# Two new species of *Sigaus* from Fiordland, New Zealand (Orthoptera: Acrididae).

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## Abstract

Two new species of grasshoppers (Orthoptera: Acrididae, subfamily Catantopinae, tribe Catantopini, subtribe Russalpiina) from Fiordland in the South Island of New Zealand are described. The morphological characteristics of *Sigaus homerensis* new species and *Sigaus takahe* new species are described. A key suitable for field use to distinguish the *Sigaus* grasshoppers is also presented.

**Keywords:** New species, Orthoptera, Acrididae, *Sigaus*, New Zealand

## Introduction

Since 1870, when F. Walker described New Zealand's first species of Acrididae, 15 additional species have been described (Hutton 1897 and 1898, Bigelow 1967, Salmon 1950, Westerman 1983 and Jamieson 1999). There are currently seven named species of grasshopper belonging to the endemic New Zealand genus *Sigaus* and two more are added in this paper. *Sigaus piliferus* Hutton, 1897 is the only *Sigaus* that is endemic to the North Island, while all other *Sigaus* are found in the South Island. The genus *Sigaus* is absent from the Stewart Island. *Sigaus australis* (Hutton, 1898) is the most common species in the genus. It is found between Arthur's Pass and Gore. *Sigaus campestris* (Hutton, 1898) is common in scattered populations, primarily along the east coast of the South Island between Lumsden and Cheviot. *Sigaus childi* Jamieson, 1999 and *Sigaus obelisci* Bigelow, 1967 are both endemic to small regions around the township of Alexandra. *Sigaus minutus* Bigelow, 1967 is confined to the Mackenzie Basin. *Sigaus villosus* (Salmon, 1950) is a truly alpine species, which is mostly found between 1900 and 2100 m and is confined to the northern half of the South Island. The genus *Sigaus* is easily distinguished from other genera within New Zealand, as the structures of the male genitalia are very distinctive. The epiphallus lophus is saddle-shaped and has a smooth outline and the mesal protuberance of lophus has a smooth outline and is rounded.

Two species of Acrididae are currently known from the Fiordland region, the common lowland grasshopper *Phaulacridium marginale* (Walker, 1870) and *Alpinacris tumidicauda* Bigelow, 1967. *Phaulacridium marginale* is found on most of the lowland grassy flats and sand dune areas throughout Fiordland and is common throughout all of New Zealand also. *Alpinacris tumidicauda* is an alpine species that is also found in Southland, Otago Lakes and Central Otago.

Both the new species of *Sigaus* described in this paper are endemic to their individual mountain ranges. They are not known to overlap with any other species of grasshopper. *Sigaus takahe* is known only from the Murchison Mountains Specially Protected (Takahe) Area. This specially protected area was set aside for the takahe (*Porphyrio mantelli* Owen) in 1953. Entry into this area is by permit only though the Department of Conservation. *Sigaus homerensis* is endemic to the Earl Mountains, which run parallel to State Highway 93. The avalanches along this road are well known for their magnitude, speed and volume (Carran, pers. comm.). Deep pockets of snow from avalanche debris can lie on the ground till January or February and may have influenced the current distribution of *S. homerensis*.

This paper describes the two new species from Fiordland and distinguishes them from the closely related species *S. australis* and *S. obelisci*. Presented is a key suitable for field use for the genus *Sigaus*.

## Methods

The male genitalia of *S. homerensis* and *S. takahe* were extracted by lifting the epiproct, and the epiphallus, epiphallic sclerites, cingulum and phallic complex were extracted with forceps. Some drawings were made using a stereomicroscope with a grid eyepiece, and digitised using a Hewlett Packard, ScanJet 5300C with HP PrecisionScan version 3, edited using CorelDraw version 9 and Corel Photo Paint version 9. Others were from photographs with a digital camera (Olympus C-700 Ultra Zoom, AF Zoom 5.9-59 mm 1:2.8 - 3.5,

with a Macro Conversion Lens f = 40 cm), then edited and traced with CorelDraw. The map was prepared using VisualMap version 6 and CorelDraw. All grasshopper data are stored in the New Zealand Grasshopper Database using Microsoft Access 2003 (Morris, 2002).

