



New species and new records of genus *Rhyacophila* Pictet (Trichoptera: Rhyacophilidae) from Dabie Mountains, east-central China

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Abstract

Three new species of *Rhyacophila*, *Rhyacophila longiramata* n. sp., *Rhyacophila haplostephanodes* n. sp., and *Rhyacophila brevitergata* n. sp., from the Dabie Mountains of east-central China, are described and illustrated. *Rhyacophila longiramata* n. sp. and *R. haplostephanodes* n. sp. both are highly specialized, which makes them very difficult to be put in any existing species group. Possible positions for these two species are discussed. *Rhyacophila brevitergata* n. sp. belongs to the *R. nigrocephala* Species Group. *Rhyacophila* spp. from Dabie Mountains are listed.

Key words: Oriental Biogeographic Region, caddisfly, species groups, male genitalia, morphology

Introduction

The Rhyacophilidae comprise one of the oldest lineages of the order Trichoptera (Kjer *et al.* 2001), with most of its species (762 of 815 spp.) in the genus *Rhyacophila* (Morse 2016). Larvae of species of *Rhyacophila* most commonly occur in rapidly flowing, unpolluted streams (Wiggins 1996) in the northern hemisphere, with the highest species diversification occurring in the Oriental Region (Morse 2016). There are 120 species of *Rhyacophila* recognized in China (Yang *et al.* 2016). The Dabie Mountains (Ta-pieh Mountains, as in Wade-Giles Romanization) are in east-central China on the borders of An-hui, Hu-bei, and He-nan Provinces, approximately in the boundary between southern (Oriental) and northern (Palearctic) China. The streams in these mountains provide ideal habitat for *Rhyacophila* species. The aim of this article introduces some new knowledge of *Rhyacophila* species from Dabie Mountains.

Material and methods

Specimens were collected by a light sheet or over a light pan trap (Steyskal *et al.* 1986), with a few specimens collected by an aerial sweep net during 2014–2015. The light sheet trap apparatus consisted of a piece of white sheet outdoors near streams at night illuminated with a 250-W mercury vapor light. Attracted by the light, the caddisfly adults alighted on the sheet and were easily collected into vials of 100% EtOH by hand.

The light pan trap apparatus consisted of a white pan with some 100% EtOH in it on the bank of a creek at night. A portable ultraviolet light tube (15-watt BL) was placed across the plate above the alcohol. Trichoptera adults were attracted by the light, then fell into the alcohol and drowned. The pan trap was often left outside overnight and the specimens were collected and sorted the next morning.

Trichoptera adults were also collected with an aerial sweep net, beating the vegetation near clean creeks during early morning or late afternoon hours.

Specimens were preserved in 100% alcohol. To illustrate male genitalia, abdomens were removed and immersed in 10% KOH overnight. After KOH-macerated muscle and other non-chitinous tissues were removed,

specimens were submerged in a few drops of glycerin and observed under a dissecting, stereo microscope. Either an ocular grid or a drawing tube were used to prepare pencil templates of the various views. The templates were traced with the vector graphics software Adobe Illustrator® to produce digital illustrations.

Terminology used in the descriptions follow that of Schmid (1970) except the sclerotized basal part of the phallus is called “phallobase” (Nielsen 1957) and the apical portion of the phallus is called “phallicata” (“phallicata” [sic], Ross 1956).

Types of the new species are deposited in the Insect Collection, Nanjing Agriculture University, Nanjing, Jiangsu Province, PR China (NJAU) and Huazhong University of Science and Technology, Wuhan, Hubei Province, PR China. (HUST).

***Rhyacophila longiramata* Qiu, n. sp.**

(Figs. 1A–1D)

Holotype, male. P.R. CHINA: An-hui Province, Yue-xi County, Yao-luo-ping Nature Preserve, 30.9863°N, 116.0981°E, 9-v-2015, Coll. Shuang Qiu, Tianyu Liu (NJAU).

Paratype. P.R. CHINA: An-hui Province: Same data as holotype, 3 males (HUST).

Male. Body brown, forewings each 7.9–8.7 mm long (n = 4).

Male genitalia. Segment IX (IX) subrectangular, about twice as tall as long, broadly concave anteriorly and broadly convex posteriorly in lateral view, without apicodorsal lobe. Segment X tall, with two branches: dorsal, horizontal branch of segment X (h.b.X) with pair of short setose apicolateral lobes (preanal appendages?) separated by broad and rounded excision, strongly sclerotized and slender bifid process (b.p.) extending from beneath base of horizontal branch (Figs. 1A, 1B); vertical branch (v.b.X) taller than length of horizontal branch, anterior and posterior margins sinuous in lateral view (Fig. 1A). Anal sclerites (a.s.) large, triangular in lateral and ventral views (Figs. 1A, 1D). Tergal strap vestigial and apical band (a.b.) well sclerotized, apical band U-shaped in ventral view (Fig. 1D), spoon-like in lateral view (Fig. 1A). Inferior appendages 2.5 times as long as segment IX, each with first segment (f.s.i.a.) subrectangular in lateral view, slightly broader apically than basally, second segment (s.s.i.a.) with distal margin slightly incised, covered mesally with subapical spines, lower lobe twice as large as upper lobe (Fig. 1A). Phallobase (phb.) and tenons (t.) very short (Fig. 1A); phallicata (phc.) slightly longer than apical band (Fig. 1A), flask-like in ventral view (Fig. 1C); dorsal process (d.p.) small, half as long as phallicata, slightly trifid apically; parameres absent.

Diagnosis. This species stands apart from other *Rhyacophila* species by its impressive bifid process of segment X and the especially shortened and simplified phallus. Its position in genus *Rhyacophila* will be discussed below.

Female. Unknown.

Etymology. Latin adjective *longiramata*, or English “long branched,” referring to the bifid process of segment X.

Distribution. Known only from An-hui Province, RPC, the Oriental Region.

***Rhyacophila haplostephanodes* Qiu, n. sp.**

(Figs. 2A–2D)

Holotype, male. P.R. CHINA: Hu-bei Province, Huang-mei County, Nuo-bu-yuan, 30.2302°N, 115.8316°E, 22-iv-2015, Coll. Shuang Qiu, Tianyu Liu (NJAU).

Paratype. P.R. CHINA: Hu-bei Province: Same data as holotype, 2 males (HUST).

Male. Body brown, forewings each 9.4–9.8 mm long (n = 3).

Male Genitalia. Segment IX (IX) subrectangular in lateral view, with upper portion slightly broader than lower portion, anterior, posterior and ventral margins straight, dorsal margin rounded; apicodorsal lobe (ad.l.) very large, two times as long as preanal appendages (p.a.), divided into pair of lateral lobes apically with small sharp process mesally; middle of ventral side with small triangular projection (Figs. 2A, 2B). Preanal appendages (or horizontal branches of segment X) large, setose, projecting caudad, each with short dorsal lobe (d.l.) at midlength and another apicoventrally. Segment X (X) oblique, projecting posterad ventrally (Fig. 2A), strongly sclerotized on

edges, slightly bifurcate apically (Figs. 2A, 2D). Tendons (td.) highly sclerotized and fused with phallic dorsal process at base. Anal sclerites (a.s.) surrounded by lobes of segment X, small, triangular in ventral view (Fig. 2D). Apical band (a.b.) very thin, slightly sclerotized and U-shaped (Fig. 2D). Tergal strap (t.s.) short, membranous (Figs. 2A, 2D). Inferior appendages large, four times as long as segment IX at midheight, first segment (f.s.i.a.) trapezoidal in lateral view (Fig. 2A); second segment (s.s.i.a.) somewhat rectangular in lateral view, articulating with first segment dorsally, otherwise connected with first segment by membranes, movable, with prominent basoventral angle and small finger-like lobes on apicodorsal and apicoventral corners, curved posteromesad, with no mesal spinous area (Fig. 2A). Phallobase (phb.) short, tenons (t.) small; phallicata (phc.) slender and short, curved slightly upward, with tiny tooth at midlength dorsally, (Fig. 2A, shown here retracted in endothecal membrane); parameres absent; dorsal process (d.p.) in lateral view slightly longer than phallicata, sword-like, in ventral view with its base narrower, apex slightly wider and shallowly incised mesally, ventral branch slightly longer than retracted phallicata (Fig. 2A), lateral edges curved upward with shallow apical excision between them (Fig. 2C).

