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The Fijian Species of *Goera* Stephens, 1829 (Trichoptera: Goeridae) with Description of Two New Species[1]

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Abstract. *Goera vuda*, **n.sp**. and *Goera abaca*, **n.sp**. are described and illustrated from Viti Levu, Fiji and compared with *Goera fijiana* Banks, the only previously known species from Fiji. Records are given of unassociated females collected on Viti Levu and Vanua Levu, and distribution maps are presented for all Fijian species in the genus.

INTRODUCTION

The family Goeridae Ulmer belongs to the caddisfly suborder Brevitentoria Weaver (Kjer *et al*., 2001; Weaver, 1983). The 11 genera recognized in the family are divided into the subfamilies Goerinae Ulmer (9 genera), Larcasinae Navas and Lepaniinae Wiggins, the latter 2 each with a single genus. The 6 species in the genus *Larcasia* Navas are known from either the Palaearctic or the Oriental Region and the monotypic genus *Lepania* Ross is endemic to the Nearctic Region. The most diverse genus of the Goerinae is *Goera* Stephens which, with 133 described species, represents more than 80% of the Goeridae species diversity. Representatives of the genus are recorded in the Nearctic, Palaearctic and Afrotropical Regions but the highest number of species is recorded in the Oriental Region. Two *Goera* species have previously been described from the Australasian Region. *Goera aneityuma* Neboiss was described from the Vanuatu (Aneityum) based on a relatively large sample comprising 5 males and 10 females. No species have been recorded so far from other areas in the Australasian biogeographical region, and the Vanuatu and Fijian species represent the southernmost records of the genus.

MATERIALS AND METHODS

This study is based on material collected in the Terrestrial Arthropod Survey of Fiji project founded by the US National Science Foundation and the Schlinger Foundation. Right wing pairs of the three species were removed, mounted on slides in glycerol and photographed using the Olympus DP70 digital camera mounted on an Olympus SZX12 stereomicroscope. The abdomens were cleared in ProteinaseK — which also generated DNA extracts — followed by final maceration in hot 8% KOH for half an hour. The abdomens were dehydrated in absolute alcohol and mounted in Euparal on a microscope slide before

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examination and drawing. All drawings were produced by help of a drawing tube mounted on a Leitz Ortholux II. After drawings were completed the abdomens were returned to the alcohol vial with the rest of the animal. The illustrations were completed on drawing film, scanned at 600 dpi grayscale, and mounted onto plates in Adobe© Photoshop© 8.0. The records were plotted on maps from Map Resources using the iMap©2 software. The nomenclature applied to the genitalic morphology follows that of Nielsen (1957). Specimens are deposited in the following repositories Bishop Museum, Hawai'i (BPBM), Fiji National Insect Collection, Suva (FNIC) [currently held at Bishop Museum], Museum of Comparative Zoology, Harvard University, Cambridge, Mass. (MCZ), and the Swedish Museum of Natural History, Stockholm (NRM).