Sites referred to in this paper can be located on maps (for *S. homerensis*, D40-Milford and D41-Eglinton; for *S. takahe*, C42-Mount Irene and D42-Livingstone; other search areas, C44-Hunter Mountain) in the NZMS 260 series. The locations and altitudes were either taken off these maps or determined using Global Positioning System. The New Zealand Map Grid co-ordinates are recorded in Geodetic Datum 1949. Abbreviations for repositories are: Canterbury Museum, Christchurch, New Zealand, CMNZ; Otago Museum, Dunedin, New Zealand, OMNZ; Simon Morris, Private collection, Darfield, New Zealand, SMNZ. All the paratypes in the author's private collection will be finally deposited in CMNZ. Morphological terms follow Pfadt (1994) and Bigelow (1967). Two-letter area codes follow Crosby *et al.* (1998).

## Taxonomy

### Key to species of Adult *Sigaus*

1 Specimen from the North Island . . . . . .***S. piliferus***
- Specimen from the South Island . . . . . .**2**
2 Caudal margin of the pronotum sinuate . . . .**3**
- Caudal margin of the pronotum smooth . . .**5**
3 Specimen rugose . . . . . .**4**
- Specimen smooth . . . . . .***S. campestris***
4 Specimen medium-sized and stout; female 29 mm and male 12 mm. Only known from a small region east of the township of Alexandra . . . . . .***S. childi***
- Specimen very small; female 15 mm and male 8 mm. Only known from the Mackenzie Basin . . . . . .***S. minutus***
5 Lateral carinae on pronotum absent . . . . . .***S. villosus***
- Lateral carinae on pronotum present . . . . . .**6**
6 Specimen from the Fiordland region . . . . . .**7**
- Specimen not from the Fiordland region . . .**8**
7 Female: Antennae filiform (threadlike, slender segments of equal diameter)
Male: Upper margin of ninth tergum uniform with eighth in lateral view (Fig. 17) . . . . . .***S. homerensis***
- Female: Antennae clavate (clubbed, having a thickened or expanded distal end)
Male: Upper margin of ninth tergum projecting above eighth in lateral view (Fig. 21) . . . . . .***S. takahe***
8 Male: Upper margin of ninth tergum uniform with eighth in lateral view. . . . . .***S. australis***
Male: Upper margin of ninth tergum projecting above eighth in lateral view . . . . . .***S. obelisci***

### Descriptions

***Sigaus homerensis*** new species

**Diagnosis.** Female with antennae filiform (threadlike, slender segments of equal diameter); male with upper margin of ninth tergum uniform with eighth in lateral view (Fig. 17), epiphallus lophus in dorsal view strongly curved; bridge very wide (Fig. 20).

**Male -** Figs 2, 4, 6, 8, 17-23, 26.

**Length.** Body length 19-21 mm (Table 1).

**Head.** Antenna clavate with 24 segments. Fastigium longer than broad. Vertex convex and without median carina. Frontal costa narrowing dorsally. Frons profile slightly conical. **Thorax.** Pronotum prozona smooth with metazona rugose. Three transverse sulci present and distinct; first transverse sulcus extending between lateral carinae, second and third transverse sulci extending beyond lateral carinae. Median carina extending full length of pronotum. Pronotum with posterior margin curving smoothly from either side into a deep median notch. Metathorax smooth and with medial carina. Sternum with metasternal interspace narrow. Antero-lateral metasternal margin tapering inwards. Mesosternal interspace wide. Tegmina small and extending no further than half way to the second abdominal segment. **Abdomen.** First nine abdominal terga dorsally with medial carina. Epiproct shield-shaped and slightly longer than broad. Cerci rounded or pointed apically. **Foreleg and Midleg.** Tibia 4 to 5 submedial ventral spines and 1 sublateral ventral spine. **Hindleg.** Tibia 6 to 9 anterior spines and 8 to 9 posterior spines. **Genitalia.** Epiphallus lophus very saddle-like in shape. Mesal protuberances of the lophi large and well rounded. Epiphallus bridge

**Table 1. Body length measurements of *S. homerensis* and *S. takahe*.**

| | Body length | | | |
|---|---|---|---|---|
| | Mean ± SD | Minimum | Maximum | n |
| *Sigaus homerensis* | | | | |
| Homer Tunnel | | | | |
| Female | 31 ± 3 | 28 | 36 | 9 |
| Male | 20 | 20 | 20 | 3 |
| Monkey Creek | | | | |
| Female | 36 ± 3 | 32 | 36 | 4 |
| Male | 20 ± 1 | 19 | 21 | 4 |
| Hut Creek | | | | |
| Female | 32 ± 2 | 30 | 35 | 4 |
| Male | | | | |
| *Sigaus takahe* | | | | |
| Female | 31 ± 3 | 30 | 36 | 4 |
| Male | 20 ± 0.5 | 19 | 20 | 5 |

very wide. Cingulum zygoma widely curved. Apodeme of cingulum projecting into a rounded point.

