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***Limnometra faracii* sp.n. from Viti Levu and further notes on the water striders (Heteroptera: Gerridae) of Fiji Islands**

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Abstract

Limnometra faracii sp.n. from Viti Levu, Fiji Islands, is described. It is closely related to "*Tenagonus*" *valentinei* HUNGERFORD & MATSUDA, 1961 from the same island. Faunistical notes on the Gerridae of Fiji Islands and a key to species are added.

Key words: Heteroptera, Gerridae, *Limnometra*, new species, Viti Levu, Fiji, species list, new records, key.

Zusammenfassung

Limnometra faracii sp.n. von der Insel Viti Levu in Fidschi wird beschrieben. Die neue Art ist mit "*Tenagonus*" *valentinei* HUNGERFORD & MATSUDA, 1961 von derselben Insel nahe verwandt. Faunistische Notizen über die Gerridae der Fidschi Inseln und ein Bestimmungsschlüssel zu den Arten sind beigefügt.

Introduction

This study mainly deals with the description of a new water strider from Viti Levu, which belongs to the so-called "*Tenagonus-Limnometra* complex" (HUNGERFORD & MATSUDA 1958). The correct placement of the more than fifty species group taxa, which have been described in this genus group, is still under discussion, and these species variably placed (see, e.g., LUNDBLAD 1933, HUNGERFORD & MATSUDA 1958, 1962, MATSUDA 1960, ANDERSEN 1964, 1982, 1995, MIYAMOTO 1967, CHEN & NIESER 1992, ANDERSEN & WEIR 1997, ZETTEL & CHEN 2000, CHENG et al. 2001). Recent morphological studies carried out by the author indicate that species of "*Tenagonus*" described from New Guinea, Australia, and the Fiji Islands actually belong to *Limnometra* MAYR, 1865 rather than to *Tenagonus* STÅL, 1853. This conclusion is supported by, inter al., the absence of claws on the hind legs and by similar structures in the vesicula sclerites of the males. The new species is therefore placed in *Limnometra*, although its closest relatives have been described in *Tenagonus*: *T. fijiensis* HUNGERFORD & MATSUDA, 1958 and *T. valentinei* HUNGERFORD & MATSUDA, 1961. An analysis of relationships within the "*Tenagonus-Limnometra* complex" is in preparation.

Material and methods

The material used for this study has been collected mainly by Mr. Franco Faraci (Bardolino, Italy) in 1998 and by Dr. Michael Balke (Munich, Germany) and Prof. Dr.

Günther Wewalka (Vienna, Austria) in 2003. All specimens have been dry-mounted, either pinned or glued on card boards. Type repositories are designated below. The non-type series will be divided to be deposited in the Natural History Museum Vienna (Austria), the Franco Faraci Collection, and the author's collection.

Terminology and methods of the description part follow previous studies by the author (e.g., ZETTEL & CHEN 2000).

Examination of structural characters were done mainly with a Leica Wild M10 binocular microscope at magnifications up to 128 \times . Drawings (Figs. 4 - 13) were prepared with an attached drawing apparatus. Digital photographs (Figs. 1 - 3) were taken with a Leica DFC camera attached to a Leica MZ16 binocular microscope by help of Image Manager IM50 and processed with Auto-Montage Pro and Adobe Photoshop 7.0 programmes.

In the faunistical section, island and locality names were adopted to KAY (1986) or, if not mentioned there, placed in quotation marks.

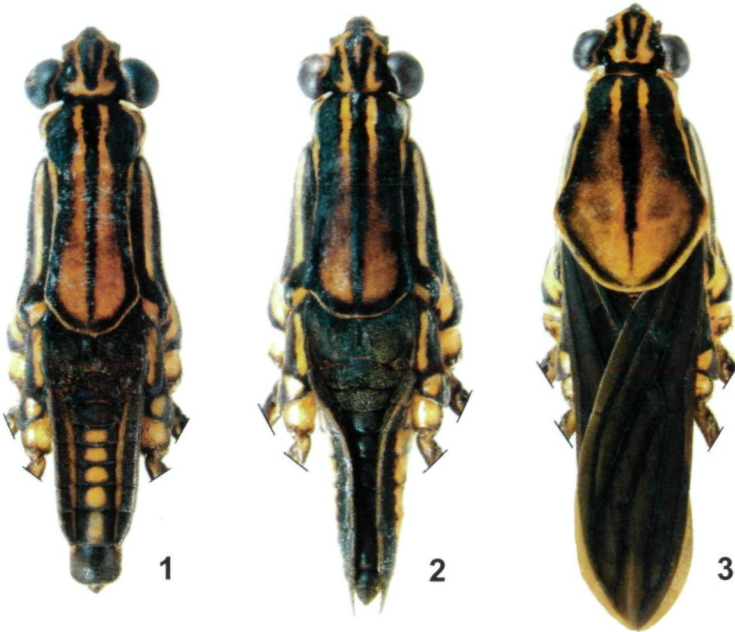
Description of *Limnometra faracii* sp.n. (Figs. 1 - 10)

Type material: Holotype (apterous male) and paratypes (two apterous females, two macropterous females) labelled "FIJI: Viti Levu\ Navala\ 22.XI.1998\ leg. F. Faraci (FJ3)", holotype and one paratype in the Natural History Museum Vienna, one paratype in Museo civico di Storia naturale di Verona, two paratypes in Coll. Franco Faraci.

Description of apterous male: Dimensions: body length 6.4 mm; maximum body width (at mesacetabula) 1.96 mm.

Colour: Dorsal colour pattern see Figure 1. Ground colour of sides and venter light yellow. Mesopleura with two, posteriorly confluent, black stripes, ventral one broader than dorsal one and broader than yellow stripe between them; small area behind procoxa infuscated; all acetabula with black marks, those of mesacetabulum anteriorly extended to short stripe. Dorsal areas of abdominal sternites black. Antenna blackish (antennomeres 3 and 4 broken off). Coxae, protochanter, and base of profemur yellow; meso- and metatrochanters brownish; other leg parts blackish.

Structural characteristics: Head (Fig. 1) comparatively short and wide, head width 1.47 mm; eyes large, laterally strongly surpassing sides of pronotum. Rostrum reaching base of mesosternum, length 1.40 mm. Lengths of antennomeres 1 - 2: 2.06 mm, 1.43 mm; antennomere 2 hardly longer than head width. Pronotum (Fig. 1) anteriorly with medial impression, pronotal lobe with concave sides, posterolaterally almost angular, hind margin strongly convex, dorsal surface with some transverse ridges. No wing rudiments externally visible. Mesosternum with distinct medial impression in posterior two-thirds. Metasternum medially flat, with small gland orifice. Lengths of leg segments: profemur 2.59 mm, protibia 2.22 mm, protarsus 0.30+0.39 mm, mesofemur 6.39 mm, mesotibia 5.88 mm, mesotarsus 2.20+0.49 mm, metafemur 7.10 mm, metatibia 4.40 mm, metatarsus 0.73+0.38 mm. Profemur (Fig. 4) with prominent basal tubercle, slightly incrassate, at midlength 1.8 times as wide as base of mesofemur, ventrally with extremely short, dense pilosity. Protibia distally slightly curved. Mesofemur distally with one short spine (Fig. 5), ventrally without spines or subapical tooth, but with inconspicuous, dense, oblique pilosity about one-fourth as long as mesofemur width, and with row of short stiff, almost spine-like setae obscured by that pilosity. Mesotarsus with short claws, Metatarsus without claws. Abdomen (Fig. 1) relatively short, with subparallel (posteriorly slightly converging) sides; connexival spines absent. Tergites 1 - 2 convex, tergites 3 -



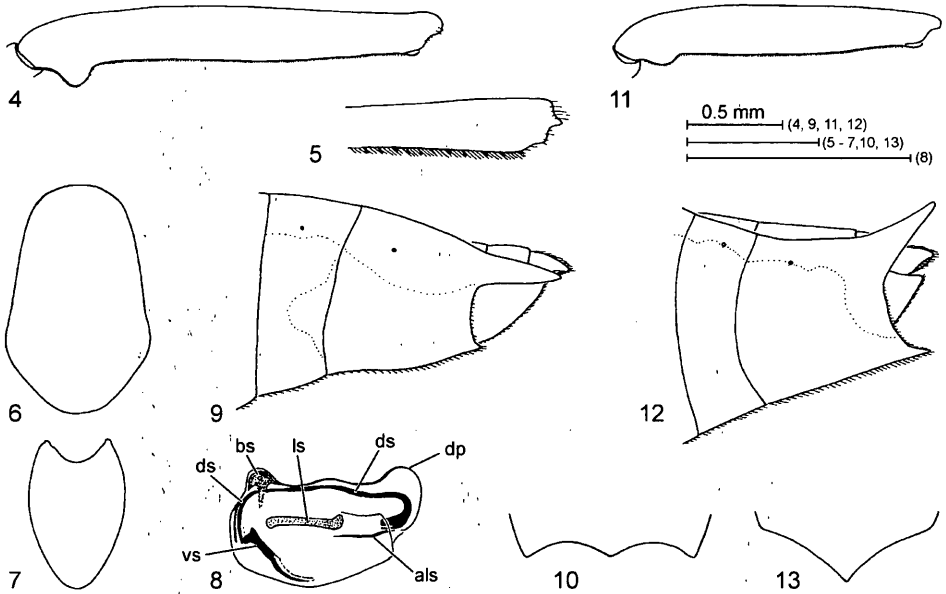
Figs. 1 - 3: *Limnometra faracii* sp.n., dorsal aspect of (1) holotype, apterous male, body length 6.4 mm; (2) paratype, apterous female, body length 8.0 mm; (3) paratype, macropterous female, body length 8.1 mm. Antennae and legs omitted. Different scales.

7 almost flat; tergites 1 - 6 wider than long, tergite 7 as long as wide. Sternites without median carina; sternites 2 - 5 with shallow, wide impressions and slightly raised hind margins. Sternite 7 with simple, concave hind margin. Segment 8 relatively robust, ventrally with shallow transverse impression, but otherwise without modifications, ventral hind margin slightly protruded. Pygophore (Fig. 6) subovate, distolaterally slightly widened. Proctiger (Fig. 7) slender, lanceolate, apex narrowly rounded. Paramere absent. Vesica (Fig. 8) dorsally sclerotized and with characteristic undulate outline, dorsal plate nose-like protruded (same in *T. valentinei*); basal sclerite distinct; dorsal sclerite slender (in dorsal and lateral views), apical recurved part weakly forked, base more distinctly divided into two branches; ventral sclerites slender and short; lateral sclerites slender, almost straight; a very slender secondary lateral sclerite present distally.

Description of apterous female: Dimensions: body length 8.0 - 8.3 mm; maximum body width (at mesacetabula) 2.58 - 2.64 mm; head width 1.65 - 1.67 mm; length of first antennomere 2.11 - 2.20 mm; length of mesofemur 7.55 - 8.26 mm.

Colour: Dorsal colour pattern see Figure 2. Lateral pattern similar to male's, but sternites with additional small, black marks laterally. Antenna uniformly blackish. One specimen with relatively large black mark on mesopleura behind procoxa.

Structural characteristics (measurements refer to the smaller specimen): Larger than male, thorax more robust, abdomen more slender. Lengths of antennal segments 1 - 4: 2.11 mm, 1.38 mm, 1.10 mm, 1.28 mm; antennomere 2 shorter than head width. Pronotal (Fig. 2) lobe similar to that of male, sides slightly less concave, posterolaterally with



Figs. 4 - 10: *Limnometra faracii* sp.n. (4 - 8: holotype, male; 9, 10: paratype, apterous female): (4) profemur; (5) apex of mesofemur; (6) pygophore, ventral; (7) proctiger, dorsal; (8) vesica: als – accessory lateral sclerite, bs – basal sclerite, dp – dorsal plate, ds – dorsal sclerite, ls – lateral sclerite, vs – ventral sclerite; (9) apex of abdomen, lateral; (10) hind margin of sternite 7, ventral.

Figs. 11 - 13: *Limnometra valentinei*: (11) profemur of apterous male; (12) apex of abdomen of apterous female, lateral; (13) hind margin of sternite 7 of apterous female, ventral.

small, but sharp angles. Mesosternum without impression. Lengths of leg segments: profemur 2.99 mm, protibia 2.66 mm, protarsus 0.36+0.50 mm, mesofemur 7.55 mm, mesotibia 6.86 mm, mesotarsus 2.34+0.60 mm, metafemur 8.22 mm, metatibia 5.21 mm, metatarsus 0.82+0.45 mm. Profemur basally with weak swelling, much less incrassate than in male, at midlength 1.15 times as wide as mesofemur at base. Mesofemur similar to male's. Abdomen (Fig. 2) slender, much narrowed posteriorly, connexiva strongly convergent and partly overlapping tergites on segments 4 - 7, so tergites not fully visible and sternites partly visible in dorsal view. All tergites flat; tergite 1 without long setae. Sternites without impressions; hind margin of sternite 7 (Fig. 10) posteriad protruded into short, obtuse medial tip. Connexival spines (Figs. 2, 9) long, almost parallel, directed directly caudad. Tergite 8 and proctiger directed caudad.

Description of macropterous female: Dimensions: body length (exclusive of wings) 8.0 - 8.1 mm; maximum body width (at mesacetabula) 2.50 - 2.56 mm; head width 1.56 - 1.60 mm; length of first antennomere 1.98 - 2.18 mm; length of mesofemur 7.8 mm.

Colour: Dorsal colour pattern see Figure 3. Tergites beyond wings yellow. Lateral pattern similar to that of male, but stripes on mesopleura posteriorly separated by narrow yellow line. Sternites lacking the lateral black marks present in apterous female.

Structural characteristics: Body robust. Pronotum (Fig. 3) very large, at humeri approximately as wide as body at mesopleura, hind margin evenly rounded. Connexiva

Table 1: Morphological differences between apterous morphs of *Limnometra faracii* sp.n. and “*Tenagonus*” *valentinei*.

characteristic	sex	<i>L. faracii</i> sp.n.	<i>T. valentinei</i>
ratio of body length / maximum body width	♂ ♀	ca. 3.1 - 3.2 (Figs. 1, 2)	ca. 2.5
ratio of abdomen length / pronotum length	♂ ♀	ca. 1.2	ca. 0.9 (♂) - 1.0 (♀)
colour of pronotal lobe (except margin)	♂ ♀	orange-brown and black (Figs. 1, 2)	yellow and black
yellow marks on tergite 1	♂ ♀	absent	present
tubercle at base of profemur	♂	prominent (Fig. 4)	low (Fig. 11)
abdominal segment 8 ventrally	♂	transversely impressed	not impressed
long setae medially on tergite 1	♀	absent	present
connexival spine directed	♀	caudad (Fig. 9)	dorsocaudad (Fig. 12)
posteromedian process on sternite 7	♀	vestigial (Fig. 10)	triangular (Fig. 13)

slightly less convergent than in apterous female; other characteristics similar to that morph.

Comparative notes: *Limnometra faracii* sp.n. is similar and closely related to “*Tenagonus*” *valentinei*; in the apterous morph, both species have the same characteristic shape of the pronotum. Apterous specimens of these two species are compared in Table 1. For differences from the more distantly related “*Tenagonus*” *fijiensis*, see the key (below).

Etymology: Named in honour of Franco Faraci, who discovered this interesting new species.

The Gerridae of Fiji

Species diversity: Up to now, only nine species of Gerridae have been recorded from Fiji, seven freshwater species belonging to the subfamily Gerrinae and two marine coastal species of the Halobatinae. In addition, three oceanic species of *Halobates* (*H. germanus* WHITE, 1883, *H. micans* ESCHSCHOLTZ, 1822, *H. sericeus* ESCHSCHOLTZ, 1822) occur on the oceans offshore Fiji Islands (see maps in ANDERSEN & POLHEMUS 1976, and in ANDERSEN & CHENG 2004). Individuals of such ocean species may occasionally be taken near shore or on beaches after severe storms (ANDERSEN & WEIR 1994). Five of the nine recorded species are endemic, one occurs in an endemic subspecies, and three species are widely distributed in the tropical Pacific region.

Gerrinae:

Limnogonus (s.str.) *fossarum* gilguy ANDERSEN & WEIR, 1997

Notes: ANDERSEN (1975, 1995) treated this subspecies under the name *Limnogonus* (s.str.) *fossarum* *skusei* (TORRE-BUENO, 1926); *skusei* is a replacement name for *Hydrometra australis* SKUSE, 1893, but this is a synonym of *Limnogonus luctuosus* (see ANDERSEN & WEIR 1997).

Data from literature: VITI LEVU: Nadi; Nausori Highlands (ANDERSEN 1975).
Material examined: VITI LEVU: 1 ♀ (macropterous), surroundings of Naivuvuni, ca. 15 km W of Rakiraki, small track with muddy rain water, 23.XI.1998, leg. F. Faraci (FJ1); 1 ♂, 1 ♀ (macropterous), Namuaimada, ca. 15 km SE of Rakiraki, small pond near beach, 24.XI.1998, leg. F. Faraci (FJ2); 2 ♀♀ (apterous), Navala, ca. 20 km SE of Ba, in mountains along road from Ba (between Lautoka and Rakiraki) to Sigatoka, along a tributary of Ba River, ca. 200 m a.s.l., 22.XI.1998, leg. F. Faraci (FJ3).

***Limnogonus* (s.str.) *luctuosus* (MONTROUSIER, 1865)**

Data from literature: VITI LEVU: “five localities” not named (ANDERSEN 1975).
Material examined: VITI LEVU: 1 ♂ (macropterous), surroundings of Naivuvuni, ca. 15 km W of Rakiraki, small track with muddy rain water, 23.XI.1998, leg. F. Faraci (FJ1); 1 ♂ (macropterous), 1 ♂, 1 ♀ (macropterous), Namuaimada, ca. 15 km SE of Rakiraki, small pond near beach, 24.XI.1998, leg. F. Faraci (FJ2); 1 ♂ (macropterous), Navala, ca. 20 km SE of Ba, in mountains along road from Ba (between Lautoka and Rakiraki) to Sigatoka, along a tributary of Ba River, ca. 200 m a.s.l., 22.XI.1998, leg. F. Faraci (FJ3). VANUA LEVU: 1 ♂ (apterous), Mt. Dalaikoro, 600 m, 14.XI.2003, leg. M. Balke & G. Wewalka, FI 019.

***Limnogonus* (s.str.) *buxtoni fijiensis* ANDERSEN, 1975 (endemic subspecies)**

Data from literature: VITI LEVU: Suva; Suva – Nasinu River; Nadi; Rewa; “Vatuthere nr. Naudarivatu”; “Tholo-i-suva”; “Waito Tailevu”. OVALAU: Levuka, “Wainiloka”. MATUKU. TAVEUNI: “Ura” (ANDERSEN 1975).

Material examined: VITI LEVU: 1 ♀ (apterous), Navala, ca. 20 km SE of Ba, in mountains along road from Ba (between Lautoka and Rakiraki) to Sigatoka, along a tributary of Ba River, ca. 200 m a.s.l., 22.XI.1998, leg. F. Faraci (FJ3); 1 ♂, 1 ♀ (apterous), Suva, Colo-I-Suva Forest, 100 m, 5.XI.2003, leg. M. Balke & G. Wewalka, FI01. KADAVU: 1 ♂, 2 ♀♀ (apterous), nr. Vunisea, 100 m, 24.XI.2003, leg. M. Balke & G. Wewalka, FI 031.

“*Tenagonus*” *fijiensis* HUNGERFORD & MATSUDA, 1958 (endemic species)

Data from literature: TAVEUNI (HUNGERFORD & MATSUDA 1958), VANUA LEVU (ANDERSEN 1995).

Material examined: none.

“*Tenagonus*” *valentinei* HUNGERFORD & MATSUDA, 1961 (endemic species)

Data from literature: VITI LEVU: “Nandarivatu”, “Waito Tailevu” (HUNGERFORD & MATSUDA 1961).

Material examined: VITI LEVU: 1 ♂, 1 ♀ (apterous) stream near Suva, 20.III.1966, leg. L. Kuzmina; 5 ♂♂, 9 ♀♀ (apterous), Suva, Colo-I-Suva Forest, 100 m, 5.XI.2003, leg. M. Balke & G. Wewalka, FI01.

***Limnometra faracii* sp.n. (endemic species)**

Material examined: VITI LEVU: 1 ♂, 2 ♀♀ (apterous), 2 ♀♀ (macropterous), Navala, ca. 20 km SE of Ba, in mountains along road from Ba (between Lautoka and

Rakiraki) to Sigatoka, along a tributary of Ba River, ca. 200 m a.s.l., 22.XI.1998, leg. F. Faraci (FJ3).

***Limnometra ciliata* MAYR, 1865**

Data from literature: VITI LEVU: Lami, Rewa. VANUA LEVU: "Muanicula". TAVEUNI: "Ura". VANUA BALAVU: "Mvana", "Bavatu". OVALAU: "Wainiloka". MATUKU (HUNGERFORD & MATSUDA 1958).

Material examined: VITI LEVU: 1 ♂, 2 ♀ ♀ (micropterous), Suva, Colo-I-Suva Forest, 100 m, 5.XI.2003, leg. M. Balke & G. Wewalka, FI01; VANUA LEVU: 2 ♂ ♂, 1 ♀ (micropterous), cross- road of Labasa-Suvasuva and Labasa-Nabouwalous roads, 50 m, 15.XI.2003, leg. M. Balke & G. Wewalka, FI021.

Halobatinae:

***Halobates fijiensis* HERRING, 1958 (endemic species)**

Data from literature: VITI LEVU: Suva (HERRING 1958, 1961, POLHEMUS & CHENG 1982); "USP Pier" (POLHEMUS & CHENG 1982).

Material examined: VITI LEVU: 1 ♂, 1 ♀, Saweni Beach, ca. 6 km N Lautoka, 22.II.1998, leg. F. Faraci (FJ4); 1 ♂, "Ellington Wharf", ca. 5 km E of Rakiraki, 24.II.1998, leg. Faraci. VANUA LEVU: 1 ♂, 6 ♀ ♀, S Savusavu, Mumu Resort, nr. Nagigi, sea level, 16.XI.2003, leg. M. Balke & G. Wewalka, FI022.

***Halobates bryani* HERRING, 1961 (endemic species)**

Data from literature: MATUKU (HERRING 1958, 1961).

Material examined: VITI LEVU: 1 ♂, 1 ♀, Saweni Beach, ca. 6 km N Lautoka, 22.II.1998, leg. F. Faraci (FJ4).

Identification key to the Gerridae of Fiji

- 1 Macropterous, apterous, or brachypterous. Pronotum in all morphs much longer than wide, with black or yellow stripes. Freshwater species, rarely also found in brackish water. Subfamily **Gerrinae**. 2
- Apterous. Pronotum much wider than long, uniformly greyish black. Marine species. Subfamily **Halobatinae**: Genus ***Halobates***. 8
- 2 Pronotum with yellow median line and two yellow dots anteriorly. Genus ***Limnogonus***. 3
- Pronotal lobe with black median line. ***Tenagogonus-Limnometra-complex*** 5
- 3 Dorsum of body with large, strongly shiny areas. Rostrum very long, in male reaching middle of mesosternum, segments 3 + 4 ca. 1.6 - 1.8 times head width. Abdomen comparatively short, especially in male. . . ***Limnogonus buxtoni fijiensis***
- Dorsum of body without conspicuous shiny areas. Rostrum relatively short, segments 3 + 4 ca. 1.1 - 1.2 times head width. Abdomen comparatively long 4

- 4 Yellow stripe on mesopleura posteriorly tapering, not reaching spiracle. . . .
..... *Limnogonus fossarum giguy*
- Yellow stripe on mesopleura posteriorly widened, reaching spiracle.
..... *Limnogonus luctuosus*
- 5 Large, very elongate species, body length ca. 12 - 21 mm. Male with fringe
of long setae on mesofemur. Sternite 7 of female with median carina.
..... *Limnometra ciliata*
- Small and relatively stout species, body length ca. 4 - 9 mm. Male without
distinct fringe of setae on mesofemur. Sternite 7 of female not carinate. 6
- 6 Pronotum of apterous morph with sides parallel, with apex narrowly round-
ed. Male very stout, about 2.0 times as long as wide. Female with broad,
flap-shaped connexival spines usually overlapping each other.
..... "*Tenogonus*" *fijiensis*
- Pronotum of apterous morph with concave sides, with apex broadly round-
ed. Male less stout, about 2.5 - 3.2 times as long as wide. Female with slender,
pointed connexival spines usually not overlapping each other. 7
- 7 Ground colour of pronotum light yellow. Body relatively stout, ca. 2.5 times
as long as wide. See also Tab. 1 (p. 45). "*Tenogonus*" *valentinei*
- Ground colour of pronotum orange-brown. Body relatively slender, ca. 3.1 -
3.2 times as long as wide. See also Tab. 1. *Limnometra faracii* sp.n.
- 8 Abdominal venter dark. Species of the open ocean; no records from Fiji. . .
..... (*Halobates germanus*, *H. micans*, *H. sericeus*)
- Abdominal venter partly yellow. Species of the sea shore. 9
- 9 First protarsomere slightly longer than second. Segment 7 of male cylindri-
cal, enclosing segment 8. Proctiger of male longer than wide, with rounded
sides. Female with very elongate metacoxa. *Halobates fijiensis*
- First protarsomere much shorter than second. Segment 7 of male normal,
not enclosing segment 8. Proctiger of male wider than long, with angul-
ate sides. Female without conspicuously elongate metacoxa.
..... *Halobates bryani*

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