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Descriptions of two new species of *Rhagovelia* (Heteroptera: Gerromorpha: Veliidae) from Vietnam

Nguyen X.Q. & Tran* A.D.

Abstract. Two new species of *Rhagovelia* are described from Northern Vietnam: *Rhagovelia caudata*, new species and *Rhagovelia bisinuata*, new species, both belonging to the *R. sarawakensis* species group. These findings have increased the number of known *Rhagovelia* species in Vietnam to six.

Key words. Veliidae, taxonomy, new species, Vietnam

INTRODUCTION

The genus *Rhagovelia* Mayr, 1865, also known as the riffle bugs, distributes worldwide, mostly in tropical regions, and is probably the most speciose genus of the Gerromorpha, with about 300 species (Chen et al., 2005). Previous studies, e.g., Polhemus & Polhemus (1988), Lansbury (1993), Zettel (1994, 1995, 1996), Nieser & Chen (1993), Nieser et al. (1997), have reported that this genus has its centre of species diversity in the Indo-Australian region, especially in the Philippines, Borneo, Sulawesi, and New Guinea, with records of around 30 species in each of these areas respectively. In contrast, Southeast Asian mainland seems to have lower species diversity of *Rhagovelia*. However, the number of known species varies significantly among different areas: Thailand with eight species (Zettel, pers. comm.); Peninsular Malaysia with five species (Yang & Polhemus, 1994); Vietnam with four species prior to this study (Zettel, 2000; Zettel & Tran, 2004); Laos with two species (Zettel, 2000); Myanmar with only one species, the widespread *R. sumatrensis* Lundblad, 1933 (Zettel, 2011); no formal record of *Rhagovelia* species from Cambodia. It indicates that the *Rhagovelia* of Southeast Asian mainland is still inadequately studied, the knowledge on taxon diversity and distribution is still very limited, thus further taxonomic studies of *Rhagovelia* in this region are necessary.

The present paper describes two species from Vietnam, *Rhagovelia caudata*, new species and *Rhagovelia bisinuata*, new species, both considered belonging to the *R. sarawakensis* group (see Polhemus & Polhemus, 1988; Polhemus, 1990). These findings have increased the number of known *Rhagovelia* species in Vietnam to six. Previous records of *Rhagovelia* species in Vietnam include *R. sumatrensis* Lundblad, 1933, *R. inexpectata* Zettel, 2000, *R. yangae* Zettel & Tran, 2004, and *R. polymorpha* Zettel & Tran, 2004 (Zettel, 2000; Zettel & Tran, 2004).

MATERIAL AND METHODS

Material studied consists of dry-mounted and alcohol preserved specimens, deposited in the following collections:

NHMW	Natural History Museum Vienna (Austria)
ZMHU	Zoological Collection of Biological Museum, Hanoi University of Science (Vietnam)
ZRC	Zoological Reference Collection, Lee Kong Chian Natural History Museum, National University of Singapore (Singapore)

Morphological characteristics of specimens were studied with binocular microscopes; parameres and proctigers of male specimens were examined with compound microscopes. Illustrations were made with the help of a Camera Lucida fixed to the microscopes. Colour pictures of habitus were taken using the Visionary Digital imaging system in the Lee Kong Chian Natural History Museum. Measurements were mainly made using stage micrometers attached to the eye-pieces of these microscopes, with 0.01 mm accuracy. Measurements refer to the holotype, the allotype, or the single winged specimen, if no variations are given. All measurements are given in millimetres.

TAXONOMY

Genus *Rhagovelia* Mayr, 1865

Rhagovelia caudata, new species
(Figs. 1, 2, 5–15)

Material examined. Holotype (apterous male) and **allotype** (apterous female): VIETNAM, Nghe An Prov., Ky Son, Ta

