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Three new species of *Goera* Stephens (Trichoptera: Goeridae) from Sulawesi, Indonesia

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Three new species of *Goera* Stephens (Trichoptera: Goeridae) from Sulawesi, Indonesia

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Abstract. Three **new species** of the caddisfly genus *Goera* Stephens (Trichoptera: Goeridae) are described from the Indonesian island of Sulawesi. *Goera neboissi* sp. n., *G. jolanda* sp. n., and *G. higleri* sp. n. were found to be related to *G. skiasma* Neboiss, which is the only previously recorded species from Sulawesi. These species share the following combination of characters: an upright IXth segment; the absence of the median dorsal process of tergum X; a long, mesal process of the inferior appendage with a subbasal projection; and, the absence of parameres.

Key words. Caddisfly, Trichoptera, *Goera*, new species, Indonesia, Sulawesi

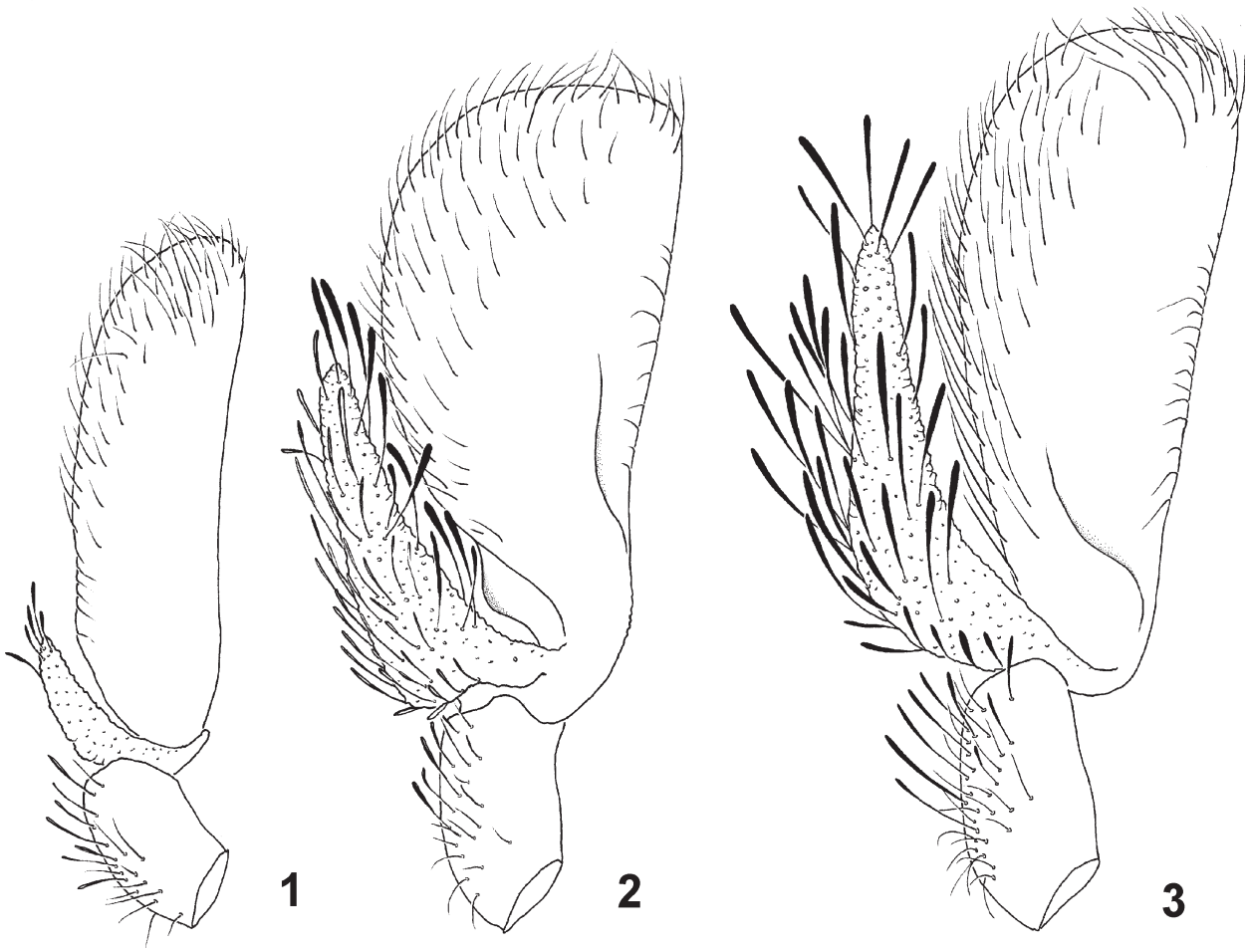
Introduction

Sulawesi is one of the largest Sunda Islands in Indonesia, the fourth largest island in that country, and the eleventh largest island in the world. It is a part of a group of Indonesian islands that lie between Wallace's Line and Lydekker's Line. These islands, to varying degrees, host species from both the Oriental and Australasian Biogeographic Regions, and contain many endemics that are not truly from either of these biogeographic regions in terms of current relationships (Simpson 1977). The currently described caddisfly fauna of Sulawesi consists of 99 species, the overwhelming majority of which are endemic. Investigations of the Sulawesi caddisfly fauna began in the late 19th and first half of the 20th centuries by McLachlan (1875) and Ulmer (1905, 1930, 1951). However, most of the species in Sulawesi were described during the late 20th Century and the first decade of the 21st Century (Cartwright 1992; Geraci and Morse 2008; Malicky et al. 2009; Mey 2006; Neboiss 1987, 1989, 1990, 1993, 1994, 1999; Neboiss and Botosaneanu 1988; Weaver and Huisman 1992; Wells 1990; Wells and Huisman 2001; and, Wells and Neboiss 1987).