Diagnosis. This species looks very similar to *R. haplostephana* Sun & Yang 1998, in the male genitalia, but can be distinguished by the following characteristics: (1) The new species has a sharp process between the two lateral lobes of the apicodorsal lobe of segment IX (there is no sharp process in this position, but instead a subapical tooth on the mesal surface of each of the lateral lobes of *R. haplostephana*), (2) there is a small triangular projection at midlength on the ventral margin part of this apicodorsal lobe (there is no such process in *R. haplostephana*), (3) the apical band is much thinner than in *R. haplostephana*, and (4) the anal sclerites are triangular in ventral view (round in ventral view in *R. haplostephana*).

These two species look very similar to each other morphologically; their position in the genus *Rhyacophila* will be discussed below.

Female. Unknown.

Etymology. Latin adjective *haplostephanodes*, English “like a half crown,” referring to the close similarity of the male genitalia to those of *R. haplostephana*.

***Rhyacophila brevitergata* Qiu, n. sp.**

(Figs. 3A–3E)

Holotype, male. P.R. CHINA: Hu-bei Province, Huang-mei County, Nuo-bu-yuan. 30.2302°N, 115.8316°E. 22-iv-2015, Coll. Shuang Qiu, Tianyu Liu.

Male. Body dark brown, forewings each 8.5 mm long (n = 1).

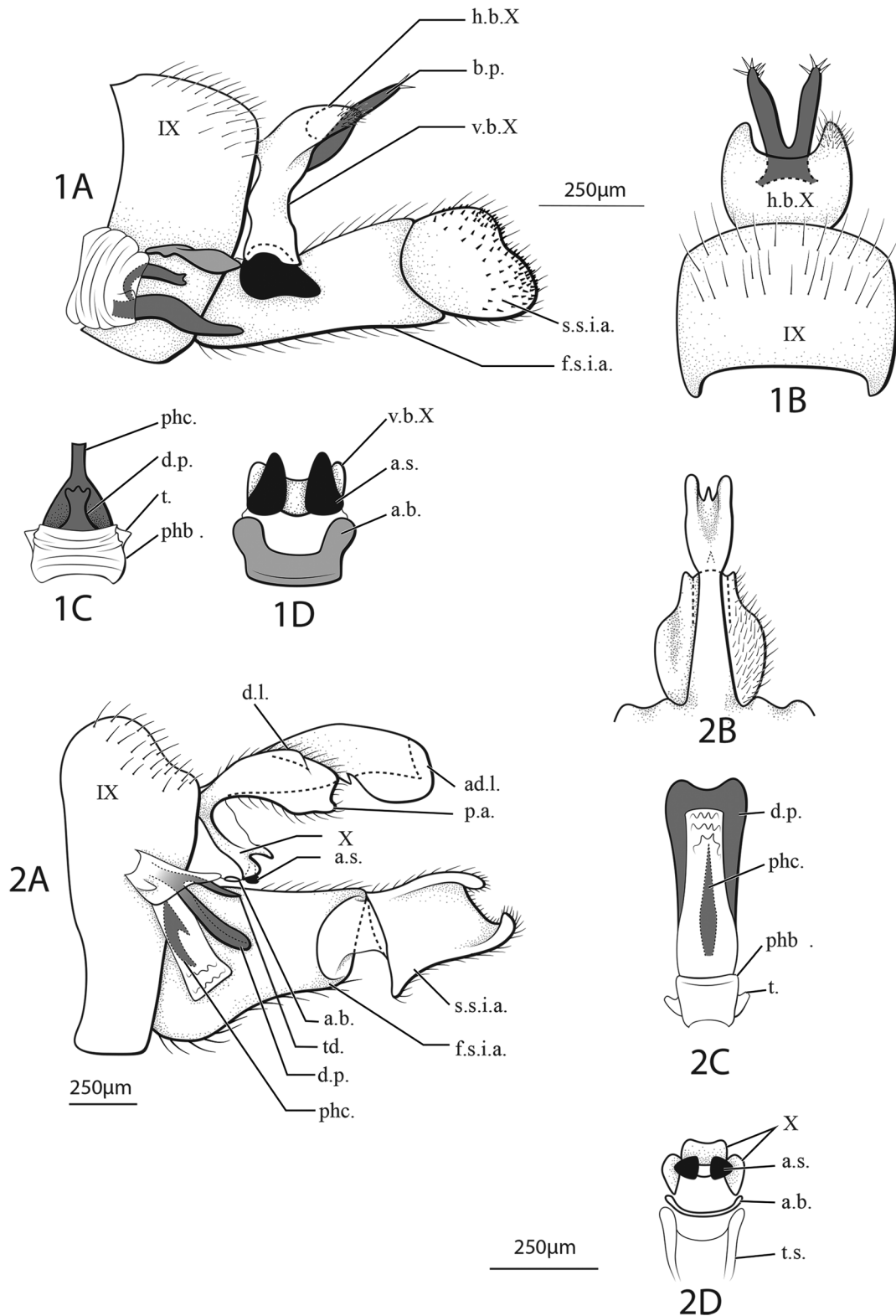
Male Genitalia. Segment IX (IX) ring-shaped, subrectangular in lateral view, without apicodorsal lobe (Fig. 3A). Segment X (X) flat, as long as segment IX, finger-like in lateral view (Fig. 3A), rectangular in dorsal view (Fig. 3B), with apex produced posterad as small tongue-like lobe, as long as dorsal part of segment IX. Anal sclerites (a.s.) large, deeply divided into two lobes, 1.5 times as long as segment X (Figs. 3A, 3B). Apical band (a.b.) small, crescent-like in lateral view (Fig. 3A). Tergal strap (t.s.) long and thin, sagittal process (s.p.) shaped vaguely as trefoil (Fig. 3D), half as long as tergal strap. Inferior appendages stout, slightly longer than segment IX; each with first segment (f.s.i.a.) rectangular and about as long as anal sclerites in lateral view, second segment (s.s.i.a.) about 1/3 as long as first segment, apex slightly incised and with spinous areas subapicomeresally above and below incision (Fig. 3A). Phallobase (phb.) short, subtriangular in lateral view (Fig. 3A); phallicata (phc.) long, abruptly acuminate apically (Fig. 3E); without parameres.