SYSTEMATICS

Goera Stephens

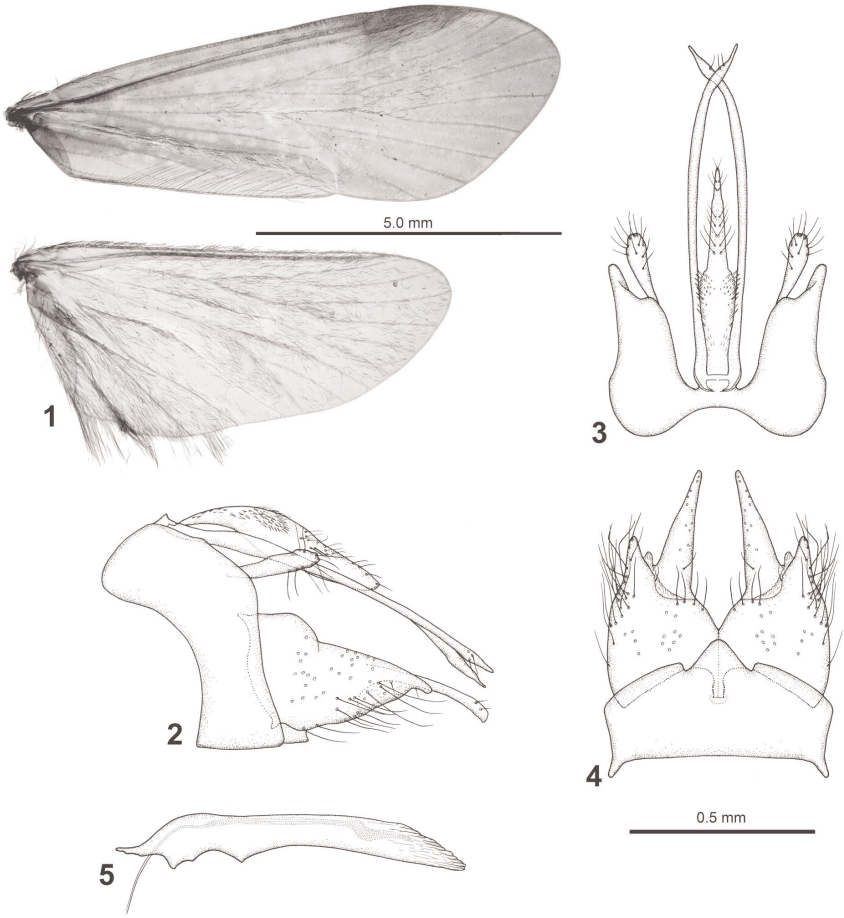
Goera Stephens, 1829: 28. Type species, *G. pilosa* (Fabricius, 1775) (=*Phryganea pilosa* Fabricius, 1775) (subsequent designation by Westwood, 1840)
Lasiostoma Rambur, 1842; Fischer, 1967: 3.
Sinion Barnard, 1934; Schmid, 1980: 190.
Spathidopteryx Kolenati, 1848; Hagen, 1858: 119.

Goera fijiana Banks
(Figs. 1–5)

Goera fijiana Banks, 1924: 444.
Goera vunida Mosely, 1941: 362; Neboiss, 1986a: 220.

Diagnosis. This species is distinguished from the other Fijian *Goera* species in that the dorsal part of segment IX is less strongly produced anterad; the dorsal process of segment X is wider in its proximal half in dorsal view; the coxopodites in lateral view are broader basally than in the middle; and the harpagones are depressed and narrow in lateral view.

Re-description based on new material. Male.
Wings (Fig. 1). Forewing length 6.0–9.1 mm, hind wing length 5.0–7.2 mm. Forewing crossvein M—Cu about as long as basal-most part of M3+4.
Abdomen. Ventral processes of segments VI and VII slightly curving posterad in lateral view (as in Fig. 7), sternum VII process shorter than sternum VI process; apices truncate in ventral view.
Genitalia (Figs. 2–5). Segment IX anterior and posterior margins nearly parallel in lateral view (Fig. 2); subdorsal parts produced anterad, with rounded anterior apices; in dorsal view (Fig. 3) with widely U-shaped, diverging posteromesal margin; anterior margin shallowly concave; in ventral view (Fig. 4) with widely triangular posteromesal process, anterior margin nearly straight. Superior appendages originating from segment IX well below dorsal-most part of segment IX (Fig. 2). Dorsal process of segment X strongly exceeding superior appendages (Fig. 2); broad in lateral view (Fig. 2); basal half with microtrichia being shortest at base of process; distal half with minute setae; basal half about 2 times broader than distal half in dorsal view (Fig. 3). Lateral processes of segment X narrowly tuboid, sub-straight in lateral view, with nearly drop-shaped apices and with 2–3 minute, subapicolateral setae (Figs. 2, 3); apices crossing each other in dorsal view (Fig. 3). Coxopodites more or less triangular, proximal one-third of each coxopodite distinctly wider than its central and distal parts (Fig. 2); tapering distally from one-third its length, apex pointed; ventral margin nearly straight (Fig. 2). Harpagones uniformly narrow in lateral view (Fig. 2), slightly curving ventrad, with numer-