The genus *Goera* Stephens (Trichoptera: Goeridae) is represented in all biogeographic regions except the Neotropical. It is found from the subarctic to the circum-equatorial islands of Indonesia. The classification and evolution of *Goera* within the Goeridae has been discussed by Schmid (1980), and later by Gall (1994), who defined the family Goeridae based on a revision of the world genera. Of the approximately 140 described species, about 110 are known from the Oriental Region. Only one species, *Goera skiasma* Neboiss 1990, has been previously described from Sulawesi. During 1989, scientists from the National Museum of Natural History, Leiden, the Netherlands (RMNH) collected aquatic insects in Sulawesi. Examination of these collections revealed three new species of *Goera*.

The type material of *Goera skiasma* (holotype and paratype males) was received from the Victoria Museum, Melbourne, Australia. During the examination of *G. skiasma* and the three new species described herein, it became apparent that they are closely related, and obviously form a group within the genus. This group shares the following combination of characters: an upright IXth segment; the median dorsal process of tergum X absent; the mesal process of the inferior appendage long, evenly tapered to the apex, and having a subbasal projection; and, parameres are absent.

The purpose of this paper is to describe and illustrate the three new species of *Goera* and to illustrate the paratype male of *G. skiasma*. All new species are stored in 80% alcohol and will be deposited in the entomology collection of the RMNH. Terminology follows that of Yang and Armitage (1996).



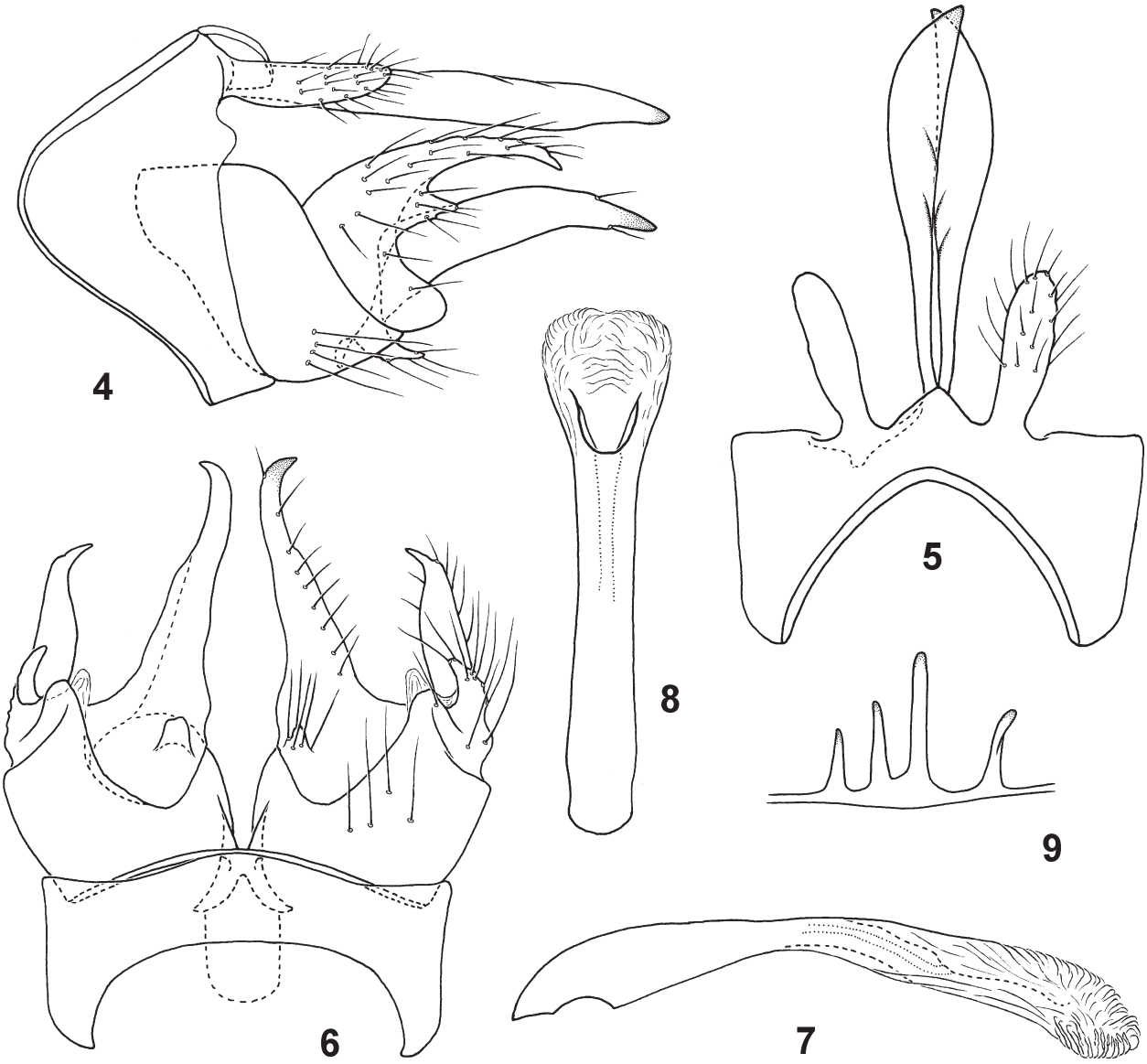
Figures 1-3. Left maxillary palpi, lateral. **1)** *Goera neboissi* sp. n. **2)** *Goera jolanda* sp. n. **3)** *Goera higleri* sp. n.

