, mesotarsus 0.08 + 0.47 + 0.75, metafemur 1.88, metatibia 1.88, metatarsus 0.04 + 0.12 + 0.40. Measurements of paratypes (n = 7). Body length 3.38–3.88; maximum body width (at metapleura) 1.22–1.44. Head width 0.81–0.88. Pronotum length 0.88–1.00, width 1.09–1.25.

Colour. Body in various tones of brown; venter of head (except last rostral segment), prothorax except pronotal lobe, mesothorax, and stripes along lateral margins of laterotergites and sterna yellow; mediotergites in some specimens blackish (except mediotergite 1 and middle of mediotergite 7 orange). Pronotal lobe usually brown, towards anterior margin often blackish; midline and posterior margin yellow. Antennomere 1 yellow; its tip and antennomeres 2–4 blackish. Legs brown; coxae and trochanters, base and ventral face of metafemur yellow; tarsi black.

Pilosity. Head, antennae, legs (especially femora), all thoracic pleura dorsally, and the metanotum laterally with some long setae. Entire abdomen with moderately long, oblique setae and a grey, inconspicuous, appressed pilosity. Antennae and legs with numerous long black standing setae.

Structures. A comparatively stout species. Head subequal or slightly narrower than anterior margin of pronotum. Juga flat, strongly inclined, moderately broad; some spiculae

posteriorly, rarely lacking. Pronotum long, along midline about 2.1 times as long as head. Mesonotum not visible. Proepisterna bearing small black spiculae anteromesally, the area laterally not exceeding level of juga. Propleuron with row of pits near hind margin; mesopleuron with similar scattered pits; metapleuron with few pits.

Profemur on extensor side lacking concavity. Coxae and trochanters lacking black spiculae. Hind leg (Figs 11, 14): metatrochanter with several granules, some of them elongated (tooth-like). Hindleg strongly variable, especially dentition of femur: in large specimen, femur very stout, two long, isolated, prominent teeth (the distal one is the largest) are slightly shifted to posterior of flexor side, basal row consisting of ca. 8–10 granules; a short row consisting of 3–4 moderately long teeth could be interpreted as the postero-distal row; several, but not many additional teeth and granules dispersed over flexor side; metatibia of such specimens very stout, with strongly developed granulation on flexor side, strongly and evenly curved until the long subapical tooth at approximately distal tenth of tibia length; the apex strongly bent. In very small specimens, dentition of metafemur resembles that of related species, with a short basal row ending in one short tooth, and more or less distinct posterior and anterior distal rows; their metatibia is relatively slender and moderately curved; the subapical tooth strongly reduced; distal of the subapical tooth only one apical tooth in all specimens. Intermediate forms do occur.

Laterotergites moderately inclined. Mediotergites 1–6 slightly convex; mediotergite 7 flat, about 1.7 times as long as mediotergite 6, and 0.9 times as long as broad at hind margin; its medial part and dorsal face of segment 8 shiny. Abdominal venter simple, without distinct modifications; sternum 7 with a short medial carina posteriorly. Segment 8 and genitalia small. Proctiger (Fig. 21) slender, with hardly protruded lateral wings; their apex acute. Paramere (Fig. 24) small, elongated, distal part strongly narrowed towards apex; apex small, strongly curved ventrad and with acute tip.

**Description of apterous female.** Measurements ( $n = 10$ ). Body length 3.63–3.81; maximum body width (at metapleura) 1.28–1.38. Head width 0.80–0.86. Pronotum length 0.88–0.94, width 1.13–1.22.

Colour similar as in apterous male, except mediotergites in some specimens entirely black to dark brown.

**Pilosity.** Pilosity of head and thorax similar to that in male. Only mediotergites 1–3 with rows of subdecumbent setae; short pilosity on mediotergites 6 and 7 strongly reduced, almost missing; sternum 7 at connexival corner with some long black setae. Gonocoxa with short setae, at dorsal margin with short, black setae.

**Structures.** Head and thorax similar to those of apterous male. Fore and middle leg (including mesofemur) unmodified. Metatrochanter without or with 1–3 small granules. Metafemur (Fig. 15) more slender than in male, but relatively stout compared to those of females of related species (e.g., Figs 12, 13); basal row reduced, 1–3 granules and in some specimens one small distal tooth present. Posterodistal row in distal three fifths consisting of 2 longer teeth, each followed by 3–5 short teeth; anterodistal row variable, consisting of 4–6 short teeth, sometimes uneven. Metatibia very weakly curved, dentition on flexor side much weaker than in male, but stronger than in females of related species; subapical tooth never present.

**Abdomen** (Figs 8, 18) rather stout. Laterotergites steep; connexival margins almost straight, weakly converging posteriorly, apices distinctly separated, not covering posterior mediotergites. Mediotergites 1–3 convex, 4–8 flat; mediotergite 7 about 1.2 times as long as mediotergite 6 and about 1.0 times as long as anteriorly wide, without shiny area;



mediotergite 8 about 0.7 times as long as mediotergite 7, without shiny area, directed posteriorly. Connexival corner in lateral view rectangular. Gonocoxa of medium size, ventral margin straight. Proctiger small, narrow, knob-like.

Macropterous morphs unknown.

**Comparative notes.** A species of the *R. cotabatoensis* group sensu ZETTEL (1996). *Rhagovelia torosa* sp.n. differs from other species from Luzon by much smaller size (from *R. akrita*, *R. rigovae*, and *R. montana* sp.n.), a simply structured abdomen of the apterous female (from *R. cotabatoensis*), or relatively few black spiculae on jugum and proepisternum (from *R. isabela* sp.n.). Most males (except the smallest) have a characteristic, extremely enlarged metafemur with a prominent tooth on the posterior (dorsal) surface, and a similarly prominent subapical tooth on the metatibia. Females often differ from other species by light (not black) mediotergites, but there is some variation from reddish orange to dark brown.

**Distribution.** Northern Luzon, Aurora Province.

**Etymology.** From the Latin adjective *torosus*, meaning muscular and referring to strongly expanded metafemora of males.

### ***Rhagovelia akrita* POLHEMUS, 1976**

*Rhagovelia luzonica*: DRAKE 1948: 62 (misidentification, see POLHEMUS & REISEN 1976: 279).

*Rhagovelia akrita* POLHEMUS, 1976: 280.

**Type locality.** Luzon Island, Benguet Province, Baguio, ca. N 16°24', E 120°35' (USNM, Carl J. Drake Collection).

**Material examined** (ADMU, NHMW, UPLB, USNM). 3 ♂♂, 1 ♀ (apterous), Luzon, Benguet Province, Baguio, Pacdal, 15.IV.1975, leg. A. A. Barroso; 13 ♂♂, 13 ♀♀ (apterous), Philippines, Luzon, Mountain Province, Mount Data, mountain stream, 2300 m a.s.l. (7,500 ft), 29.XII.1980, leg. V. P. Gapud; 4 ♂♂, 7 ♀♀ (apterous), Luzon, Mountain Province, Mount Data, near Mount Data Hotel, 2300 m a.s.l., 25.II.1999, leg. H. Zettel; 1 ♂, 1 ♀ (apterous), Philippines, Luzon, Mountain Province, S of Sagada, Bagnen, slopes of Mount Polis, 1600 m a.s.l., 26.II.1999, leg. S. Schödl; 3 ♂♂, 3 ♀♀ (apterous), Luzon, Mountain Province, Bauko, mountain creek, N 17°03.7', E 120°05.1', 1860 m a.s.l., 17.IV., leg. C.V. Pangantihon et al.; 2 ♂♂, 2 ♀♀ (apterous), Luzon, Mountain Province, Bauko, mountain creek, N 17°03.9', E 120°05.15', 1820 m a.s.l., 17.IV., leg. C.V. Pangantihon et al.; 1 ♀ (macropterous), Luzon, Ifugao, Banaue, Sumigar Bridge; mountain creek, N 16°59.6', E 121°02.85', 1700 m a.s.l., 17.IV., leg. C.V. Pangantihon.

**Notes.** The types are part of the Carl J. Drake Collection in USNM and therefore they are not available for loans abroad. However, this characteristic species is easy to identify with the original description, and the first author was able to study specimens identified by J. T. Polhemus after he compared them with the types (see POLHEMUS & REISEN 1976).

**Comparative notes.** *Rhagovelia akrita* differs from all other Philippine species of the *R. cotabatoensis* subgroup by a median carina on sterna of both sexes. Body ground colour is often bright yellow, sometimes brownish yellow, with black markings. Black spiculae on juga and proepisterna are few or lacking. Apterous females differ from those of several species by the moderately convergent connexiva. This is the largest *Rhagovelia* species in the Philippines; body length 4.9–5.6 mm.

**Distribution.** Northern Luzon: Benguet, Mountain Province, Ifugao.

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