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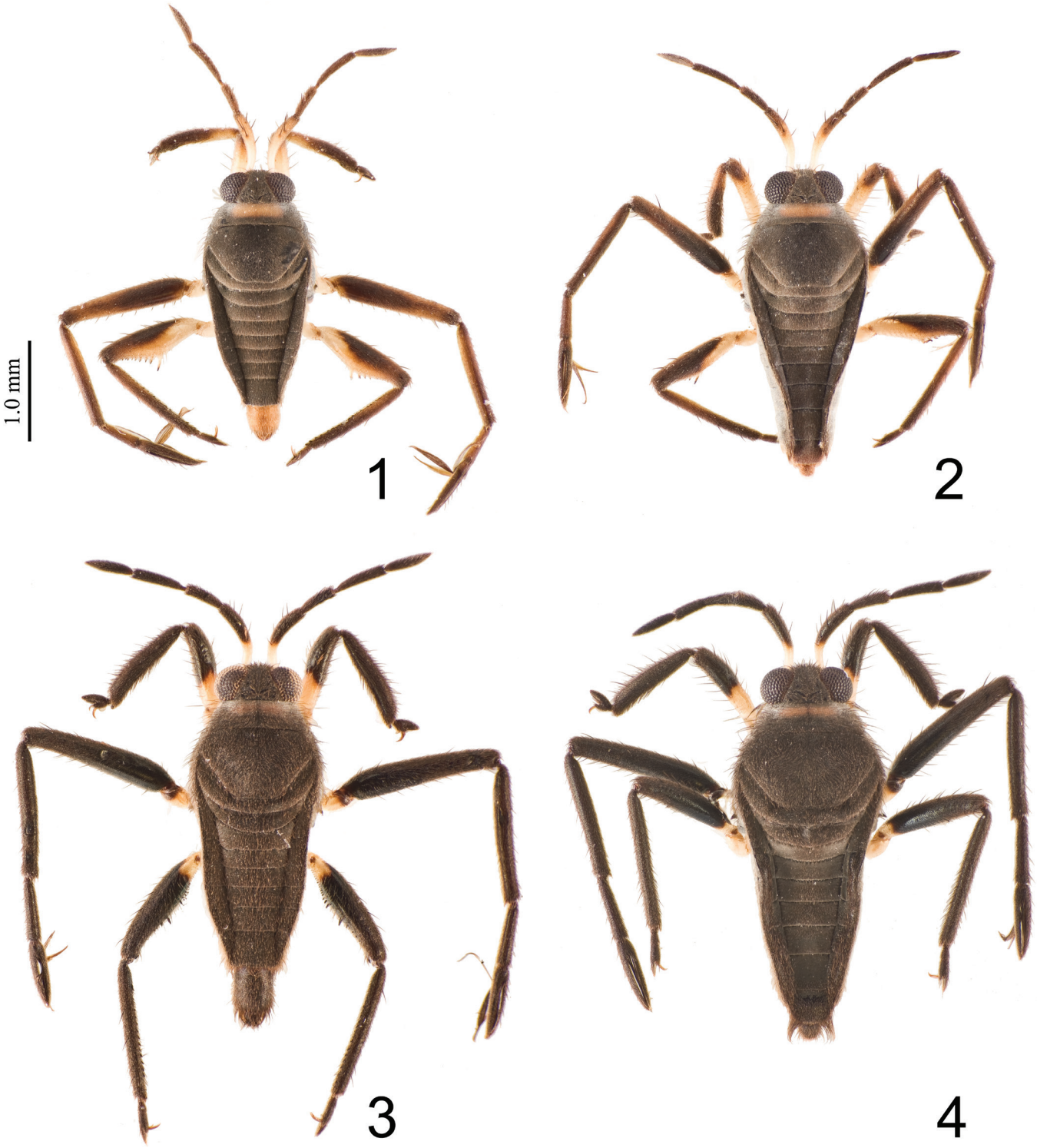


Figs. 1–4. Habitus of two new species of *Rhagovelia* (paratypes). 1, 2, *Rhagovelia caudata*, new species; 3, 4, *Rhagovelia bisinuata*, new species; 1, 3, apterous males; 2, 4, apterous females, all of same scale.

Ca, feeder stream of Loi stream, coll. Tran A.D. & Nguyen V.H., 16 April 2013, TAD1302 (ZMHU). **Paratypes:** VIETNAM: **Nghe An Prov.:** 6 males, 1 female (apterous), 3 males, 7 females (macropterous), same locality data as holotype (ZMHU); 2 males, 1 female (apterous), Pu Mat N'Park, Khe Kem waterfall & stream, site #1, coll. Ngo Q.H., 20 December 2012, NQH1203 (ZMHU); 1 male (apterous), Con Cuong, near Tung Huong, Khe Num stream, coll. Ngo Q.H., 21 December 2012, NQH1211 (ZMHU). **Dien Bien Prov.:** 7 males, 15 females (apterous), Muong Phang, Muong Phang stream, coll. Tran A.D., 26 July 2004, DY0415 (ZRC); 6 males, 7 females (apterous), National Rd6, km9 to DBP city, a stream on road side, coll. Tran A.D., 26 July 2004, DY0416 (ZRC); 3 males, 2 females (apterous), 1 male (macropterous), upstream and waterfall of Muong Phang stream, coll. Tran A.D., 28 July 2004, DY0419 (ZRC); 1 female (apterous), no name stream northeastern side, near DBP City, coll. Tran A.D., 29 July 2004, DY0420 (ZRC). **Lai Chau Prov.:** 3 males, 1 female (apterous), 2 males, 1 female (macropterous), Muong Te,