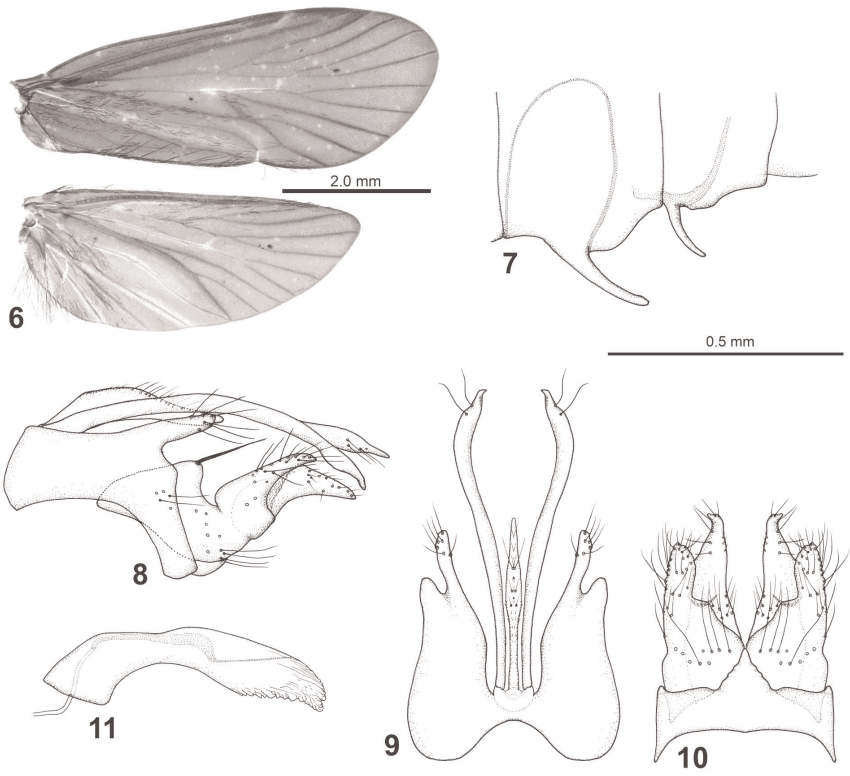
Figures 1–5. *Goera fijiana* Banks. **1**, right wings, dorsal; **2**, genitalia, left lateral view; **3**, genitalia, dorsal view; **4**, genitalia, ventral view; **5**, phallus, left lateral view. The scale bar in Fig. 1 relates to Fig. 1. The scale bar in Fig. 4 relates to Figs. 2–5.

ous setae; in ventral view (Fig. 4) uniformly tapering toward posterad-oriented apices. Phallus (Fig. 5) nearly straight, with large membranous posterior part; sperm duct anteriorly narrow before widening and darkening from one-fifth length inside phallus.

Female. Figures of the female genitalia purportedly of this species were given by Neboiss (1986b): 167.

Type. *Holotype* ♂ FIJI: **Viti Levu**: Nandarivatu, 17°34'S, 177°58'E, W.M. Mann (MCZ 14819, genitalia cleared, in separate vial, examined).

Material examined: FIJI: **Viti Levu**: 2♂, Mt. Nakobalevu, 22 Sep–9 Oct 2002, 18°03'S, 178°25'E, 340 m, Malaise trap, M. Irwin, E. Schlinger, M. Tokota'a; 6♂, PABITRA, 1034 m, 17–20 Nov 2003, Malaise trap, Wabu Baseline Survey, collected from



Figures 6–11. *Goera vuda*, new species. **6**, right wings, dorsal; **7**, abdominal segments VI and VII, with ventral processes; **8**, genitalia, left lateral view; **9**, genitalia, dorsal view; **10**, genitalia, ventral view; **11**, phallus, left lateral view. The scale bar in Fig. 6 relates to Fig. 6. The scale bar in Fig. 7 relates to Figs. 7–11.

Delena Veikovi, 17.5833°S, 178.0833°E; 1♂, Koroyanitu Prk., 1 km E Abaca Vlg., 26 Nov–3 Dec 2002, 17.667°S, 177.55°E, 800 m, Malaise trap 1, Schlinger, Tokota (BPBM).

Remarks. *Goera fijiana* Banks, 1924 was described from Fiji based on a single specimen from Viti Leon (= Viti Levu), Nadarivatu, collected by W. M. Mann (no date given), and was cited in the list of Fijian species by Mosely (1934). Additional records of this species were given by Banks (1936) from Wainganitu and Mt. Victoria, Viti Levu and by Mosely (1941) as *Goera vunida* from Vunidawa and Waidgi, Viti Levu. *Goera vunida* was synonymized with *G. fijiana* by Neboiss (1986a).

The original description of the species included mainly body color and wing venation details. No genitalic characters were described or illustrated. The male genitalia and right wing venation were illustrated by Mosely (1941) under the synonymous name *G. vunida*. Illustrations purportedly of the female were given by Neboiss (1986b).

Examination of the holotype of *G. fijiana* (in MCZ) confirms that the illustrations given by Mosely (1941) corresponds completely to the genitalia of the holotype of *G. fijiana*. The genitalia of the newly collected specimens are slightly different from those of the holotype, i.e. the ventral half of segment IX is broader than in the holotype, and the posteromesal process of segment IX is more widely triangular. Until more material and the morphological variation of this species has been examined, the new individuals are considered belonging to *G. fijiana* and the differences in the genitalia due to intraspecific variation.

Goera vuda Johanson & Oláh, **new species**
(Figs. 6–11)

Diagnosis. This species is distinguished from the other *Goera* species by having subdorsal margins of segment IX strongly produced anterad, a generally narrow dorsal process of segment X that is broadest at half length in dorsal view, coxopodites that are basally very broad, abruptly narrowed dorsally in their central part in lateral view, and conical harpagones that are broad in lateral view.

Description. Male.

Wings (Fig. 6). Forewing length 5.7 mm, hind wing length 4.6 mm. Forewing crossvein M—Cu tangent to basis of M3+4.

Abdomen. Ventral processes of segments VI and VII slightly curving posterad in lateral view (Fig. 7), sternum VII process shorter than sternum VI process; apices truncate in ventral view.

Genitalia (Figs. 8–11). Segment IX subventral part short, oriented posteroventrad, subdorsal parts twice as long as subventral part, strongly produced anterad, apices pointing ventrad (Fig. 8); in dorsal view (Fig. 9) with narrow irregularly U-shaped, posteromesal margin; anteromesal margin deeply concave; in ventral view (Fig. 10) with sharply triangular posteromesal process; anterior margin nearly straight. Superior appendages originating from dorsolateral part of segment IX (Fig. 8). Dorsomesal process of segment X slightly exceeding superior appendages (Fig. 8); moderately thick in lateral view (Fig. 8); basal half with microtrichia, these being shortest at base of process; in dorsal view, broadest at mid-length, distal half with minute setae (Fig. 9). Lateral processes of segment X slender, tubular, divergent basally, convergent apically, and slightly curving ventrad along their lengths, apices drop-shaped, each with 2–3 minute, lateral setae (Figs. 8, 9) not crossing each other in dorsal view (Fig. 9). Proximal part of coxopodites about 2 times taller than median part (Fig. 8); each with blackish, stout seta at posterodorsal corner; coxopodites abruptly more slender and tapering distally from two-thirds their lengths, apices pointed; ventral margins nearly straight (Fig. 8). Harpagones with numerous setae; conical, wide basally, narrowing distally in lateral and ventral views (Figs. 8, 10); apices curving laterad in ventral view (Fig. 10). Phallus (Fig. 11) slightly curving along its length, with large membranous posterior part; sperm duct anteriorly narrow before widening and darkening from one-fifth inside phallus.

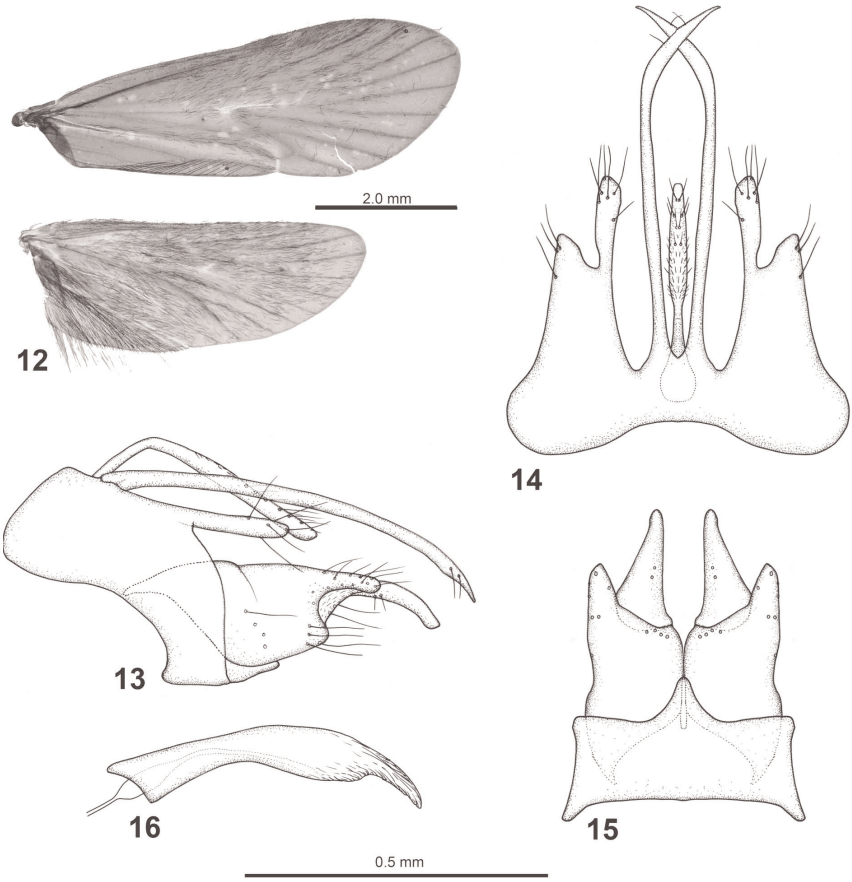
Female. Unknown.

Type. *Holotype* ♂ FIJI: **Viti Levu**: km WSW Colo-i-Suva Village, Mt. Nakobalevu, 12 Apr 2004, 18.057°S, 178.42°E, 300 m, Malaise trap, E. Schlinger, M. Tokota'a (FNIC).

Etymology. The species name is in reference to the type locality.

Goera abaca Johanson & Oláh, **new species**
(Figs. 12–16)

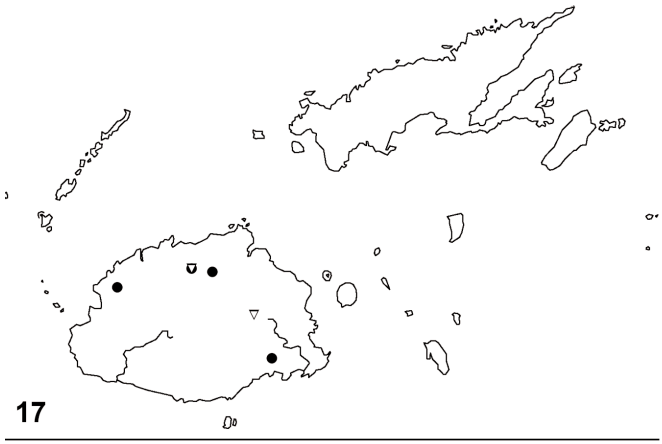
Diagnosis. This species is distinguished from the other *Goera* species by having subdorsal margins of segment IX strongly produced anterad, a generally slender dorsal process of segment X that is broadest at half length in dorsal view and nearly right angled at prox-



Figures 12–16. *Goera abaca*, new species. **12**, right wings, dorsal; **13**, genitalia, left lateral view; **14**, genitalia, dorsal view; **15**, genitalia, ventral view; **16**, phallus, left lateral view. The scale bar in Fig. 12 relates to Fig. 12. The scale bar in Fig. 16 relates to Figs. 13–16.

imal one-third its length in lateral view, coxopodites that are only slightly broader basally than in their central part in lateral view, and depressed harpagones that are narrow in lateral view.

Figures 17–19. Maps of *Goera* species in Fiji. **17**. Map with the new (filled circles) and earlier (open triangles) records of *Goera fijiana* Banks. **18**. Map with the records of *Goera vuda*, new species (filled triangle) and *Goera abaca*, new species (filled circle). **19**. Map with the records of unidentified *Goera* spp. females (filled circles).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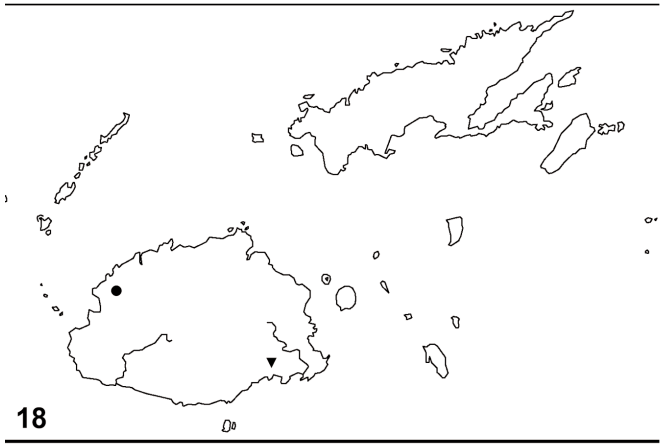
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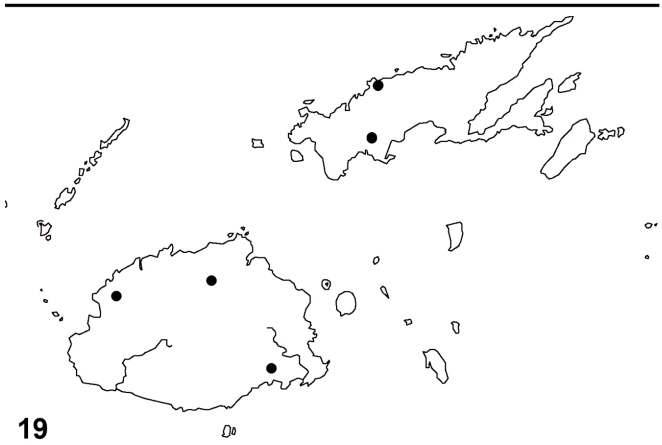
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Description. Male.

Wings (Fig. 12). Forewing length 6.1 mm, hind wing length 4.8 mm. Forewing crossvein M—Cu tangent to basis of M3+4.

Abdomen. Ventral processes of segments VI and VII slightly curving posterad in lateral view (as in Fig. 7); sternum VII process shorter than sternum VI process; apices truncate in ventral view.

Genitalia (Figs. 13–16). Segment IX subventral parts moderately short, lengthened dorsally, oriented ventrad, subdorsal parts twice as long as shortest ventral parts, strongly produced anterad, apices pointing ventrad (Fig. 13); in dorsal view (Fig. 14) with wide U-shaped, posteromesal margin; anteromesal margin shallowly concave; in ventral view (Fig. 15) with triangular posteromesal process; anterior margin nearly straight. Superior appendages originating from dorsolateral parts of segment IX (Fig. 13). Dorsomesal process of segment X slightly exceeding superior appendages (Fig. 13); in lateral view (Fig. 13) slender, bent posteroventrad at basal one-third; basal half with microtrichia, these being shortest at base of process; in dorsal view, broadest from one-third its length, distal half with minute setae (Fig. 14). Lateral processes of segment X slender, tubular, slightly divergent basally, convergent apically, and slightly curving ventrad along their lengths, apices weakly drop-shaped, each with 2 minute, lateral setae (Figs. 13, 14), crossing each other in dorsal view (Fig. 14). Proximal part of each coxopodite slightly taller than median part (Fig. 13); without blackish, stout seta at posterodorsal corner; coxopodites tapering distally from two-thirds their lengths, apices pointed; ventral margins nearly straight (Fig. 13). Harpagones with few visible setae; depressed and narrow in lateral view (Fig. 13), narrowing distally in ventral view (Figs. 15), their apices directed posterad in ventral view (Fig. 15). Phallus (Fig. 16) slightly curving along its length, with large membranous posterior part; sperm duct widest at anterior end, narrowing posteriorly inside phallus.

Female. Unknown.

Type. *Holotype* ♂ FIJI: **Viti Levu**: Koroyanitu Prk., 1 km E Abaca Vlg., 26 Nov–3 Dec 2002, 17.667°S, 177.55°E, 800 m, Malaise trap 1, Schlinger, Tokota'a [FBA 180476] (FNIC).

Etymology. The species name is in reference to the type locality.

In addition, females of unidentified *Goera* spp. were collected at various sites on Viti Levu and Vanua Levu.

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