Diagnosis. This new species belongs to the *R. nigrocephala* Species Group and looks similar to *R. exilis* Sun & Yang 1999 in male genitalia, but can be easily distinguished by the following characteristics: (1) Segment X of the new species is straight and half as long as the inferior appendages (segment X is curved slightly upward and longer than the inferior appendages in *R. exilis*) and (2) the anal sclerites are 1.5 times as long as segment X (small, not visible in dorsal view in *R. exilis*).

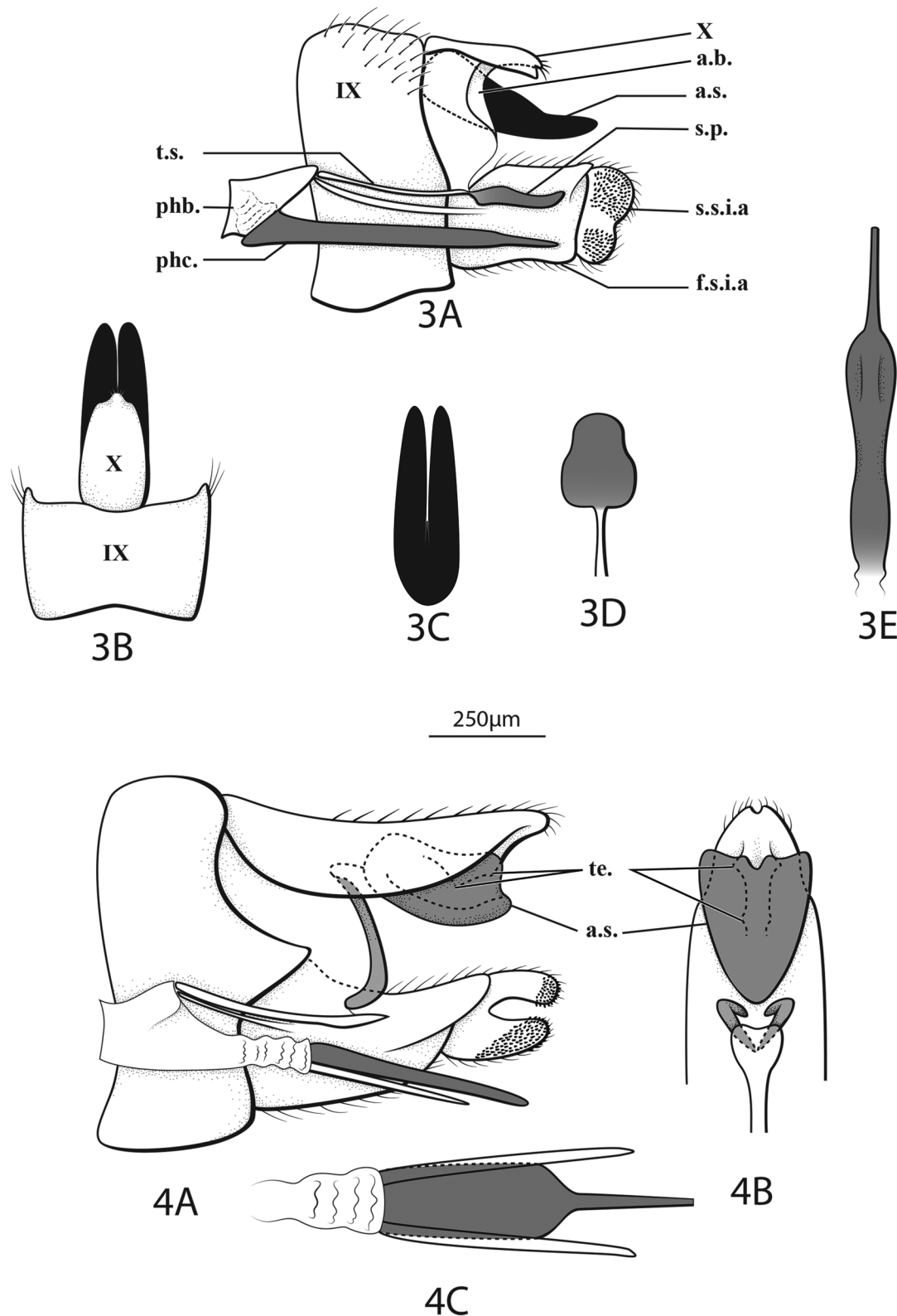
Female. Unknown

Etymology. Latin adjective *brevitergata*, or English “short backed,” referring to the short tergite X of this species.

Distribution. Known only from Hu-bei Province, PRC, the Oriental Region.



FIGURES 1–2. *Rhyacophila* spp., male genitalia. 1A–1D, *Rhyacophila longiramata* n. sp.: 1A, left lateral, with the left inferior appendage omitted; 1B, segments IX and X, dorsal; 1C, phallus dorsal; 1D, anal sclerites and apical band, ventral. 2A–2D, *Rhyacophila haplostephanodes* n. sp.: 2A, left lateral, with left inferior appendage omitted; 2B, apicodorsal lobe of segment IX and preanal appendages, dorsal; 2C, phallus, ventral; 2D, anal sclerites and apical band, ventral. Abbreviations: a.b. = apical band; ad.l. = apicodorsal lobe of segment IX; a.s. = anal sclerite; b.p. = bifid process; d.l. = dorsal lobe; d.p. = dorsal