Bum Nua, a stream by the road from Muong Te town to Pa Tan, ca. 13 km from Muong Te town, coll. Tran A.D. et al., 2 June 2013, TAD1328 (ZMHU); 3 females (apterous), Muong Te, Muong Mo stream, by the road from Muong Te town to Lai Ha, ca. 33 km from Muong Te town, coll. Tran A.D. et al., 3 June 2013, TAD1329 (ZMHU); 1 male (macropterous), Muong Te, Muong Mo, Ban 41 stream, by the road from Muong Te town to Lai Ha, ca. 45 km from Muong Te town, coll. Tran A.D. et al., 3 June 2013, TAD1330 (ZMHU). **Ha Giang Prov.:** 1 male, 3 females (macropterous), Yen Minh, Na Khe commune, stream near Nat' road 4C, coll. Tran A.D. et al., 8 May 2014, TAD1404 (ZMHU). **Phu Tho Prov.:** 2 males, 2 females (apterous), Xuan Son N'Park, Lap stream, site 1, at Ngoc waterfall, coll. Tran A.D. et al., 5 June 2013, TAD1331 (ZMHU); 1 male, 1 female (apterous), Xuan Son N'Park, Lap stream, site 2, first concrete bridge from Ngoc waterfall, coll. Tran A.D. et al., 5 June 2013, TAD1332 (ZMHU); 1 female (apterous), Xuan Son N'Park, Kim Thuong, Tan Ong stream, site 2, ca. 2 km from Chin Tang waterfall, coll. Tran A.D. et al., 6 June 2013, TAD1335 (ZMHU); 3 males, 2 females (apterous), Xuan Son N'Park, Kim Thuong, Tan Ong stream, site 2, ca. 2 km from Chin Tang waterfall, coll. Tran A.D. et al., 28 August 2013, TAD1341 (ZMHU); 1 male (apterous), Xuan Son N'Park, Kim Thuong, Tan Ong stream, site 3, ca. 4 km from Chin Tang waterfall, coll. Tran A.D. et al., 28 August 2013, TAD1342 (ZMHU); 2 females (apterous), Xuan Son N'Park, Dong Son, Than stream, site 1, coll. Tran A.D. et al., 29 August 2013, TAD1346 (ZMHU); 4 males, 9 females (apterous), Xuan Son N'Park, Ban Coi, Coi stream, site 1, water from underground, coll. Tran A.D. et al., 29 August 2013, TAD1349 (ZMHU, NHMW); 2 males (apterous), Xuan Son N'Park, Ban Coi, Coi stream, site 2, near bridge, coll. Tran A.D. et al., 29 August 2013, TAD1350 (ZMHU). **Thanh Hoa Prov.:** 1 male, 3 females (apterous), Ben En N'Park, Nhu Xuan, La Rong stream, coll. Pham T.D., 03 August 2012, BE1204 (ZMHU).

Description. Size: Apterous males: body length 2.47–2.75 (holotype: 2.69), width 1.08–1.14 (holotype: 1.12); apterous females: length 2.66–3.00 (allotype: 2.81), width 1.08–1.26 (allotype: 1.23); macropterous males: length (without wings) 2.56–2.78, width 1.19–1.21; macropterous females: length (without wings) 2.81–2.97, width 1.17–1.26.

Colour (Figs. 1, 2): body mainly black; antennal segment 1 mostly light yellowish, at most only orange brown at distal third; antennal segments 2–4 variable, orange brown to dark brown; juga light yellowish, anteclypeus and rostrum yellowish to brown; pronotum anteriorly with large median transverse orange band (width about half of pronotum width, median length about two thirds of pronotum length); pro-, meso- and metacetabula apically orange brown or black; all coxae and trochanters light yellowish; profemur light yellowish at least at proximal half, distal part variable, brown to black; basal fifth of dorsal side and all ventral side of metafemur yellowish; mesofemur, tibiae and tarsi of all legs variable, mostly orange-brown to black, ventral side usually lighter, mostly orange-brown; apex of abdomen of both sexes (in males: segments 8 and genitalia; in females: posterior of segment 7 and genitalia) orange to orange-brown.

Pilosity: body with short, appressed golden pubescence; dorsum of head, propleura, and mesopleura with numerous long, erect brown or black setae; mesosternum with long yellowish hairs forming inverted V-shaped patch running towards posterior margin; metasternum and venter of abdomen with scattered long yellowish hairs; antennae and legs with scattered long brown or black setae.

Apterous male: Head length 0.31, width 0.75, eye length 0.29. Lengths of antennal segments 1–4: 0.63, 0.32, 0.47, 0.43. Juga mostly smooth, with spicules at posterior margin; thoracic sterna and pleura with scattered black spicules, more densely distributed on pro- and mesoepisterna. Pronotum short, median length 0.19; mesonotum length 0.56, about 2.9 times length of pronotum; metanotum length 0.09. Lengths of leg segments (femur, tibia, tarsus 1+2+3): fore leg: 0.72, 0.79, 0.02+0.02+0.20; middle leg: 1.17, 0.97, 0.04+0.34+0.59; hind leg: 0.90, 1.05, 0.04+0.05+0.26. Meso-, and metacoxa with some black spicules dorsally. Ventral surface of all coxa without spicules. Mesotrochanter with some black spicules dorsally. Metatrochanter with some black spicules dorsally and 2–3 small black denticles (three in holotype) ventro-distally. Mesofemur (Fig. 5) with a row of about nine stiff setae along ventral surface. Metafemur (Figs. 6, 7) incrassate, length about 3.1 times width (width measured without teeth: 0.29), ventral surface armed with a row of teeth starting from the longest tooth in the middle, followed by nine teeth gradually decreasing in length towards apex of metafemur, and some black granules arranged in a row nearly parallel to the row of femoral teeth, running from base to apex of metafemur. Metatibia (Fig. 6) slender and straight, with a row of short teeth on inner side.