**Female -** Figs 1, 3, 5, 7.

**Length.** Body length 28-38 mm (Table 1).

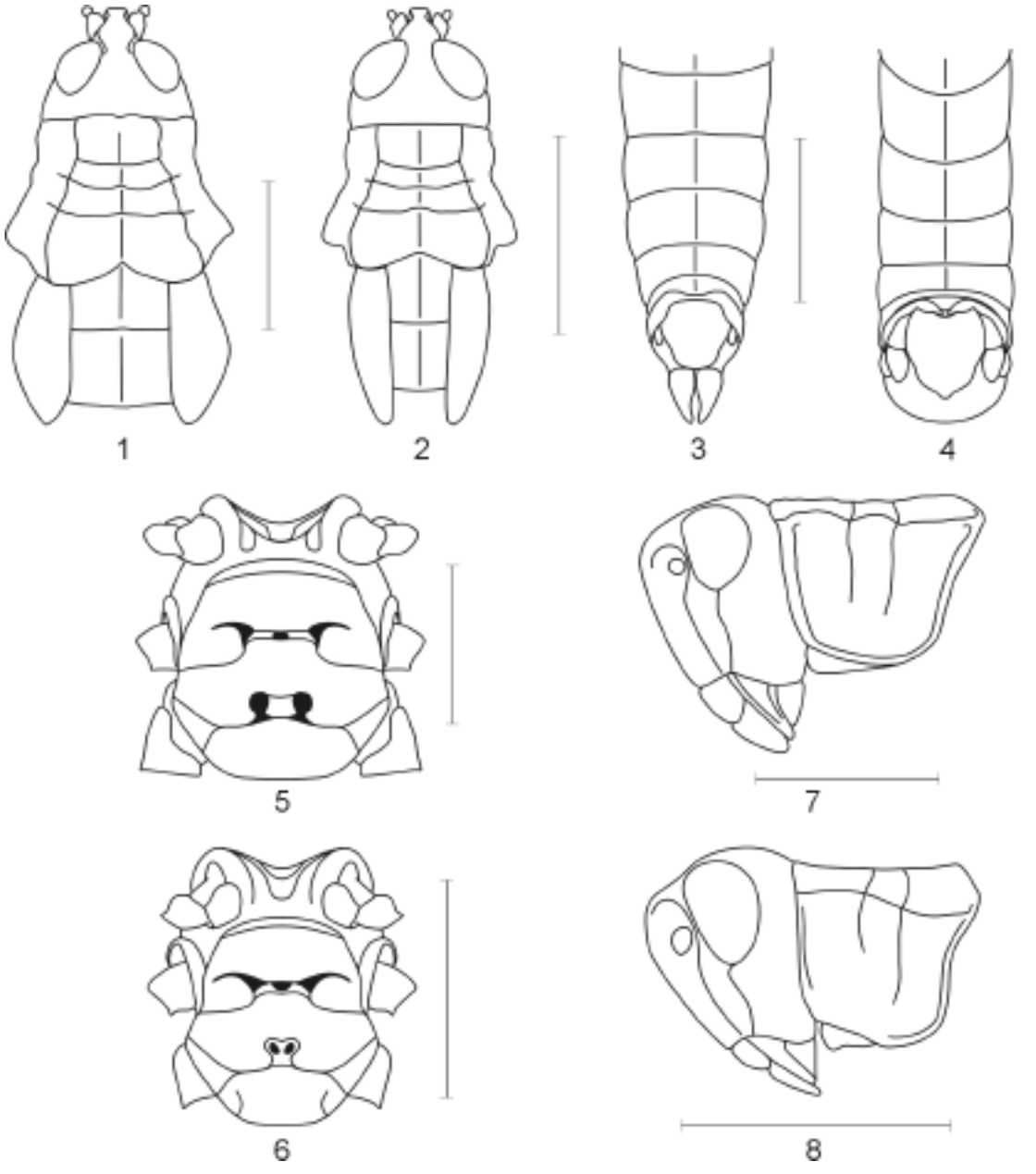
**Head.** Same as male, but antenna filiform. **Thorax.** Same as male, but sternum metasternal interspace wide. **Abdomen.** Same as male, but epiproct shield-shaped and equally wide and high. Caudal margin of epiproct rounded and smooth. Caudal margin of cercus rounded. Dorsal valves slightly upcurved in lateral view. Ventral valves gently downcurved in lateral view. **Foreleg and Midleg.** Same as male. **Hindleg.** Tibia 7 to 9 anterior spines and 8 to 9 posterior spines. **Genitalia.** Caudal margin of subgenital plate with one mesal rounded 'teeth'.