process of phallus; f.s.i.a. = fist segment of an inferior appendage; h.b.X = horizontal branch of segment X; IX = segment IX; p.a. = preanal appendage; phb. = phallobase; phc. = phallicata; s.s.i.a. = second segment of an inferior appendage; t. = tendon; td. = tendons; t.s. = tergal strap; v.b.X = vertical branch of segment X; X = segment X.



FIGURES 3–4. *Rhyacophila* spp., male genitalia. 3A–3E, *Rhyacophila brevitergata* n. sp.: 3A, left lateral, with left inferior appendage omitted; 3B, segments IX and X, dorsal; 3C, anal sclerites, ventral; 3D, sagittal process, ventral; 3E, phallicata, ventral. 4A–4C, *Rhyacophila manuleata* Martynov: 4A, left lateral, with left inferior appendage omitted; 4B, segment X, ventral; 4C, phallus, ventral. Abbreviations: a.b. = apical band; a.s. = anal sclerite; f.s.i.a. = first segment of an inferior appendage; IX = segment IX; phb. = phallobase; phc. = phallicata; s.p. = sagittal process; s.s.i.a. = second segment of an inferior appendage; te. = teeth; t.s. = tergal strap; X = segment X.

New records from Dabie Mountains

Rhyacophila manuleata Martynov 1934

(Figs. 4A–4C)

P.R. CHINA: An-hui Province, Yue-xi County, Yao-luo-ping Nature Preserve, 30.9863°N, 116.0981°E, 9-v-2015, Coll. Shuang Qiu, Tianyu Liu; **Hu-bei Province**, Huang-mei County, Nuo-bu-yuan, 30.2302°N, 115.8316°E, 22-iv-2015, Coll. Shuang Qiu, Tianyu Liu.