Abdominal segments gradually narrowed towards apex; tergites 1–5 subequal in length (0.14–0.16), tergite 6 slightly longer (0.18), tergite 7 clearly longer (0.26) than each of preceding tergite; tergite 7 length 0.8 times of width, raised posteriorly in lateral view (Fig. 9); abdominal sternites 2, 3 weakly carinate medially; sternite 7 slightly shining; both ventral and dorsal abdominal segment 8 shining. Genital segments: small and weakly modified; segment 8 small, subcylindrical; pygophore subovate, posterior margin slightly produced medially; proctiger (Fig. 10): proximal half with broadly rounded lateral lobes, distal half setiferous; paramere (Fig. 11) slender distally, curved at apex, lateral surface set with many long setae.

Apterous female: Pilosity similar to that in males, except setae in ventral row of mesofemur less stiff, and connexiva with golden pubescence directed caudad. Hind leg (Fig. 8): metatrochanter without black denticles, metafemur slightly less incrassate, length about 3.7 times width (width 0.22), and with ventral row of teeth slightly less prominent (one large teeth in the middle, followed by five shorter teeth distally), without or with very few (1–2) granules; metatibia straight, inner side without armature.

Abdomen (Figs. 12–14): connexiva evenly and moderately converging posteriorly (Fig. 12); laterotergites sloped latero-dorsad; tergites 1–4 subequal in length (0.15–0.16), tergites 5–8 longer, length as follows: 0.19, 0.23, 0.27, 0.23; tergite 7 about as long as wide; tergite 8 shorter than wide, with posterior margin straight; tergite 8 and sternite 7 on ventral area shining; in lateral view, connexivum posteriorly produced into small sub-triangular process bearing a tuft of setae (Fig. 13); posterior margin of sternite 7 almost straight (Fig. 14); gonocoxa simple, plate-like, mainly exposed; proctiger small, relatively slender, directed straight caudad. Other structural characteristics similar to males.

Macropterous males: Pronotum large, with prominent humeri. Forewing (Fig. 15) with three closed cells, the single distal cell small. In some specimens, metatrochanter without black denticles. Metafemur slightly more slender than that in apterous males. Other characteristics similar to apterous males.

Macropterous females: Pronotum and forewing similar to those of macropterous males. Other characteristics similar to apterous females.

Etymology. The word *caudata* refers to the orange to orange-brown apex of abdomen in both sexes.

Comparative notes. *Rhagovelia caudata*, new species can be assigned to the *R. sarawakensis* species group (sensu Polhemus & Polhemus, 1988), in having short pronotum (median length shorter than eye length, and about one third of mesonotal length), forewing with three closed cells, long paramere with distal hook, and abdominal terminalia in both sexes simple, without special modification. It is, however, distinctly different from all other taxa in the *R. sarawakensis* species group, in having more incrassate hind femur with only a distal row of teeth and without the proximal row of teeth, the extensive yellow-orange base of femora, and the orange-brown abdominal terminalia in both sexes. In other species of the *R. sarawakensis* group, hind femur is slender, with both proximal and distal rows of teeth, femora are mostly black or at least dark brown, and abdominal terminalia usually black. Other diagnostic characters of *R. caudata*, new species include the shape of proctiger (Fig. 10), the paramere (Fig. 11), and shape of abdominal apex of female (Figs. 12–14).

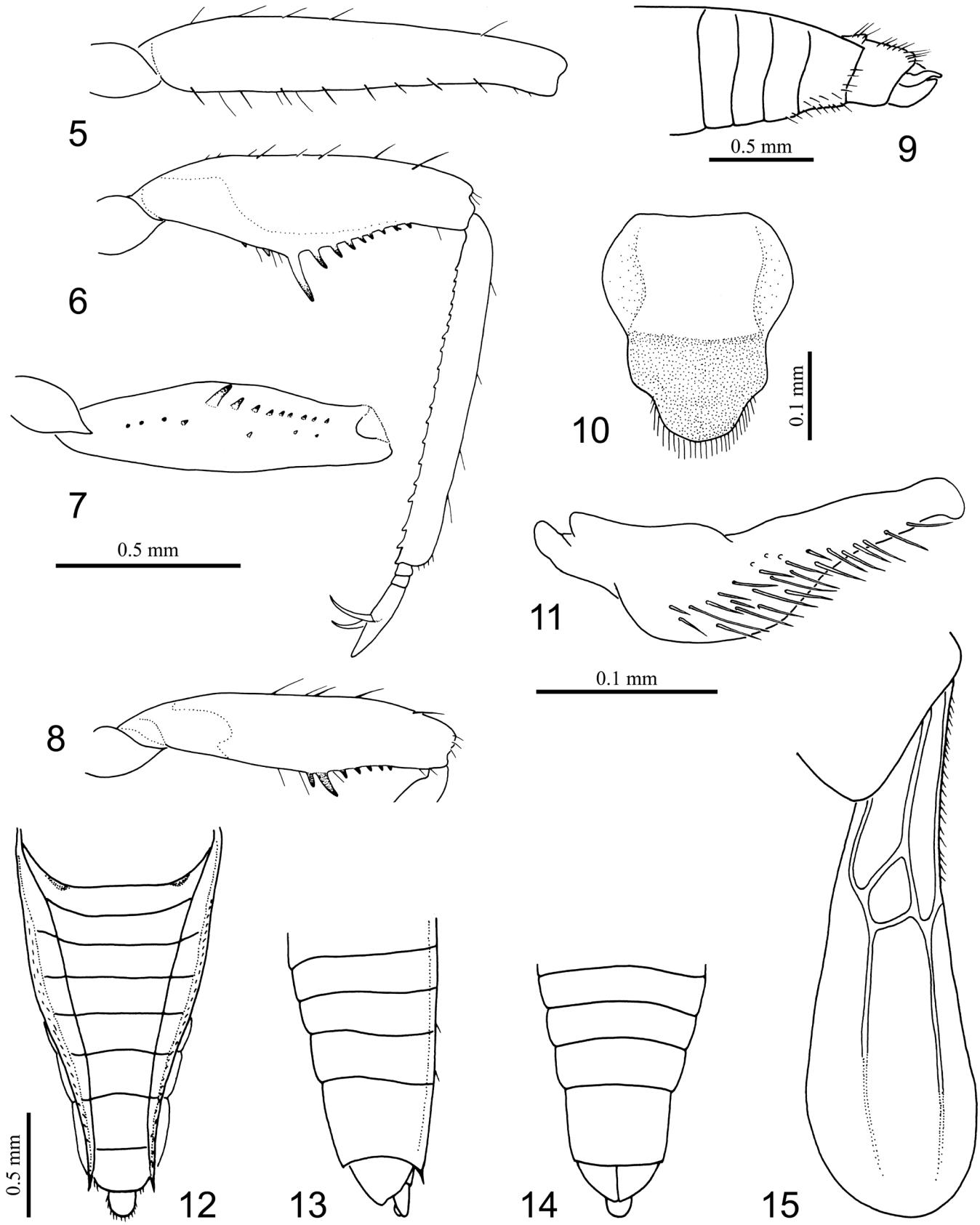
Distribution. Vietnam (northern): Dien Bien, Lai Chau, Ha Giang, Phu Tho, Thanh Hoa, Nghe An.

Rhagovelia bisinuata, new species
(Figs. 3, 4, 16–24)

Material examined. Holotype (apterous male) and **allotype** (apterous female): VIETNAM, Nghe An Prov., Pu Mat N'Park, Khe Kem waterfall & stream, site #1, coll. Ngo Q.H., 20 December 2012, NQH1203 (ZMHU). **Paratypes:** VIETNAM: **Nghe An Prov.:** 2 males, 2 females (apterous), 2 males (macropterous), same locality data as holotype (ZMHU); 1 male, 5 females (apterous), 10 males, 6 females (macropterous), Pu Mat N'Park, Kem waterfall and stream, coll. Tran A.D. et al., 18 April 2013, TAD1310 (ZMHU). **Lao Cai Prov.:** 1 male (apterous), Sa Pa, Ban Ho, Nam Pu stream 1, coll. Dinh N.H. et al., 21 October 2012, DNH12.01 (ZMHU). **Ha Giang Prov.:** 1 male, 1 female (macropterous), Vi Xuyen, Xin Chai commune, Da stream by the road from Thanh Thuy to Lao Chai, coll. Tran A.D. et al., 09 May 2014, TAD1405 (ZMHU). **Vinh Phuc Prov.:** 11 males, 3 females (apterous), 2 males, 3 females (macropterous), Tam Dao N'Park, Suoi Bua Lon (Bua Lon stream), coll. Tran A.D., 19 June 2003, TAD0356 (ZRC). **Phu Tho Prov.:** 1 male, 4 females (apterous), 1 female (macropterous), Xuan Son N'Park, Lap stream, site 1, at Ngoc waterfall, coll. Tran A.D. et al., 5 June 2013, TAD1331 (ZMHU); 4 males, 2 females (apterous), Xuan Son N'Park, Lap stream, site 2, first concrete bridge from Ngoc waterfall, coll. Tran A.D. et al., 5 June 2013, TAD1332 (ZMHU); 2 males, 2 females (apterous), Xuan Son N'Park, Lap stream, site 3, second concrete bridge from Ngoc waterfall, coll. Tran A.D. et al., 5 June 2013, TAD1333 (ZMHU); 3 males, 4 females (apterous), 1 male (macropterous), Xuan Son N'Park, Kim Thuong, Tan Ong stream, site 2, ca. 2 km from Chin Tang waterfall, coll. Tran A.D. et al., 6 June 2013, TAD1335 (ZMHU); 3 males, 1 female (apterous), Xuan Son N'Park, Kim Thuong, Tan Ong stream, site 3, ca. 4 km from Chin Tang waterfall, coll. Tran A.D. et al., 6 June 2013, TAD1336 (ZMHU); 4 males, 2 females (apterous), Xuan Son N'Park, Kim Thuong, Tan Ong stream, site 2, ca. 2 km from Chin Tang waterfall, coll. Tran A.D. et al., 28 August 2013, TAD1341 (ZMHU); 2 males, 4 females (apterous), Xuan Son N'Park, Lap stream, site 1, at Ngoc waterfall, coll. Tran A.D. et al., 30 August 2013, TAD1352 (NHMW); 1 male, 3 females (apterous), Xuan Son N'Park, Lap stream, site 2, first concrete bridge from Ngoc waterfall, coll. Tran A.D. et al., 30 August 2013, TAD1353 (ZMHU); 2 males, 1 female (apterous), Xuan Son N'Park, Lap stream, site 3, second concrete bridge from Ngoc waterfall, coll. Tran A.D. et al., 30 August 2013, TAD1354 (ZMHU). **Ha Tinh Prov.:** 32 males, 49 females (apterous), 1 male, 1 female (macropterous), Vu Quang N'Park, Khe Lim waterfall, coll. Tran A.D., 24 April 2003, TAD0304 (ZRC).

Description. Size: Apterous males: body length 3.00–3.35 (holotype: 3.15), width 1.26–1.39 (holotype: 1.35); apterous females: length 3.05–3.50 (allotype: 3.35), width 1.39–1.55 (allotype: 1.53); macropterous males: length (without wings) 3.10–3.45, width 1.41–1.46; macropterous females: length (without wings) 3.30–3.45, width 1.50–1.55.

Colour (Figs. 3, 4): body mainly black; antennal segment 1 light yellowish at proximal half, brown at distal half; antennal segments 2–4 brown to dark brown; juga, anteclypeus, and rostrum brown to dark brown; pronotum anteriorly with median transverse orange band (width ca. half of pronotum width, median length about a quarter of pronotum length); all acetabulae apically dark brown; all coxae and trochanters mostly yellowish, except distal half of mesotrochanter brown; profemur light yellowish at least at proximal half, brown to black at distal part; metafemur chiefly dark brown or black, only basal one tenth of metafemur yellowish; mesofemur, all



Figs. 5–15. *Rhagovelia caudata*, new species. 5, right mesofemur of male; 6, right hind leg of male; 7, right metafemur of male, posterior view; 8, right metafemur of female; 9, apex of abdomen of male, lateral view; 10, proctiger of male; 11, left paramere; 12, abdomen of female, dorsal view; 13, 14, apex of abdomen of female, lateral view (13) and ventral view (14); 15, right forewing of male. (5–8 same scale; 12–15 same scale).

tibiae and tarsi mostly brown to black. In females, posterior margin of sternite 7 and gonocoxa brown.

Pilosity: body with short, appressed golden pubescence; dorsum of head, pro- and mesopleura, with numerous long, erect brown or black setae; antennae with scattered long brown or black setae; mesosternum with long yellowish hairs forming inverted V-shaped patch running towards posterior margin; posterior of metasternum with long yellowish hairs; legs with scattered long brown or black setae; in males, abdominal sternites with numerous long, sub-erect yellowish hairs, particularly more dense on lateral areas of sternites; in males, abdominal segment 8 with long brown hairs posteriorly; in females, only lateral areas of sternites with long, sub-erect yellowish hairs, posterior margin of tergite 8, gonocoxa and all of proctiger with long dense brown hairs directed latero-caudad (Figs. 4, 21–23).

Apterous male: Head length 0.38, width 0.81, eye length 0.32. Lengths of antennal segments 1–4: 0.72, 0.38, 0.47, 0.45. Juga mostly smooth, without spicules; thoracic sterna and pleura without scattered spicules. Pronotum short, median length 0.23; mesonotum length 0.65, about 2.8 times length of pronotum; metanotum length 0.11. Lengths of leg segments (femur, tibia, tarsus 1+2+3): fore leg: 0.79, 0.92, 0.02+0.02+0.22; middle leg: 1.41, 1.21, 0.07+0.52+0.65; hind leg: 1.06, 1.17, 0.04+0.08+0.27. All coxae and trochanters usually without spicules (as in holotype), or at most very few black spicules on dorso-distal surface of metacoxa and metatrochanter in some specimens. Metatrochanter (Fig. 16) with 2–4 black teeth (four in holotype) ventro-distally. Metafemur (Fig. 16) slender, length about 4.5 times width (width without teeth: 0.23), ventral surface armed with a row of teeth, comprising two portions: the proximal portion with 9–10 short, closely-situated teeth starting from base of metafemur, followed by four teeth gradually increasing in length, of which the longest tooth at basal two-fifths of metafemur; the distal portion with 5–7 teeth (five in holotype), starting from the longest tooth at distal two fifths and 4–6 other short, widely-spaced teeth towards apex of metafemur. Metatibia (Fig. 16) slender and straight, inner side with a row of teeth gradually increasing in length from base to apex of tibia.