***Goera neboissi* sp. n.**
Fig. 1, 4-12

Diagnosis. This new species is similar to *Goera skiasma*, *G. jolanda* sp. n., and *G. higleri* sp. n., which together form a species group. The male genitalia of *G. neboissi* differs by the shape of the ventrolateral processes of tergum X; by the unique, trilobed shape of the distal segment of the inferior appendage; by the short subbasal projection of the mesal process of the inferior appendage; and, by the tubular phallus in dorsal view. The female genitalia of *G. neboissi* share some similarities with those of *G. skiasma* and *G. higleri* but are distinct in the shape of sternite IX in both, lateral and ventral, views, as well as in the shape of supragenital plate, vulvar scale and vaginal apparatus having a short vaginal vestibule.

Adult. Length of forewing: male – 4.7-6.2 mm; female – 5.9-7.0 mm. Body and wings (in alcohol) light yellowish brown in both sexes. Sternite VI in males usually with three spines (central longer than lateral), however holotype male with four spines unequal in number and length on each side; in females with two spines of smaller size on each side of central spine with bifid apex. Sternite V lacks spines. Erectile lobe of male maxillary palp yellowish, nearly cylindrical with short, tapered projection at base, about one-fifth length of lobe in unexpanded condition (Fig. 1).

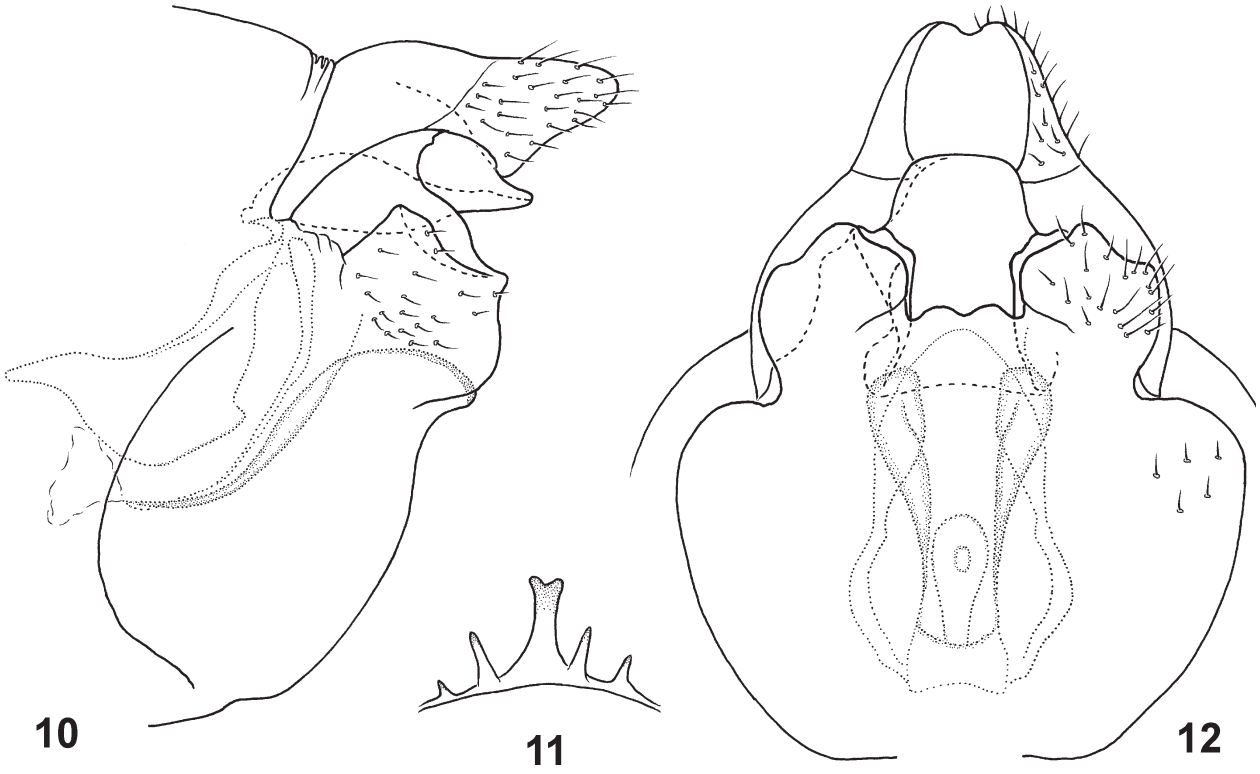
Male genitalia (Fig. 4-9). Segment IX nearly vertical; in lateral view, anterior margin widely rounded and medially produced anteriorly. Preanal appendages elongate, 2.5 times shorter than ventrolateral process of tergum X. Median dorsal process of tergum X absent. Ventrolateral process of tergum X flat,



Figures 4-9. *Goera neboissi* sp. n., male genitalia. **4)** Lateral. **5)** Dorsal. **6)** Ventral. **7)** Phallus, lateral. **8)** Phallus, dorsal. **9)** Processes of sternum VI.

semi-oblanceolate in dorsal view, extended posteriorly as far as inferior appendage in lateral view; with mesal margin slightly concave, and having small surface creases. Basal segment of inferior appendage about twice as high as wide in lateral view. Distal segment of inferior appendage forms three lobes: long, claw-like apicodorsal lobe; short, triangular subapical lobe; and short, rounded basal lobe. Mesal process of inferior appendage long, in lateral view bent ventrocaudad, tapering to acute apex, and having short subbasal projection; in ventral view mesal process tapering, with claw-like apex directed posterolaterad and subbasal projection knob-like. Phallus long, constricted mesally and gently bent posteroventrad in lateral view; tubular with expanded membranous apical portion in dorsal view; parameres absent.

Female genitalia (Fig. 10-12). Sternite IX with sinusoidal distal margin in ventral view. Segment X without deep apicomesal incision, typical of most *Goera* species, but with shallow depression in ventral view. Supragenital plate rather short, widely truncated distally in ventral view. Vulvar scale short, divided by shallow mesal depression in ventral view; lobes rounded. Vaginal apparatus elongate with short vaginal vestibule.



Figures 10-12. *Goera neboissi* sp. n., female genitalia. **10)** Lateral. **11)** Processes of sternum VI. **12)** Ventral.