Compared with the illustration by Schmid (1970), this specimen has two pairs of small lateral teeth (te.) instead of three teeth on the apicoventral part of segment X, and the anal sclerite (a.s.) has a small notch in the middle. The specimens collected in Japan (reported as *R. kawamurae*) showed some variation in this species (Tsuda 1940, Schmid 1970). So those differences are probably merely some other variations. This species has been reported also from East Palearctic Korean People's Democratic Republic (Mey, 1989) and Far East Russia (Martynov 1934; Ivanov 2011), and from Oriental Tai-wan (Malicky 2014), but has not been reported from mainland China previously.

Rhyacophila claviforma Sun & Yang 1998

P.R. CHINA: An-hui Province, Yue-xi County, Yao-luo-ping Nature Preserve, 30.9863°N, 116.0981°E, 9-v-2015, Coll. Shuang Qiu, Tianyu Liu; Qian-shan County, Ban-cang village, 31.0017°N, 116.5419°E, 3-x-2015. Coll. Qiu Shuang, Han Xingfeng. **Hu-bei Province**, Luo-tian County, Tian-tang-zhai, 31.0993°N, 115.7337°E, 15-vii-2014, Coll. Qiu Shuang, Yan Yunjun. The species was reported previously from East Palearctic Gan-su Province and Oriental An-hui and Si-chuan Provinces by Yang *et al.* (2005, 2016) and Cao *et al.* (2016).

Rhyacophila euterpe Malicky & Sun 2002

P.R. CHINA: Hu-bei Province, Luo-tian County, Tian-tang-zhai, 31.0993°N, 115.7337°E, 15-vii-2014, Coll. Qiu Shuang, Yan Yunjun. The species was reported preciously from East Palearctic He-nan Province (Malicky & Sun 2002); Yang *et al.* 2005, 2016) and now is known also from Oriental Hu-bei Province).

Rhyacophila eurystheus Malicky & Sun 2002

P.R. CHINA: An-hui Province, Yue-xi County, Yao-luo-ping Nature Preserve, 30.9863°N, 116.0981°E, 9-v-2015, Coll. Shuang Qiu, Tianyu Liu; Qian-shan County, Ban-cang village, 31.0017°N, 116.5419°E, 3-x-2015, Coll. Qiu Shuang, Han Xingfeng. **Hu-bei Province**, Luo-tian County, Tian-tang-zhai, 31.0993°N, 115.7337°E, 15-vii-2014, Coll. Qiu Shuang, Yan Yunjun; Ying-Shan County, Tao-hua-chong, 30.9926°N, 115.9961E 7-v-2015, Coll. Qiu Shuang, Liu Tianyu. The species was reported previously from East Palearctic He-nan Province (Malicky & Sun) 2002; Yang *et al.* 2005, 2016) and now is known also from Oriental An-hui Province.

Rhyacophila longistyla Sun & Yang 1995

P.R. CHINA: Hu-bei Province, Ying-Shan County, Tao-hua-chong. 30.9926°N, 115.9961E 7-v-2015, Coll. Qiu Shuang, Liu Tianyu. This Oriental species was reported previously also from An-hui and Jiang-xi Provinces by Sun & Yang (1995) and Yang *et al.* (2005, 2016).

Rhyacophila mimiclaviforma Sun & Yang 1998

P.R. CHINA: Hu-bei Province, Luo-tian County, Tian-tang-zhai, 31.0993°N, 115.7337°E, 3-iv-2014, Coll. Qiu

Shuang, Zha Daiming. This Oriental species was reported previously also from Yun-nan Province by Sun & Yang (1998) and Yang *et al.* (2005, 2016).

***Rhyacophila pentagona* Malicky & Sun 2002**

P.R. CHINA: Hu-bei Province, Luo-tian County, Tian-tang-zhai, 31.0993°N, 115.7337°E, 28-v-2014, Coll. Qiu Shuang, Ke Caixia; Ying-Shan County, Tao-hua-chong, 30.9926°N, 115.9961°E, 7-v-2015, Coll. Qiu Shuang, Liu Tianyu. This Oriental species was reported previously also from Yun-nan Province by Malicky & Sun (2002) and Yang *et al.* (2005 as *Rhyacophila pentagonum*, 2016).

***Rhyacophila triangularis* Schmid 1970**

P.R. CHINA: An-hui Province, Tong-Cheng Town, Longmian mountain, 31.1063°N 116.8884E, 14-ix-2015, Coll. Qiu Shuang, Qiu Guihan; Qian-shan County, Ban-cang village, 31.0017°N, 116.5419°E, 3-x-2015. Coll. Qiu Shuang, Han Xingfeng. **He-nan Province**, Xin-yang County, Dong-zhai Nature Preserve, 31.9490°N 114.2551°E, 9-vii-2015, Coll. Qiu Shuang, Sun Xianhui; **Hu-bei Province**, Da-wu County, Da-wu mountain, 31.3750°N 114.2310°E, 1-v-2015, Coll. Qiu Shuang, Liu Tianyu. The species was reported previously also from Oriental Hunan Province (Schmid 1970; Yang *et al.* 2005, 2016). Our record from He-nan Province now extends its range slightly into the East Palearctic Region.

Discussion

Ross (1956) and Schmid (1970) both gave rather comprehensive discussions on *Rhyacophila* species. Some of the species groups are still in use today. In order to find the possible position of each of *R. longiramata* and *R. haplostephanodes*, we compared the characters of each clade and tried to find the closest species group for each of these two new species. Since Schmid's (1970) work was based on Ross' (1956) taxonomy of the genus *Rhyacophila* and is widely accepted, our discussion will concentrate mainly on Schmid's system.

The phallus of each of these new species has no parameres. This character occurs in species that are remotely separated both geographically and phylogenetically (for example, *R. ecosa* of the *R. ecosa* Group, *R. divaricata* Branch, the Nearctic Region; *R. montana* of the *R. montana* Group, *R. vulgaris* Branch, the Nearctic Region; *R. obtusa* of the *R. tristis* Group, *R. philopotamoides* Branch, the West Palearctic Region). It appears that the absence of parameres is homoplastic, occurring independently in these different groups. Furthermore, when the parameres are absent, there seems to be no trace or vestige. So in this discussion, we will not give much weight to presence/absence of parameres.

Position of *R. longiramata* n. sp. In Schmid's (1970) system, *R. longiramata* shares some characters with the *R. philopotamoides* Branch with regard to (1) the apparent absence of preanal appendages and (2) the vertical orientation of segment X (key by Saini & Lakhwinder 2012). This Branch has high species diversification and was divided into three clades: *R. invaria* Clade, *R. philopotamoides* Clade, and *R. castanea* Clade.

There are some species without parameres in the *R. philopotamoides* Clade. However, *R. longiramata* seems not to belong to this clade because: (1) Anal sclerites of this group are fused into one sclerite; (2) the apical band of this group is not in a U-shape, but in a large median tongue shape with two arms; (3) the tergal strap of this group is very long and narrow; (4) the phallicata of this group has a ventral lobe; and (5) most of the species in this group do not have a phallic dorsal process.

The *R. castanea* Clade contains many Oriental species. Species groups in this clade share a character of having a well-developed ventral lobe below the phallicata. Species in this clade also have long tergal strap, a relatively small apical band and an elongated phallobase ("phallotheca"). None of these characters fit with *R. longiramata* well.

It is more likely that this new species belongs to *R. invaria* Clade, because (1) segment X of this clade is large; (2) the anal sclerites are large, and paired; (3) the phallus has a dorsal process; (4) the phallobase and tendons are

short, and (5) the second segment of the inferior appendages each has one spinous area. On the other hand, species in this group often have a large phallic ventral lobe (Schmid 1970, Schmid *et al.* 1993) which *R. longiramata* does not have.

Within the *R. invaria* Clade, there are 12 species groups. Among these groups, we hypothesize that *R. longiramata* n. sp. is in the *R. sibirica* Group as indicated by the following characters: (1) Segment X is large, subvertical; (2) the median tongue of the apical band is absent; (3) the tergal strap is short; (4) the endotheca is greatly reduced; (5) the dorsal process of the phallus has three lobes; (6) the phallobase is reduced; (7) the anal sclerites are paired and not fused with each other; and (8) parameres are absent. All of these characters can be observed in other species in the *R. sibirica* Group but not in other species groups.

Schmid (1970) treated the *R. angelita* Group as a sister group of the *R. sibirica* Group because they have a similarly shaped segment X and phallus. Further diagnosis evidence that *R. longiramata* is not in the *R. angelita* Group is that species in this group are highly specialized: they have a very long horizontal branch of segment X and the phallicata has a pair of lateral processes, which are not observed in *R. longiramata*.

Apparently for lack of specimens in the *R. yosiiiana* Group, Schmid (1970) did not say much about this group. Schmid's (1970) work was based on Ross' (1956), so we will discuss this species group in Ross's system.

In Ross' (1956) system, the *R. sibirica* Group belongs to branch 7 and is a sister group of the *R. yosiiiana* Group. The general character of branch 7 is the U-shaped apical band connected directly to the phallobase. *Rhyacophila longiramata* seems to fit this description well. However, Ross thought that the ventral lobe of the *R. sibirica* Group is a fusion of parameres, and this is the most distinctive difference between the two groups in this branch. Since the new species has neither a ventral lobe nor parameres, this character seems not helpful on deciding the position of *R. longiramata* in Ross' *R. sibirica* Group.

Ross' (1956) description of the *R. yosiiiana* Group mentioned an "undivided dorsal structure" of segment X, which may have some relationship with the impressive bifid structure of *R. longiramata*. Species in this group also have a slightly divided phallicata. However, species in this group have the anal sclerites very small or, mostly, absent. So the new species apparently does not belong to Ross' *R. yosiiiana* Group.

Briefly, we suggest that the most likely species group for *R. longiramata* is the *R. sibirica* Group. However, it is hard to ascribe it to any of the six subgroups of the *R. sibirica* group because of the lack of a ventral lobe on the phallus. The absence of a ventral lobe, together with the bifid appendage of segment X, and the shortened, simplified phallus are probable unique apomorphies. Consequently, we suggest that *R. longiramata* be assigned to a new subgroup, the *R. longiramata* Subgroup.

Position of *R. haplostephanodes* n. sp. Sun & Yang (1998) described segment X of *R. haplostephana* as a large segment with two branches, as in the *R. sibirica* Group. The appendages beside the apicodorsal lobe were treated as horizontal branches of segment X. Those authors did not state a similar species or a phylogenetic position. We suggest that those thick lobes are preanal appendages because they are setose. In Schmid's illustrations, the preanal appendages are always covered with setae, and segment X often has a few setae or are without setae. Holzenthal (2007) also summarize the typical appearance of preanal appendages as "large, digitiform and setose." The presence of preanal appendages and the vertical segment X suggest that this new species belongs to Schmid's (1970) *R. vulgaris* Branch.

The structure and shape of segment IX and segment X look like those of the *R. rotunda* Group species. However, species of this group do not have a phallic dorsal process and the anal sclerites of this group are relatively large. In addition, the species of this group are restricted to the Nearctic Region. Thus, it seems not likely for *R. haplostephanodes* to be close to this group.

The most similar group in this branch apparently is the *R. anatina* Group suggested by the following characters: (1) Species of the *R. anatina* Group have a bilobed apicodorsal lobe of segment IX; (2) segment X of this group is vertical; (3) the tergal strap of this group is short; and (4) the phallus of this group has a dorsal process. Furthermore, species of this group have a considerable distribution in the Oriental Region (31 spp., Sun 2016). Again, the phallicata of the *R. anatina* Group is slender, half inserted in the well-developed endotheca. This suggests a possibility that the membrane surrounding the phallicata of *R. haplostephanodes* is endotheca. However, the apicodorsal lobe of segment IX in the *R. anatina* Group is never longer than the first segment of the inferior appendages, and segment X is extended from the middle of the preanal appendages in lateral view, not extended from the base of the preanal appendages as in *R. haplostephanodes*. Another important character of this group is that the apical band is strongly sclerotized and divided into two parts, not like that of *R. haplostephanodes*.

In general what these suggest is that *R. haplostephanodes* is not in the *R. anatina* Group, but possibly represents a new species group very close to it. The complete apical band and the enlarged apicodorsal lobe of segment IX are distinctive characteristics. The new species group, *R. haplostephana* Group, contains *R. haplostephana* Sun & Yang 1998, and *R. haplostephana* n. sp.

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