Abdominal segments gradually narrowed towards abdominal apex; tergites 1–6 subequal in length (0.15–0.20), tergite 7 clearly longer (0.31) than each of preceding tergite, length 0.8 times width, raised posteriorly in lateral view (Fig. 18); abdominal sternites 2, 3 weakly carinate medially; sternite 7 slightly shining; both ventral and dorsal abdominal segment 8 shining. Genital segments: small and weakly modified; segment 8 small, subcylindrical, dorsal length 0.40, anterior of ventral surface medially keeled; pygophore subovate, posterior margin produced medially forming angular apex; proctiger (Fig. 19) longer than wide, proximal half bearing rounded lateral lobes, distal half setiferous; paramere (Fig. 20) flat and sinuate, apex blunt, the middle of lateral surface set with few long setae.

Apterous female: Hind leg (Fig. 17): metatrochanter without black teeth, metafemur slightly more slender, length about 4.8 times width (width 0.22), ventral surface of metafemur with fewer teeth than in males, the proximal row completely reduced or with fewer teeth, the distal row comprising one longer tooth and 3–4 shorter teeth situated towards apex; metatibia straight, inner side without armature.

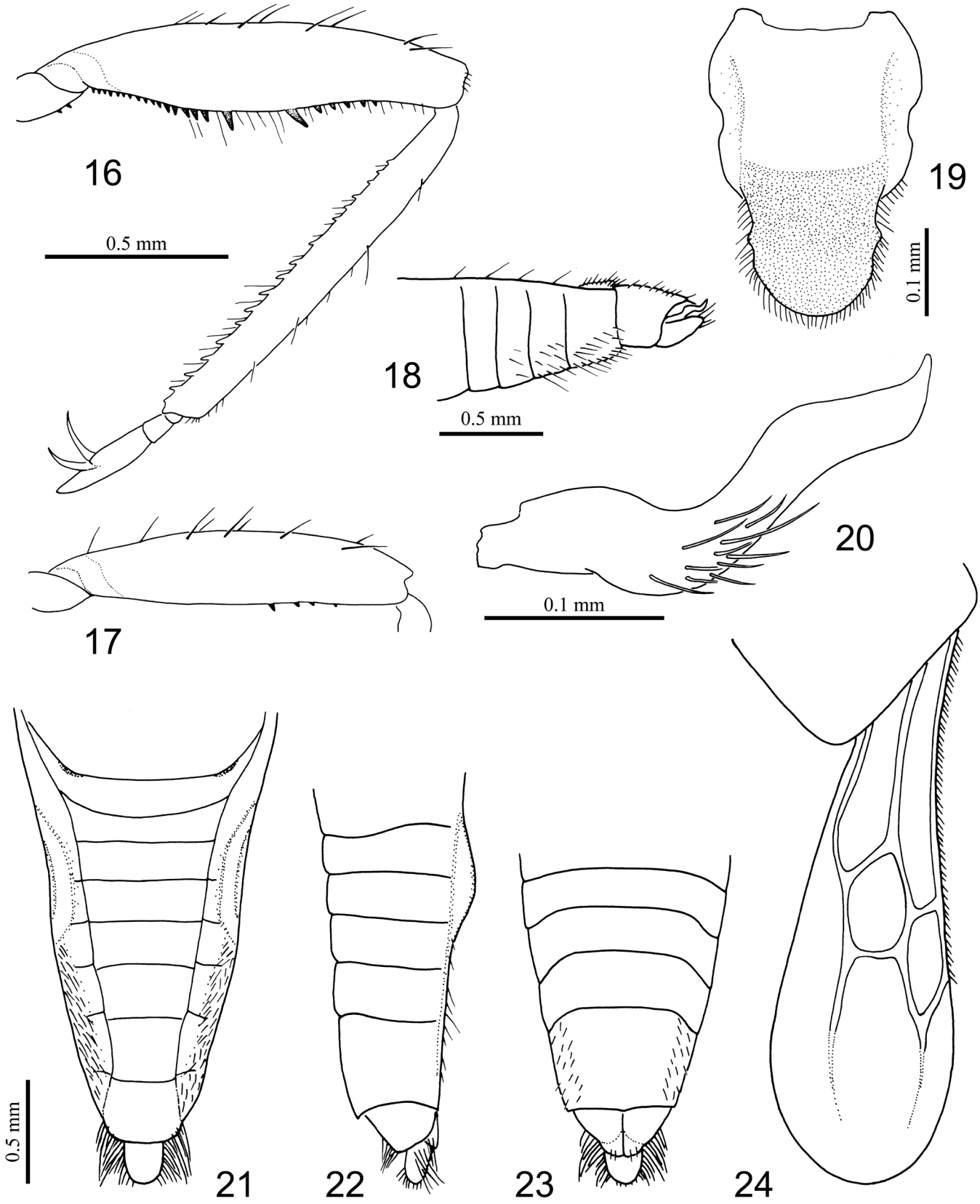
Abdomen (Figs. 21–23): laterotergites sloped latero-dorsad; laterotergites 6, 7 covered with dense appressed long brown hairs making connexiva 6, 7 appearing somewhat thick; connexiva unevenly converging posteriorly: connexiva 1, 2, 6, 7 narrow; connexiva 3 and 4 shining, swollen upwards and inwards; tergites 1–4 subequal in length (0.16–0.19), tergites 5–8 longer, length as follows: 0.22, 0.25, 0.31, 0.29; tergite 7 about as long as wide; tergite 8 shorter than wide, with posterior margin straight, and postero-lateral margin with dense tufts of hair (Fig. 21); tergite 8 and sternite 7 shining; in lateral view, posterior end of connexivum right-angled and not produced (Fig. 22); abdominal sternites 2, 3 weakly carinate medially; posterior margin of sternite 7 slightly produced medially (Fig. 23); gonocoxa simple, plate-like, mainly exposed; proctiger small, relatively slender, directed straight caudad. Other structural characteristics similar to males.