**Holotype data.** (Male). Homer Tunnel, FD, 2113252E 5592864N, 1052 m, ID No. 446, 28 February 2003, Simon J Morris (SJM), CMNZ, Colour Morph A.

**Paratypes.** (19 females, 11 males, 3 juveniles) Homer Tunnel, 989 m, 2113236E 5592854N, 22 February 1996, ID No. 444, SJM, 1 female & 1 juvenile (CMNZ), 2 females (SMNZ); Homer Tunnel, 1040 m, 21133E 55929N, 24 February 1996, ID No. 35, SJM, 2 juveniles (CMNZ), 2 females (SMNZ); Homer Tunnel, 989 m, 2113236E 5592854N, 2 February 1998, ID No. 36 & Gen. collection, SJM, 1 female (CMNZ), 2 females & 5 males (SMNZ); Hut Creek, 639 m, 2114710E 5579315N, 1 February 1996, ID No. 54, SJM, 2 females (SMNZ); Hut Creek, 774 m, 2114464E 5579609N, 1 February 1996, ID No. 445, SJM, 2 females (SMNZ); Monkey Creek, 1257 m, 2114408E 5588599N, 3 February 1998, ID No. 37 & Gen. collection, SJM, 3 males (CMNZ), 4 females & 1 male (SMNZ); Homer Tunnel, 2113252E 5592864N, 1052 m, ID No. 446, 28 February 2003, SJM, 1 female & 1 male (CMNZ), 1 female & 1 male (OMNZ), 1 male (SMNZ); Hut Creek, 21146E 55805N, 1050 m, ID No. 457, Roger Wood, 1 female (SMNZ).

**Distribution.** The distribution of *S. homerensis* is not known to overlap with that of any other grasshopper species. *S. homerensis* is known only from the Earl Mountains (Fig. 25). Additional searches for *S. homerensis* were undertaken in February 1996 in the upper Hollyford River. Mount McPherson, Gertrude Valley and Mount Belle were all surveyed in good weather, sunny, with no wind and with high temperatures (Morris 2003). All three searches were unsuccessful in locating any grasshoppers.

**Habitat and Sites.** All three populations of *S. homerensis* are small and isolated. The size of each




**Figs 1-8.** *Sigaus homerensis.* **1,** head, thorax, first abdominal segment and tegmina, female, dorsal; **2,** same, male; **3,** abdomen apex, female, dorsal; **4,** same, male; **5,** sternum of thorax, female, ventral; **6,** same, male; **7,** head and thorax, female, lateral; **8,** same, male. Scale bar = 5 mm.

site is approximately 30 x 30 m, with the largest site being located at the type location. All sites are regularly swept clear of tall plants by avalanches, making these areas more sparsely vegetated than the surrounding. Similar terrain and vegetation is found surrounding all the sites; however, *S. homerensis* are not found in these areas. A possible explanation of this could be associated with avalanches, vegetation height and sunshine hours. This region receives high rainfall (about 8000 mm/year, Carran, pers.comm.) coupled with the lowest sunshine hours in New Zealand (1400 to 1600 h/year). It appears that these small cleared areas are better for *S. homerensis* than avalanche-free areas with their taller vegetation. New Zealand Acrididae are diurnal sun-baskers and require basking surface to become active for the day.

**Coloration.** Two adult colour morphs are known from the Homer Tunnel site, a drab gold and a dark blue-grey colour. Approximately two-thirds of the adults *S. homerensis* were of the drab gold colour. Three *S. homerensis* hoppers were observed at the Homer Tunnel site; two were patterned very similarly to the dark blue-grey colour morphs, except that they were darker, and one female hopper was patterned as a drab gold colour pattern but was only missing the brown blotches on its body.

**Colour Morphs**

Colour Morph A - drab gold (Fig. 26) (Adult both sexes).

**Head.** Antenna dark brown to light brown, anterior to posterior. Eyes dark brown with small light brown speckles. Head drab gold with very small olive blotches. Occiput dark brown to drab gold. **Thorax.** Pronotum drab gold with very small brown blotches. Lateral lobe dark brown dorsally fading to drab gold ventrally. Sternum shield drab yellow to cream with small dark brown spots. Prosternum drab gold. Mesosternum and metasternum cream. Prosternal spine olive. Metasternal interspace pink or red. **Abdomen.** Terga black to dark brown laterally and brown medially. Cream spots submedially and posteriorly on each tergum. Tegmina dark brown dorsally, fading to brown ventrally, wing veins light brown. Sternum drab yellow to cream with small brown speckles, submedially pink. Subgenital plate drab yellow to cream with a pink tinge. A brown submedial strip on the male ninth sternum. **Hindlegs.** Femur knee dark brown. Lunula black. Upper carina dull orange. Upper marginal area drab gold with two broad black transverse stripes. Upper internal area drab gold with two broad dark brown transverse stripes. Medial area drab gold with two broad black slanting lines anteroventral to posterodorsal. Lower marginal area, lower carina, lower internal space, lower internal carinule and internal ridge, red to orange. Medio-internal area drab gold with two broad dark black stripes. Tibia and tarsus red to orange. Spines drab gold, black apically. **Foreleg and midleg.** Drab gold with small brown blotches and red tinge.

Colour Morph B - dark blue-grey (Adult both sexes).

**Head.** Antenna dark grey with a light purple tinge basally. Eyes black with very small light grey speckles. Head, dark blue-grey with small light grey blotches. **Thorax.** Pronotum blue-grey with small light grey blotches postero-laterally. Lateral lobe dark blue-grey dorsally fading to light grey ventrally. **Abdomen.** Terga dark blue-grey with large light grey blotches, light grey spots submedially and posteriorly on each tergum with a brown margin between each spot. Tegmina black with very small light grey blotches. **Hindlegs.** Femur knee black with a purple tinge around apical margins. Lunula black. Upper marginal area and upper carina light grey with small blue-grey blotches, two broad blue-grey transverse stripes. Medial area light grey with small blue-grey blotches, two broad blue-grey slanting lines anteroventral to posterodorsal. **Foreleg and midleg.** Light grey with small blue-grey blotches.

**Suggested Common Name:** Homer grasshopper.

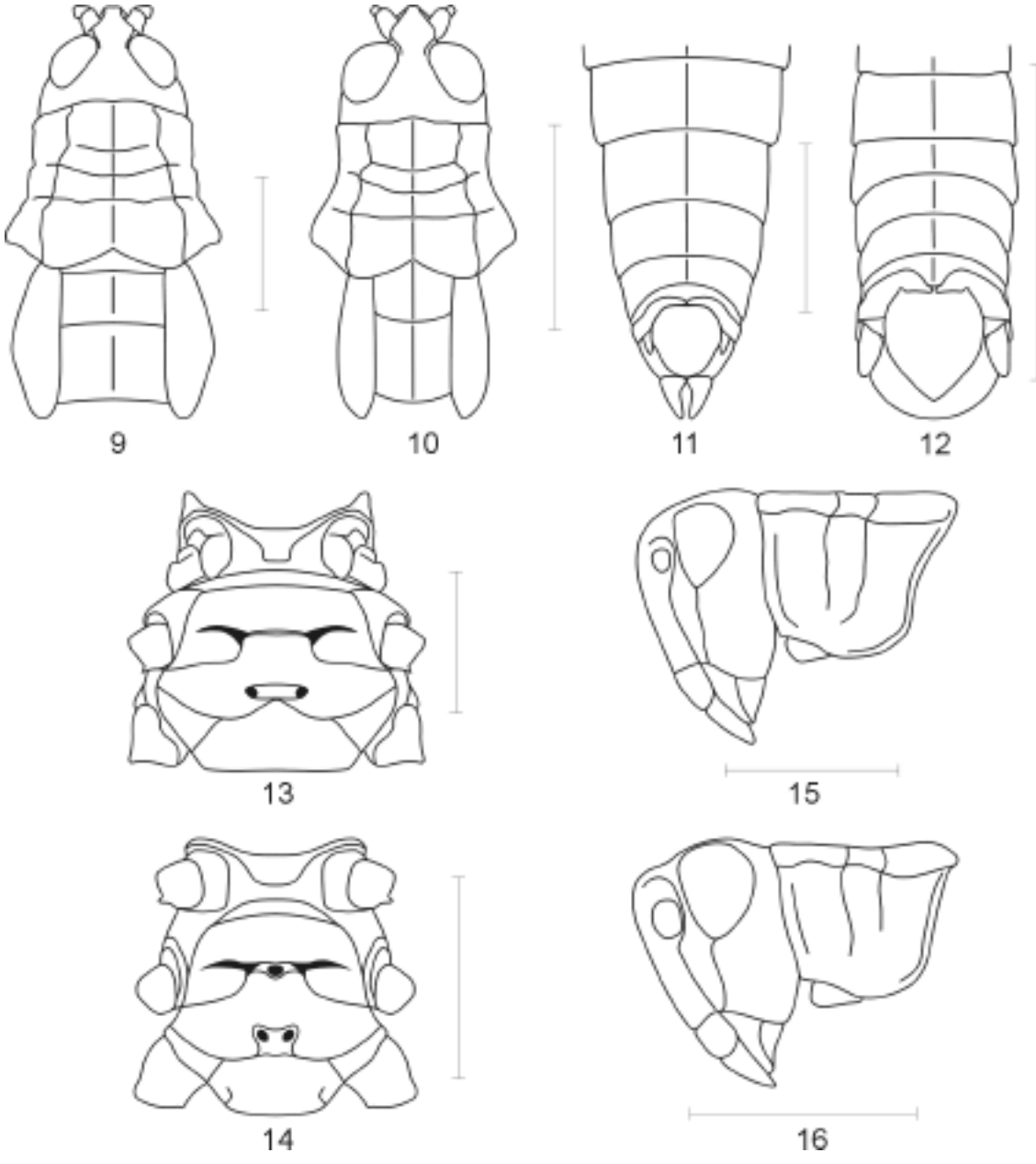
***Sigaus takahe*** new species

**Diagnosis.** Female with antennae clavate (clubbed, having a thickened or expanded distal end); male with upper margin of ninth tergum projecting above eighth in lateral view (Fig. 21), epiphallus lophus in dorsal view gently curved; bridge narrow (Fig. 24).

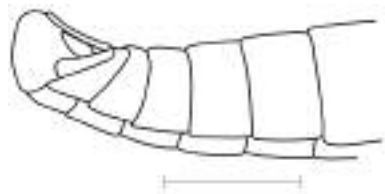
**Male -** Figs 10, 12, 14, 16, 21-24.

**Length.** Body length 19-20 mm (Table 1).

**Head.** Antenna clavate with 24 segments. Fastigium longer than broad. Vertex convex and without median carina. Frontal costa narrowing




**Figs 9-16.** *Sigaus takahe.* **9,** head, thorax, first abdominal segment and tegmina, female, dorsal; **10,** same, male; **11,** abdomen apex, female, dorsal; **12,** same, male; **13,** sternum of thorax, female, ventral; **14,** same, male; **15,** head and thorax, female, lateral; **15,** same, male. Scale bar = 5 mm.



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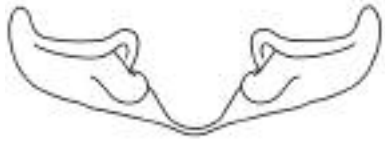

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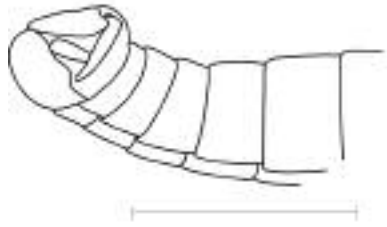

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**Figs 17-24.** Genital structures of male *S. homerensis* and *S. takahe*. **17,** *Sigaus homerensis*, abdomen apex, lateral; **18,** same, cingulum and phallic complex, dorsal; **19,** same, epiphallus, posterior; **20,** same, same, dorsal; **21,** *Sigaus takahe*, abdomen apex, lateral; **22,** same, cingulum and phallic complex, dorsal; **23,** same, epiphallus, posterior; **24,** same, same, dorsal. Scale bar = 5 mm.

dorsally. Frons profile slightly conical. **Thorax.** Pronotum prozona smooth with metazona rugose. Transverse sulci present and distinct. First transverse sulcus extending between lateral carinae, second and third transverse sulci extending beyond lateral carinae. Median carina extending full length of pronotum. Pronotum posterior margin curving smoothly from either side into a deep median notch. Metathorax smooth and with medial carina. Sternum metasternal interspace narrow. