

A New Fijian Species of *Saldula* Van Duzee (Heteroptera: Saldidae) from the Interior of Viti Levu^{1,2}

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Abstract. A new species of shore bug, *Saldula gilloglyi*, n. sp., is described from the interior plateaus of Viti Levu island, Fiji. This new species is compared to the Fijian endemic *Saldula inoana* Drake, which also occurs on Viti Levu, and a key is provided to separate the two species. Illustrations of the male genitalia of *S. gilloglyi* and *S. inoana* are provided.

INTRODUCTION

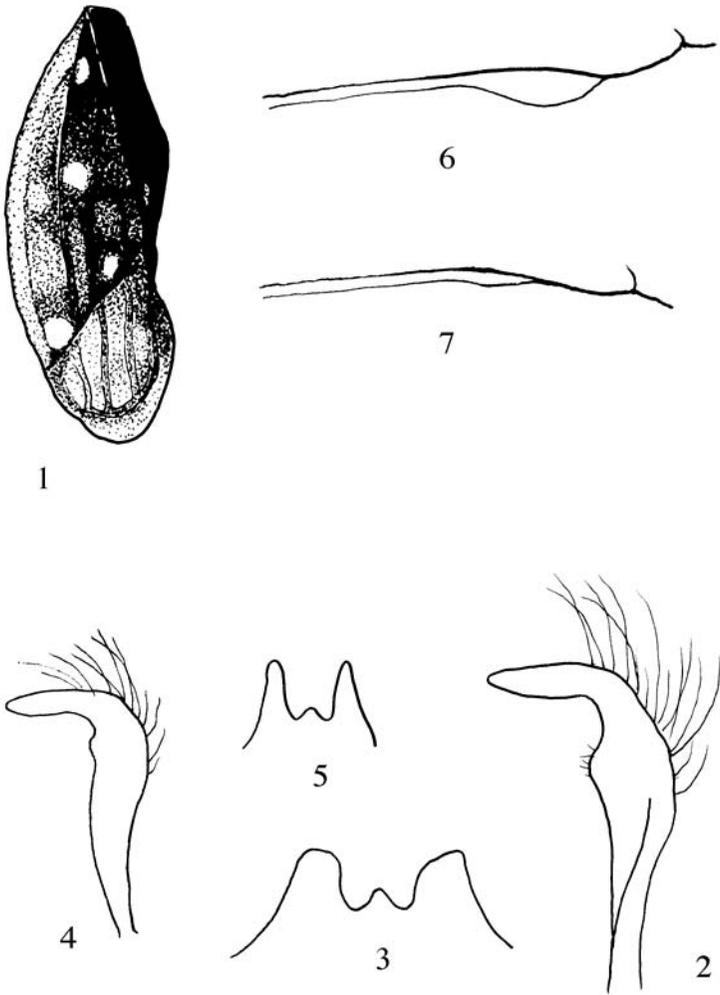
Saldidae have been among the most successful families in the semi-aquatic Heteroptera in regard to colonizing remote island groups in the Pacific region. Endemic *Saldula* Van Duzee species have now been described from Hawai'i (8 species), the Society Islands (1 species), Samoa (1 species), the Solomon Islands (2 species), and Guam (2 species). Up to the present, only a single endemic *Saldula* species, *S. inoana* Drake, has been known from the Fijian Islands; in this paper we describe a second species, *Saldula gilloglyi*, from the mountains of Viti Levu.

Overall, the species diversity of Saldidae in the Pacific region is still underappreciated in the literature. We now have additional freshwater and arboreal species in our collections awaiting description from the Marquesas, the Tuamotu Archipelago, Pohnpei, New Caledonia, Manus Island (Admiralty Islands), and Hawai'i, as well as new marine species in the genus *Salduncula* from Palau, Pohnpei, Timor, and Australia plus the Solomon Islands. We also consider it likely that further collecting in remote areas of Fiji, the Solomon Islands, and Vanuatu, particularly on rheocrene habitats, will produce additional endemic saldid species.

Several very widespread species, originally described from Africa and later found in tropical Asia, have also reached remote Pacific islands, notably *Micracanthia ornatula* (Reuter) and *Saldula niveolimbata* (Reuter), and can be expected on open shores of streams or ponds anywhere in the western Pacific. *Saldula palauana* Drake, once thought to be endemic on Palau, has now been found on Guam, Pohnpei, Ulithi Atoll and Yap: this species is closely related to *Micracanthia ornatula* (formerly held in *Saldula*), and may eventually prove to be synonymous. A basic detailed survey of the saldid fauna of the myriad Pacific islands is far from complete, and presents a significant challenge.

1. Contribution No. 2006-042 to the NSF-Fiji Arthropod Survey.

2. Contribution No. 2006-044 to the Pacific Biological Survey.



Figures 1–7. Fijian *Saldula* species, structural details. **1.** *Saldula gilloglyi*, left hemelytron. **2.** *Saldula gilloglyi*, left male paramere. **3.** *Saldula gilloglyi*, parandria. **4.** *Saldula inoana*, left male paramere. **5.** *Saldula inoana*, parandria. **6.** *Saldula gilloglyi*, costal margin and hypocostal ridge, lateral view. **7.** *Saldula inoana*, costal margin and hypocostal ridge, lateral view.

MATERIALS AND METHODS

All measurements and morphological terminology follow Chapter IV on morphology by Polhemus (1985). All measurements in the following descriptions are given in millimeters. Type repository codons are defined in the Acknowledgments section. CL numbers in the Material Examined sections refer to collection locality numbers used by the authors to cross reference specimens, field notes, and habitat photographs.

Most of the material upon which this study was based, approximately 110 specimens including immatures, was collected by the authors, with the notable exception of certain specimens collected earlier by Alan Gillogly and donated to the J.T. Polhemus Collection (JTTC), which will eventually be placed in the U.S. National Museum of Natural History (USNM). Specimens deriving from the Fiji National Insect Collection (FNIC), Suva, as part of the NSF-funded Fiji Arthropod Survey will be returned there, with duplicate exemplars placed in the Bishop Museum, Honolulu (BPBM), JTTC, and USNM.

Color, eunomy, and measurements were taken from dry mounted specimens, because observations of setae and coloration from alcohol specimens may be not always be accurate.

SYSTEMATICS

KEY TO THE SALDIDAE OF VITI LEVU

1. Second antennal segment much longer than third (ratio 1.54–1.65); ground color brown; pronotal margin without short brown streak near each humerus; claval subapical spot, when present, diffuse (Fig. 1); female hypocostal ridge produced ventrally at embolar modification (Fig. 6) *gilloglyi* Polhemus & Polhemus, **n. sp.**
- . Second antennal segment slightly longer than third (ratio 1.12–1.30); ground color blackish brown; pronotal margin with short brown streak near each humerus; claval subapical spot, when present, bright white, distinct; female hypocostal ridge not produced ventrally at embolar modification (Fig. 7).... **inoana** Drake

Saldula gilloglyi J. Polhemus & D. Polhemus, **new species**

(Figs. 1–3, 6)

Description. Macropterous male: Ground color blackish brown; head, pronotum, scutellum, shining; hemelytra light brown to brown, with soft brown and bright white markings; clavus uniformly pruinose blackish brown, with one poorly developed elongate brownish yellow spot distally; endocorium with two white spots along outer margin, one basal, one at middle, plus one white medial spot distally, also with large soft brown areas not strongly contrasting with ground color; exocorium mostly light colored on basal angle, one small diffuse white spot at middle, another bright white spot distally; embolium broadly yellowish, continuing along membrane, interrupted by black at embolar fracture. Legs leucine to testaceous. Thoracic venter black, acetabula broadly margined with testaceous. Abdominal venter brown, basal segments yellowish along posterior margin; antennae testaceous, without long setae. Dorsum clothed with moderate length recumbent golden pubescence, very noticeable on clavus, short and sparse on hemelytra.