Macropterous males: Pronotum large, with prominent humeri. Forewing (Fig. 24) with four closed cells, distal cells small, about half the size of basal cells. Metafemur slightly more slender with median teeth on ventral surface shorter than in apterous males. Other characteristics similar to apterous males.

Macropterous females: Pronotum and forewing similar to those of macropterous males. Other characteristics similar to apterous females.

Etymology. The word *bisinuata* refers to the sinuate paramere of this species.

Comparative notes. *Rhagovelia bisinuata*, new species clearly belongs to the *R. sarawakensis* group, in having pronotum shorter than eye length, forewing with four closed cells. However, it can be easily separated from other species of this group by the combination of the following characteristics: the shape of male proctiger (Fig. 19), the sinuate paramere (Fig. 20), the swollen connexiva 3 and 4 of females (Figs. 21, 22), and the postero-lateral dense tufts of hairs on tergite 8 of females (Figs. 21–23). Among these characteristics, the shape of the paramere and the modification of connexiva 3 and 4 of females have not been observed in other Asian species of *Rhagovelia*. The structure of metafemur of both sexes of *R. bisinuata*, new species, is similar to those of *R. sondaica* Polhemus & Polhemus, 1988, a common and widespread species in Peninsular Malaysia and Borneo, but the parameres and structure of the female abdomen are distinctly different between these two species.



Figs. 16–24. *Rhagovelia bisinuata*, new species. 16, right hind leg of male; 17, right metafemur of female; 18, apex of abdomen of male, lateral view; 19, proctiger of male; 20, left paramere; 21, 22, abdomen of female, dorsal view (21) and lateral view (22); 23, apex of abdomen of female, ventral view; 24, right forewing. (16, 17 same scale; 21–24 same scale).

DISCUSSION

To present knowledge, Southeast Asia mainland contains two species groups, the *R. sarawakensis* group and the *R. papuensis* group (see Polhemus & Polhemus, 1988; Polhemus, 1990; Zettel & Tran, 2004). Regarding the *R. sarawakensis* group, it was originally recognised by Polhemus & Polhemus (1988), including species with short pronotum (shorter than eye length). In the same study, Polhemus & Polhemus (1988) also recognised *R. sumatrensis* Lundblad, 1933 as a species group of its own, with most diagnostic characters same as *R. sarawakensis* group, except for having spines on proximal part of mesofemur. Polhemus (1990), via the identification key to species of Southeast Asian mainland plus South Asia and Taiwan, included *R. sumatrensis* in the *R. sarawakensis* group, and subsequent works, e.g., by Nieser et al. (1997) and Zettel (2000, 2001), followed this classification. Both *R. caudata*, new species and *R. bisinuata*, new species, although clearly belonging to the *R. sarawakensis* group (by having short pronotum), possess morphological features significantly different from other species of this group, and the relationships between these two new species and other species of this group remain unclear. On the other hand, the findings of these two new species also suggest that the diversity of the *R. sarawakensis* group in Southeast Asian mainland may be greater than what literature has reported, and thus it requires further attention to study the fauna and systematics of *Rhagovelia* in this region.

Distribution. Vietnam (northern): Lao Cai, Ha Giang, Phu Tho, Nghe An, Ha Tinh.

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