Immature stages. Unknown.

Holotype male: INDONESIA, Sulawesi, Tenggara, Peg. Boroboro, 30 km SW Kendari, 200 m, 26 October 1989, MV light, J. Huisman, RMNH JS 8926. Paratypes: 5 males, 4 females, same data as holotype.

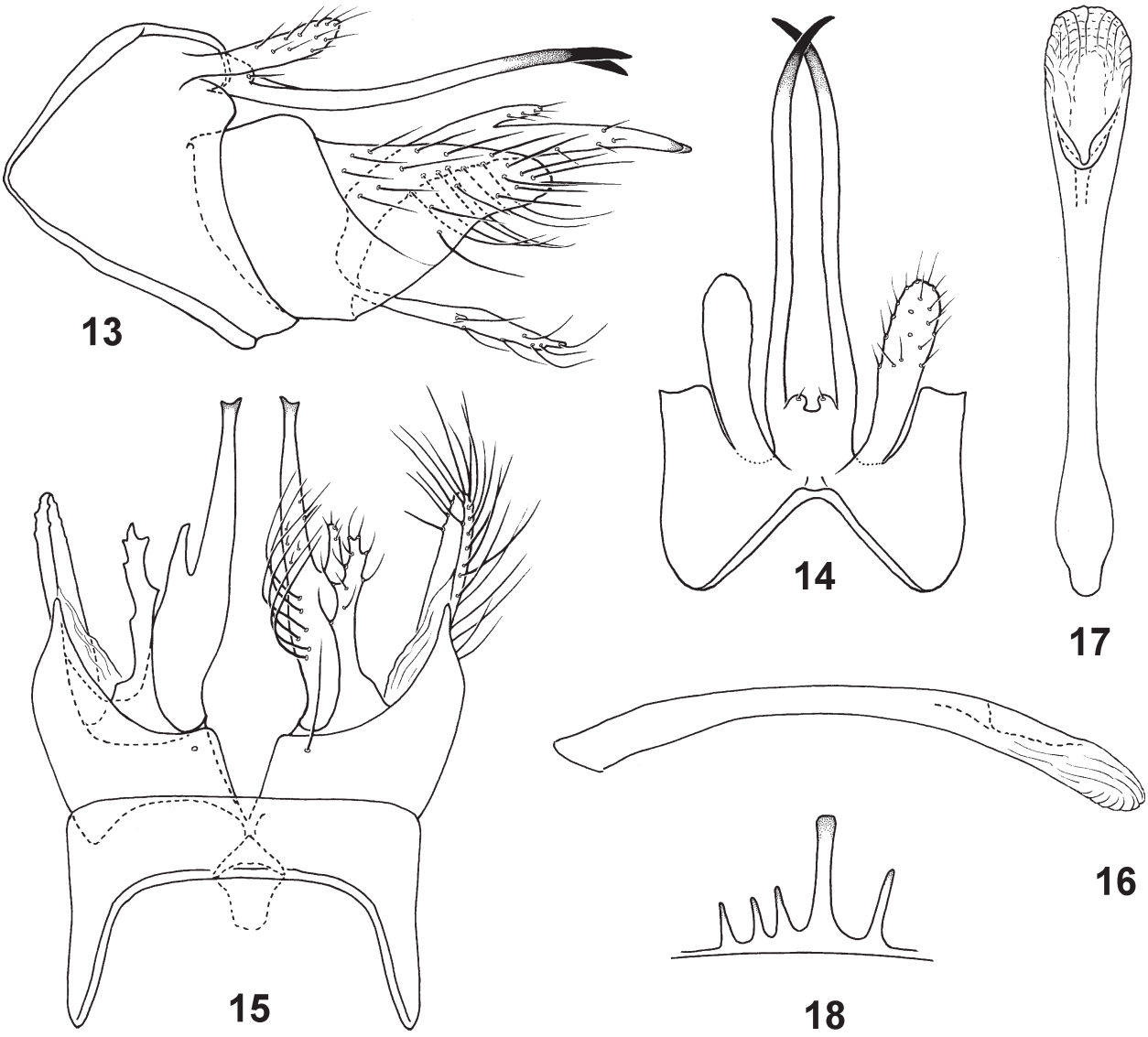
Etymology. This species is named after the late Dr. Arturs Neboiss of the Victoria Museum, Melbourne, Australia, in recognition of his lifetime passion for caddisflies.

***Goera jolanda* sp. n.**
Fig. 2, 13-18

Diagnosis. This species is similar to *Goera skiasma*, *G. neboissi*, and *G. higleri*. It differs by the rod-like ventrolateral process of tergum X; by characters of the mesal process of the inferior appendage, including the dorsomesal claw-like projection, the proboscis-like apex in ventral view, and the long subbasal projection.

Adult. Length of forewing: male – 6.6-6.9 mm. Body and wings (in alcohol) light yellowish brown. Sternite VI of holotype male with asymmetrical arrangement of 5 spines (Fig. 18); paratype male with 5 spines symmetrically arranged. Sternite V lacks spines. Erectile lobe of male maxillary palp pale-yellowish, narrow basally and expanded apically, with tapered projection located at base, about half the length of lobe in unexpanded condition; projection covered with light yellow setae and scales anteriorly and chocolate-brown scales posteriorly (Fig. 2).

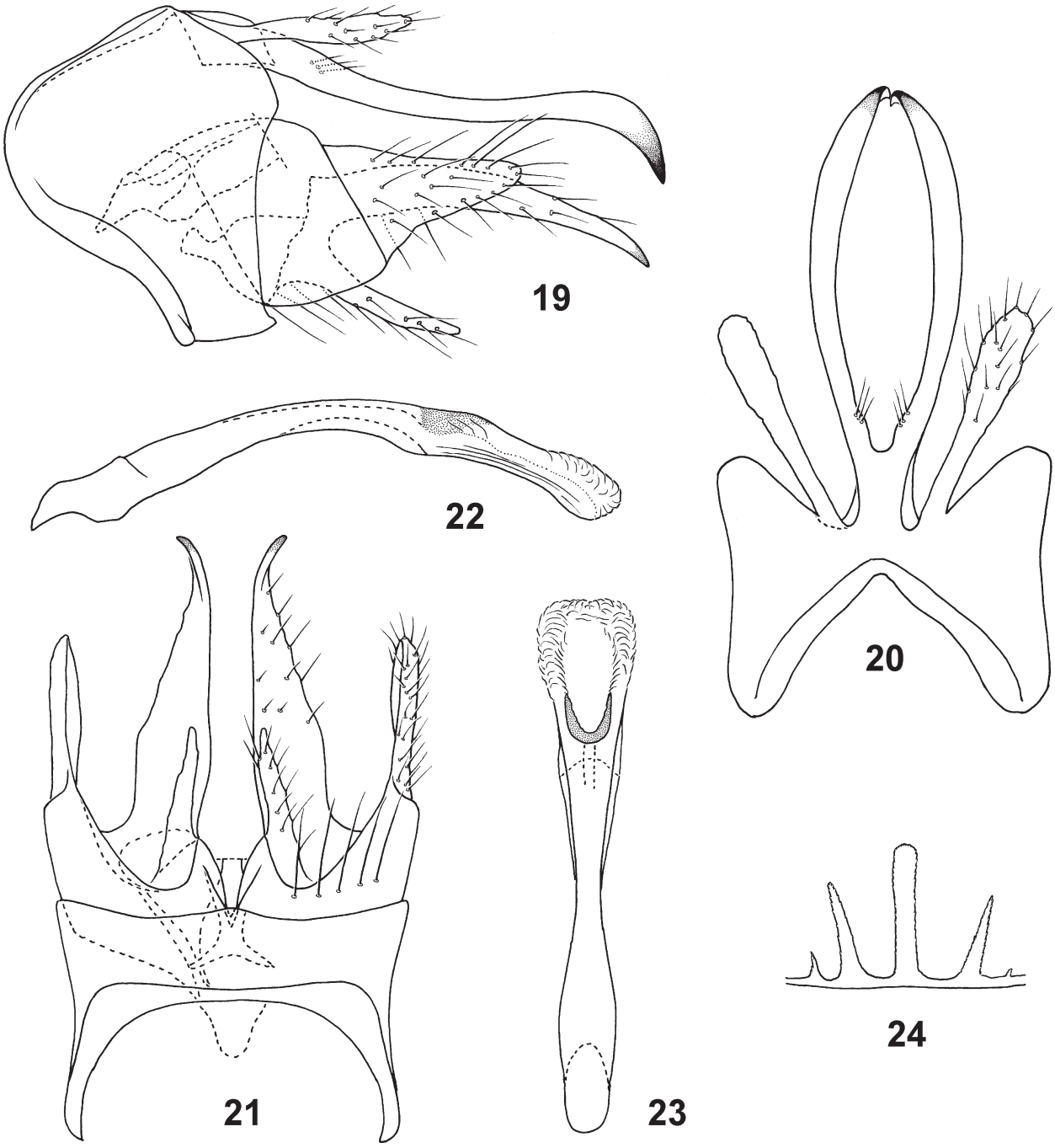
Male genitalia (Fig. 13-18). Segment IX nearly vertical, in lateral view anterior margin somewhat angular and medially produced anteriorly. Preanal appendages elongate, about 2.5 times shorter than



Figures 13-18. *Goera jolanda* sp. n., male genitalia. **13)** Lateral. **14)** Dorsal. **15)** Ventral. **16)** Phallus, lateral. **17)** Phallus, dorsal. **18)** Processes of sternum VI.

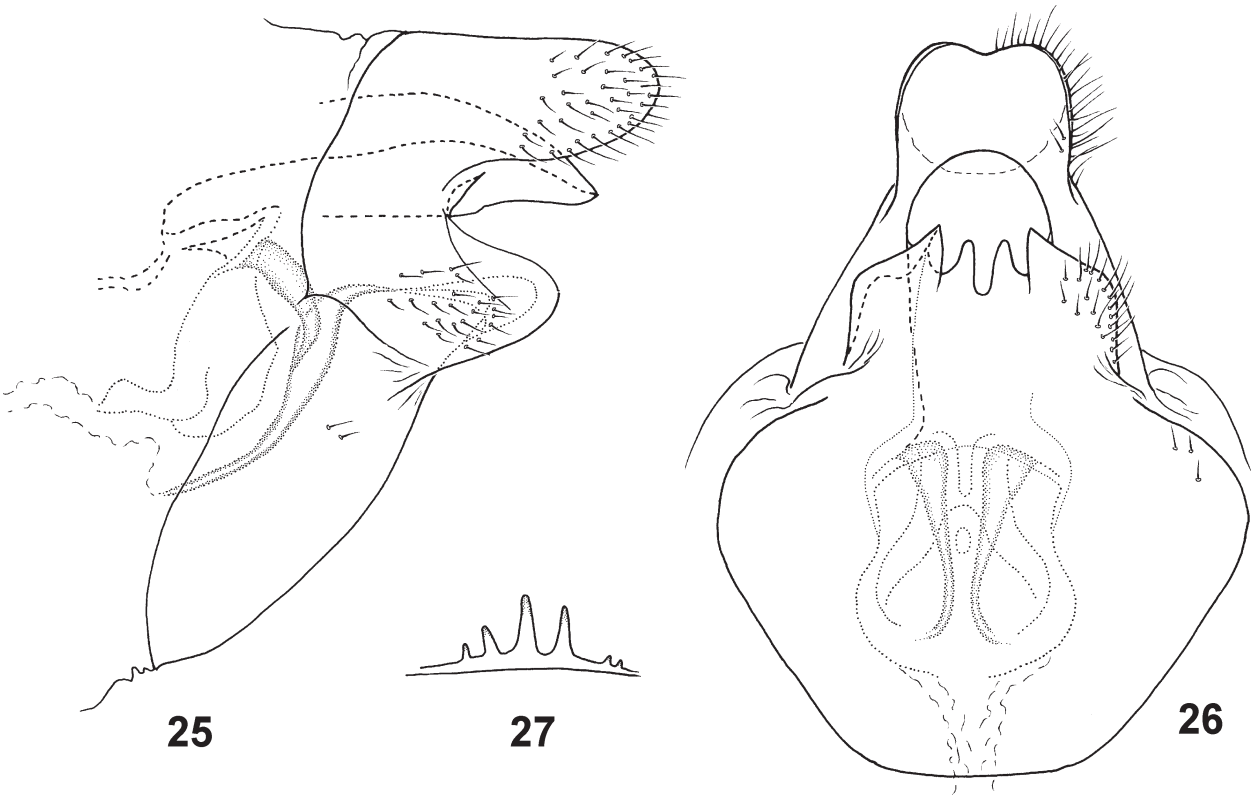
ventrolateral process of tergum X. Median dorsal process of tergum X absent. Ventrolateral process of tergum X rod-like with acute apex, slightly shorter than inferior appendage in lateral view; in dorsal view nearly parallel entire length, with apical portions bent mesad; a pair of small, slightly sclerotized rounded lobes with a single subapical seta located between ventrolateral processes at base. Basal segment of inferior appendage nearly 1.6 times as high as wide in lateral view. Distal segment of inferior appendage nearly triangular, with rounded apical portion; ventral margin slightly concave. In lateral view, mesal process of inferior appendage long, evenly tapered to apex, bearing short, fingerlike lobe dorsomesally, and having elongate subbasal projection; in ventral view, apex of mesal process proboscis-like, and subbasal projection with irregular edges. Phallus long and tubular, slightly bent posteroventrad in lateral view; in dorsal view, slightly bulbous basally and evenly expanding posterad, with membranous apical portion; parameres absent.

Immature stages and female. Unknown.



Figures 19-24. *Goera higleri* sp. n., male genitalia. **19)** Lateral. **20)** Dorsal. **21)** Ventral. **22)** Phallus, lateral. **23)** Phallus, dorsal. **24)** Processes of sternum VI.

Holotype male: INDONESIA, Sulawesi, Tenggara, Peg. Kabaena, 1 km S Tangkeno, 550 m, 9 November 1989, light, R. de Jong and J. Huisman, RMNH JS 8943. Paratype: 1 male, same data as holotype.
Etymology. This species is named for Dr. Jolanda Huisman as a tribute to her extensive field survey efforts in Indonesia and her dedication to caddisfly taxonomy.



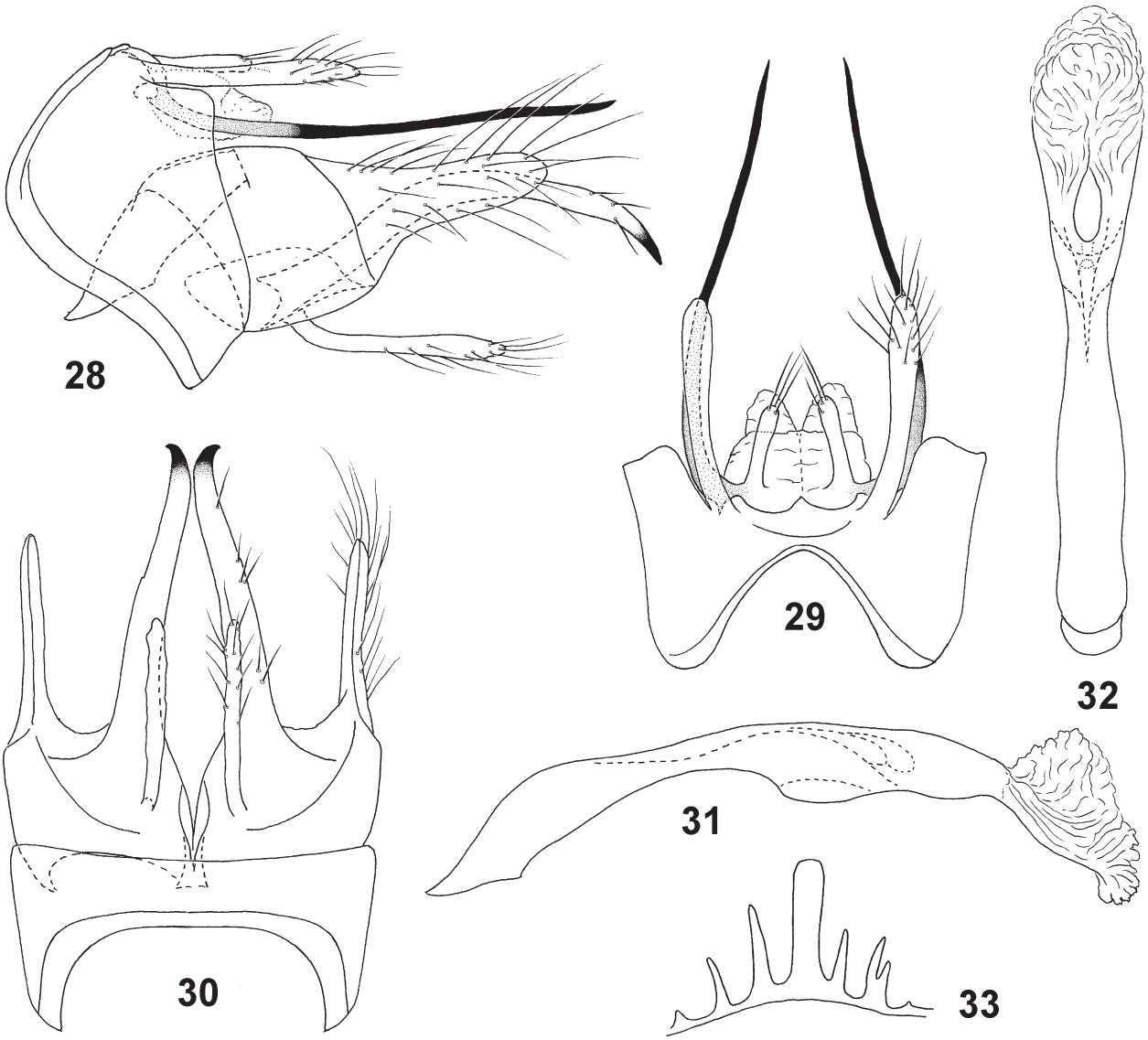
Figures 25-27. *Goera higleri* sp. n., female genitalia. **25)** Lateral. **26)** Ventral. **27)** Processes of sternum VI.

***Goera higleri* sp. n.**
Fig. 3, 19-27

Diagnosis. Among the four *Goera* species now known from Sulawesi, the male genitalia of this new species most closely resembles those of *G. skiasma* and *G. jolanda* by the mesal process of the inferior appendage possessing a rather long subbasal projection, well visible in both lateral and ventral views. However, *G. higleri* can be easily distinguished from all Sulawesi species by the shape of the ventrolateral process of tergum X. It differs from *G. skiasma* by the wider and more robust mesal process of the inferior appendage; and, from *G. jolanda* by the absence of a projection on the mesal process of the inferior appendage. The female genitalia of *G. higleri* most closely resemble those of *G. skiasma* but differ by the shape of the vaginal apparatus in ventral view.

Description. Length of forewing: male – 6.8-7.5 mm; female – 8.0-8.6 mm. Head and body yellow-brownish (in alcohol), antennae, wings and legs darker. Sternite VI in males with 3-7 spines; in females with 4-6 spines. Sternite V lacks spines. Erectile lobe of male maxillary palp light yellow, narrow basally and expanded apically, with tapered projection located at base, more than half length of lobe in unexpanded condition; projection covered with chocolate-brown setae and scales (Fig. 3).

Male genitalia (Fig. 19-24). Segment IX nearly vertical, in lateral view anterior margin widely rounded above midline and produced anteriorly. Preanal appendages elongate, less than half length of ventrolateral process of tergum X. Median dorsal process of tergum X absent. Ventrolateral process of tergum X elongate, slightly longer than inferior appendage, with distal portion slightly enlarged and then tapered to acute apex bent posteroventrad in lateral view; in dorsal view, ventrolateral processes fused basally, then each process bowed mesally until acute apices meet posteriorly; each ventrolateral process bearing mesally 3 setae slightly above fused base. Basal segment of inferior appendage nearly 1.5 times as high as wide in lateral view. Distal segment of inferior appendage nearly triangular in lateral view, ventral



Figures 28-33. *Goera skiasma* Neboiss, male genitalia. **28)** Lateral. **29)** Dorsal. **30)** Ventral. **31)** Phallus, lateral. **32)** Phallus, dorsal. **33)** Processes of sternum VI.

margin slightly concave. Mesal process of inferior appendage long (twice as long as distal segment), evenly tapered to acute apex, gently bent posteroventrad in lateral view, and having elongate subbasal projection; in ventral view, straight, almost parallel-sided for basal third, then tapered to acute apex directed posterolaterad and subbasal projection tapered, with smooth edges. Phallus bent ventrad mesally in lateral view, having small swelling ventrally; in dorsal view constricted mesally and expanded apically to rounded membranous apex; parameres absent.

Female genitalia (Fig. 25-27). Sternite IX shoulder-like in ventral view. Segment X undivided, having slight depression apicomesally in ventral view. Supragenital plate rather short, rounded distally in ventral view. Vulvar scale bifid, divided by deep mesal notch, in ventral view; lobes triangular. Vaginal apparatus slightly longer than wide, divided into nearly equal anterior and posterior portions by mesal constriction on each side in ventral view; vaginal vestibule long.

Immature stages. Unknown.

Holotype male: INDONESIA, Sulawesi, Tenggara, Moramo, Sungai Sena, 50 m, 15 November 1989, light, R. de Jong and J. Huisman, RMNH JS 8946. Paratypes: 43 males, 23 females, same data as holotype.

Etymology. This species is named after the late Dr. Bert Higler, for his lifetime accomplishments in Trichoptera biology and his affable, intellectual interactions with colleagues worldwide.

***Goera skiasma* Neboiss**

Fig. 28-33

Goera skiasma Neboiss 1990: 87-89, fig. 1-7, male, female.

Diagnosis. Male genitalia of *G. skiasma* are similar to those of the new *Goera* species from Sulawesi described herein, but can be easily distinguished from them by the ventrolateral process of tergum X positioned distantly from each other at base and by the presence of an additional pair of projections between them. In addition, it differs from *G. neboissi* by the simplicity of the distal segment of the inferior appendages, without any lobes, and by the long subbasal projection of the mesal process of the inferior appendages; from *G. jolanda*, by the absence of a fingerlike lobe dorsomesally on the mesal process of the inferior appendage; and, from *G. higleri*, in ventral view, by the shape of the mesal process of the inferior appendages and its subbasal projection. Based on the Neboiss (1990) illustrations, the female of *G. skiasma* appears to be very similar to that of *G. higleri*, but differs in the unequal anterior and posterior portions of the vaginal apparatus.

Material examined: INDONESIA, Sulawesi, Utara Dumoga-Bone N.P., Tumpah River & tributary junction, 19 May 1985, at light, Wells, Wilson, and Tan, 00°35'N 123°54'E (Project Wallace 1985), holotype male (T-10420) and paratype male (T-10421; genitalia prep. – PT - 1530).

Remarks. The holotype male of this species has never had its abdomen cleared. Neboiss (1990) figured the paratype male. We compared the holotype and paratype, and found them identical in all external characters. We have redrawn the paratype and include it for the reader's convenience. The erectile lobe of the male maxillary palp is most similar to that of *G. higleri*.

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Literature Cited

Cartwright, D. I. 1992. Descriptions of four new species of *Ecnomus* McLachlan (Trichoptera: Ecnomidae) from north Sulawesi. Bulletin Zoologisch Museum, Universiteit van Amsterdam 13: 101-108.

Gall, W. 1994. Phylogenetic studies in the Limnephiloidea, with a revision of the world genera of Goeridae (Trichoptera). Ph.D. dissertation. University of Toronto; Toronto, Canada. 140 p. + appendices.

Geraci, C. J., and J. C. Morse. 2008. New species of *Cheumatopsyche* (Trichoptera: Hydropsychidae) from north Sulawesi, Indonesia. Pan-Pacific Entomologist 84: 1-8.

McLachlan, R. 1875. Descriptions de plusieurs Névroptères-Planipennes et Trichoptères nouveaux de l'Ile de Célébes et de quelques espèces nouvelles de *Dipseudopsis* avec considérations sur ce genre. Tijdschrift voor Entomologie 18: 1-32, plates 1-2.

Malicky, H., J. P. O'Connor, and P. Ashe. 2009. Caddisflies from Sulawesi, Indonesia, with the descriptions of four new species in the genera *Chimarra* Stephens, *Helicopsyche* Siebold, *Paduniella*

Ulmer and *Tinodes* Curtis (Trichoptera). The Entomologist's Monthly Magazine 145: 79-86.

Mey, W. 2006. Notes on the caddisfly fauna of Lake Matano in Central Sulawesi - (Insecta, Trichoptera). Beiträge zur Entomologie 56: 199-212.

Neboiss, A. 1987. Preliminary comparison of New Guinea Trichoptera with the faunas of Sulawesi and Cape York Peninsula. p. 103-108. *In*: M. Bournaud and H. Tachet (eds.), Proceedings of the 5th International Symposium on Trichoptera. Dr. W. Junk; Dordrecht, Netherlands. 397 p.

Neboiss, A. 1989. Caddis-flies (Trichoptera) of the families Polycentropodidae and Hyalopsychidae from Dumoga-Bone National Park, Sulawesi, Indonesia, with comments on identity of *Polycentropus orientalis* McLachlan. Bulletin Zoölogisch Museum, Universiteit van Amsterdam 12: 101-110.

Neboiss, A. 1990. Trichoptera of the families Goeridae and Lepidostomatidae from Sulawesi, Indonesia. Memoirs of the Museum of Victoria 51: 87-92.

Neboiss, A. 1993. New species of the genus *Molanna* Curtis from Sulawesi (Trichoptera: Molannidae). Tijdschrift voor Entomologie 136: 257-258.

Neboiss, A. 1994. A review of the genus *Paranyctiophylax* Tsuda from Sulawesi, Papua New Guinea and northern Australia (Trichoptera: Polycentropodidae). Memoirs of the Museum of Victoria 54: 191-205.

Neboiss, A. 1999. Two new species of *Doloclanes* Banks from Sulawesi, with notes on the distribution of the genus. p. 285-290. *In*: H. Malicky and P. Chantaramongkol (eds.). Proceedings of the 9th International Symposium on Trichoptera. Faculty of Science, Chiang Mai University; Chiang Mai, Thailand. 479 p.

Neboiss, A., and L. Botosaneanu. 1988. Caddis-flies (Trichoptera) of the families Rhyacophilidae, Hydrobiosidae and Glossosomatidae from Sulawesi. Bulletin Zoölogisch Museum, Universiteit van Amsterdam 11: 157-168.

Schmid, F. 1980. Esquisse pour une classification et une phylogénie des Goérides (Trichoptera). Naturaliste Canadien 107: 185-194.

Simpson, R. G. 1977. Too many lines; the limits of the Oriental and Australasian Zoogeographic Regions. Proceedings of the American Philosophical Society 121(2): 107-120.

Ulmer, G. 1905. Zur Kenntniss aussereuropäesicher Trichopteren. Entomologische Zeitung (Stettin) 66: 3-119.

Ulmer, G. 1930. Trichopteren von den Philippinen und von den Sunda-Inseln. Treubia 11: 272-498.

Ulmer, G. 1951. Köcherfliegen (Trichopteren) von den Sunda-Inseln. Teil I. Archiv für Hydrobiologie 19 (Supplement): 1-528.

Weaver, J. S., III, and J. Huisman. 1992. New species and descriptions of Lepidostomatidae (Trichoptera) from Sulawesi. Zoologische Mededelingen (Leiden) 66: 429-439.

Wells, A. 1990. The micro-caddisflies (Trichoptera: Hydroptilidae) of North Sulawesi. Invertebrate Taxonomy 3: 363-406.

Wells, A., and J. Huisman. 2001. New hydroptilid caddisfly species from southern Sulawesi (Insecta: Trichoptera: Hydroptilidae). Zoologische Mededelingen (Leiden) 75: 207-216.

Wells, A., and A. Neboiss. 1987. A glimpse of north Sulawesi Trichoptera. Trichoptera Newsletter 14: 21-23.

Yang, L., and B. J. Armitage. 1996. The genus *Goera* (Trichoptera: Goeridae) in China. Proceedings of the Entomological Society of Washington 98(3): 551-569.

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