Structural characteristics: Head short, about 1.5 x wider than long in middle; head with moderate length setae in addition to usual three pairs of trichobothria; eyes large, strongly exerted; ocelli prominent, scarcely raised, each flanked by a prominent yellowish spot reaching eye margin; postclypeus not tumid; frons with a shallow median furrow between median pair of trichobothria. Antennae long, all segments slender, without long setae. Pronotum short, broad, lateral margins slightly concave, callus tumid, almost campanulate. Legs relatively slender, clothed with usual spines and short setae, tibia straight.

Measurements. Total length, 3.72 mm; width (across hemelytra) 1.78 mm. Head length, 0.61; width, 1.15; interocular space, 0.25. Pronotum length, 0.61; posterior width, 1.30; anterior width,



Figure 8. Waterfalls on the interior plateaus of Viti Levu, such as this one near the Monasavu Dam hydroelectric plant headquarters (CL 7363), provide preferred habitat for *S. gilloglyi* and *S. inoana*. Both species occurred syntopically at this locality, on the wet bedrock ledges at the left of the picture.

0.72; collar width, 0.58; callus length, 0.32; posterior lobe length, 0.20. Scutellum length, 0.79; width, 0.83. Hemelytra corium length, 2.05; clavus length, 1.22; claval commissure length, 0.61; distance apex claval commissure-apex membrane, 1.08. Metafemur length, 1.40; metatibia length, 1.87. Antennal segments, length I–IV; 0.43: 0.94: 0.58: 0.58.

Genitalia as in Fig. 2–3.

Macropterous female. Similar to male except larger; ventral abdominal sternum VII (subgenital plate) leucine on caudal half; hemelytral hypocostal ridge produced ventrally at embolar modification (fig. 6). Total length 4.55; width (across hemelytra), 1.78.

Types. *Holotype*, macropterous male: FIJI: **Viti Levu**: 2 mi (3.2 km) E. Nandarivatu, 12–XII-1970, A. Gillogly (USNM). *Paratypes* as follows (all collected by J.T. and D.A. Polhemus unless otherwise noted): FIJI: **Viti Levu**: 2 males, 3 females, same data as holotype, A. Gillogly (JTPC); 7 males, 4 females, Rairaimatuku Plateau, waterfall and rocky stream nr. Monasavu Dam headquarters, 790 m [2590 ft], 17°44'32.3"S, 178°03'16.3"E, water temp. 23 °C, 2 Feb 2005, CL 7363, D.A. Polhemus; 1 male, 1 female, rheocrenes on steep bedrock faces along Tavua–Nadarivatu road, ca. 4 km N. of Nadarivatu between culverts 19/8 and 19/10, 580 m [1900 ft], 17°33'45.9"S, 177°57'09.2"E, water temp. 23.5 °C, 26 Mar 2005, CL 7366; 2 females, roadside waterfall and rocky stream 0.4 km N. of Waikumbakumba on Tavua–Nadarivatu road, 220 m [720 ft], 17°32'28.9"S, 177°56'20.6"E, water temp. 26 °C, 3 February 2005, CL 7368, D.A. Polhemus; 1 female, Evans Range, small stream and cascade 13.5 km E. of Nagado on Vaturu Dam road, 415 m [1360 ft], 17°45'44.2"S, 177°39'59.1"E, water temp. 25 °C, 27 Mar 2005, CL 7405. Paratypes deposited in FNIC, USNM, BPBM, and JTPC.

Remarks. *Saldula gilloglyi* may be easily separated from the only other known Fijian saldid, *Saldula inoana* Drake, by the characters given in the key, combined with the differences in the male genitalia; see Figs. 2–5. The hemelytra of both of the Fijian species have a secondary hypocostal ridge (hcr), the filum gonopori of the male genitalia is coiled 1–1/2 times, and the immatures possess a larval organ in *S. inoana* (this character state cannot be evaluated for *S. gilloglyi* because no immatures are available). These characters place both species in one of the tropical clades currently held in the genus *Saldula*.

Ecological Notes. *Saldula gilloglyi* occurs on wet bedrock faces and damp boulders, frequently in association with cascades and waterfalls (Fig. 8). It is often found syntopically with *S. inoana* in such situations, but based on current collections is more localized in its occurrence. The records of this species to date are all from elevations between 220–790 m in the northern half of Viti Levu (Rairaimatuku Plateau and Koroyanitu Range), with no collections from the Namosi Highlands of the south.

Etymology. This species is dedicated to Dr. Alan Gillogly in recognition of his tireless efforts to provide material from many countries for our research.

Saldula inoana Drake (Figs. 4–5, 7)

Saldula inoana Drake, 1961: 299.

Description. Macropterous male: Ground color blackish brown; head, pronotum, scutellum, faintly shining; hemelytra with soft brown and bright white markings; clavus uniformly pruinose blackish brown, without or with one elongate brownish spot distally; endocorium with two white spots along outer margin, one basal, one at middle, plus one white medial spot distally, distal third with two large soft brown areas; exocorium mostly white on basal angle, one large white spot at middle, another distally, connected by a broad brown streak along inner margin; embolium broadly yellowish, continu-

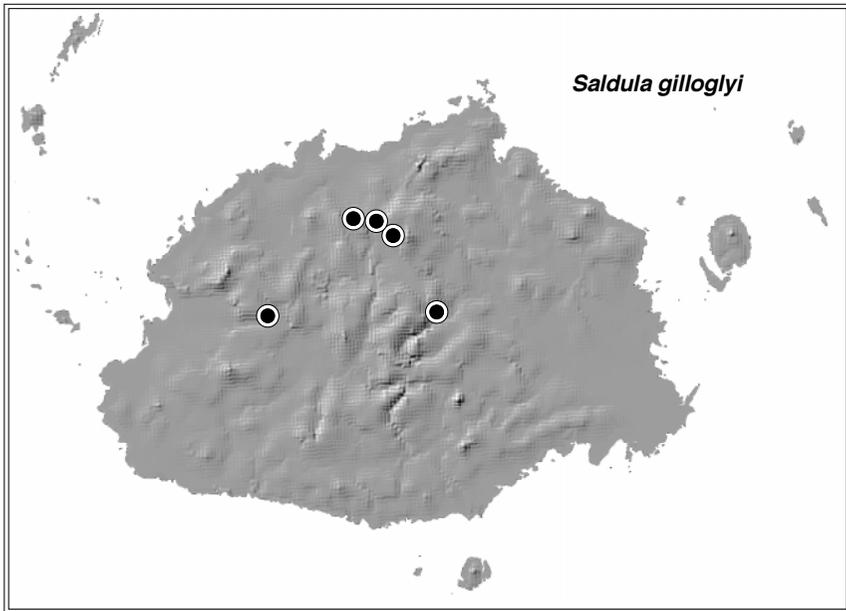


Figure 9. Distribution of *Saldula gilloglyi* on Viti Levu.

ing along membrane, interrupted by black at embolar fracture (see figure 7 in Drake, 1961). Legs leucine to testaceous, darker dorsally. Thoracic venter black, acetabula broadly margined with leucine. Abdominal venter blackish brown, basal segments brown along posterior margin; antennae dark brown, first segment lighter, fourth segment brownish to yellowish distally. Dorsum clothed with moderate length recumbent golden pubescence, darker caudad.

Structural characteristics: Head short, almost twice as wide as long in middle; head with moderate length setae in addition to usual three pairs of trichobothria; eyes large, strongly exerted; ocelli prominent, scarcely raised, each flanked by a prominent yellowish spot reaching eye margin; postclypeus not tumid; frons weakly sulcate longitudinally between median pair of trichobothria. Antennae moderately long, all segments slender, without long setae. Pronotum short, broad, lateral margins slightly concave. Legs relatively slender, clothed with usual spines and short setae, tibia straight, except hind tibia slightly curved.

Measurements. Total length, 3.72 mm; width (across hemelytra) 1.66 mm. Head length, 0.55; width, 0.92; interocular space, 0.22. Pronotum length, 0.55; posterior width, 1.28; anterior width, 0.67; collar width, 0.55; callus length, 0.29; posterior lobe length, 0.18. Scutellum length, 0.83; width, 0.90. Hemelytra corium length, 2.60; clavus length, 1.30; claval commissure length, 0.55; distance apex claval commissure–apex membrane, 1.28. Metafemur length, 1.33; metatibia length, 1.83. Antennal segments, length I–IV; 0.39: 0.83: 0.61: 0.67.

Genitalia as in figures 4–5.

Macropterous female. Similar to male except larger and ventral abdominal sterna broadly marked with leucine to yellowish medially, less so laterally; ventral abdominal sternum VII (subgenital plate) leuteous on caudal half; hemelytral hypocostal ridge not produced ventrally at coupling point (fig. 7). Total length 4.33; width (across hemelytra), 1.94.

Material Examined. (all macropterous; all collected by J.T. and D.A. Polhemus unless otherwise noted): FIJI: **Viti Levu:** 1 male, 2 mi (3.2 km) E. Nandarivatu, 12–XII-1970, A.

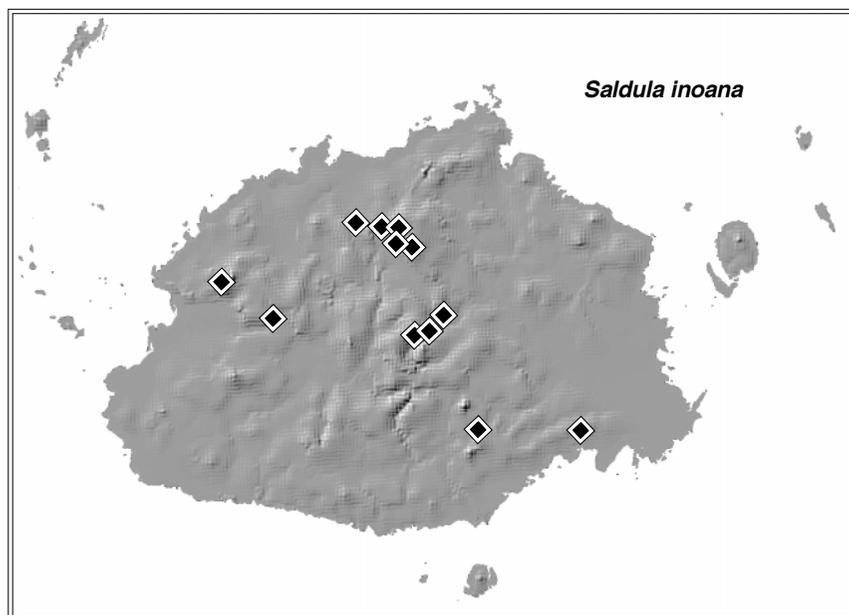


Figure 10. Distribution of *Saldula inoana* on Viti Levu.

Gillogly (JTPC); 11 males, 11 females, Rairaimatuku Plateau, waterfall and rocky stream nr. Monasavu Dam headquarters, 790 m [2950 ft], 17°44'32.3"S, 178°03'16.3"E, water temp. 23 °C, 2 Feb 2005, CL 7363, D.A. Polhemus; 2 males, 1 female, rheocrenes on steep rock faces along Tavua–Nadarivatu road, ca. 4 km N. of Nadarivatu between culverts 19/8 and 19/10, 580 m [1900 ft], 17°33'45.9"S, 177°57'09.2"E., water temp. 23.5 °C, 26 Mar 2005, CL 7366; 2 females, roadside waterfall and rocky stream 0.4 km N. of Waikumbakumba on Tavua–Nadarivatu road, 220 m [720 ft], 17°32'28.9"S, 177°56'20.6"E, water temp. 26 °C, 3 Feb 2005, CL 7368, D.A. Polhemus; 3 males, 1 female, Evans Range, small stream and cascade 13.5 km E. of Nagado on Vaturu Dam road, 415 m [1360 ft], 17°45'44.2"S, 177°39'59.1"E, water temp. 25 °C, 27 Mar 2005, CL 7405; 23 males, 14 females, headwaters of Veisari River, W. of Suva, first streamlet on road to Waivudawa, 260 m [850 ft], 18°04'27.5"S, 178°21'50.3"E, water temp. 24 °C, 23 Jan 2005, CL 7356, D. A. Polhemus; 16 males, 6 females, Nadrau Plateau, upper Wainikasau Creek above hydro intake, 9.5 km SW of Monasavu Dam hydro plant HQ, 750 m [2460 ft], 17°49'32.0"S, 178°01'41.3"E, water temp. 18 °C, 11 Aug 2005, 1030–1230 hrs, CL 7348; 7 males, 2 females, Nadrau Plateau, upper Nabilabila Creek and tributaries above hydro intake, 7.5 km SW of Monasavu Dam hydro plant HQ, 760 m [2490 ft], 17°48'33.7"S, 178°02'28.4"E, water temp. 19.5 °C, 11 Aug 2005, 13:30–15:45 hrs., CL 7364, ; 20 males, 12 females, Nadala Creek, 3.2 km SE of Nadarivatu, 700 m [2295 ft], 17°35'38.3"S, 177°58'00.8"E, water temp. 19.5 °C, 10 Aug 2005, 1400–1445 hrs., CL 7437; 4 males, 4 females, Governor's Pool, on slopes of Mt. Lomalagi, nr. Nadarivatu, 790 m [2590 ft], 17°33'43.9"S, 177°57'49.8"E, water temp. 19 °C, 10 Aug 2005, 1200–1330 hrs, CL 7436; 11 males, 3 females, trib. to Waidina River

at Namosi Road, 3 km S. of Narukunmbua, 355 m [1165 ft], 18°03'25.0"S, 178°09'25.4"E, water temp. 20.5 °C, 9 Aug 2005, 1200–1300 hrs, CL 7433; 2 males, 2 females, Mount Evans Range, trib. to rocky river at Abaca, 450 m [1475 m.], 17°40'02.0"S, 177°32'06.5"E, water temp. 24 °C, 26 Mar 2005, CL 7403 (deposited in FNIC, USNM, BPBM, JTPC).

Ecological Notes. Similar to *S. gilloglyi* discussed previously, *S. inoana* occurs in association with seep rhoecrenes and waterfall mist zones (Fig. 8) in the uplands of Viti Levu. *Saldula inoana* has been recorded from most major mountain areas of Viti Levu, including the Nadrau and Rairaimatuku plateaus, the Koroyanitu Range, and the Namosi Highlands, at elevations ranging from 220–790 m.

ACKNOWLEDGMENTS

We thank David Olson and Moala Tokota'a for logistical assistance and field support on Viti Levu, and Alan Gillogly for the donation of specimens long ago. This project was supported by grant DEB-0425970 from the National Science Foundation, and the Schlinger Foundation. The Fiji Government (Ministries of Environment and Forestry) and the Wildlife Conservation Society, Suva Office are thanked for their support of the project. In addition, JTP completed this research as an adjunct faculty member in the Bioagricultural Sciences Department at Colorado State University.

LITERATURE CITED

- Drake, C.J., 1961. Hemiptera: Saldidae. *Insects of Micronesia* 7(6): 287–305, 1 map.
Polhemus, J.T. 1985. *Shore bugs (Heteroptera, Hemiptera; Saldidae). A world overview and taxonomy of Middle American forms.* The Different Drummer, Englewood, Colorado. v + 252 pp.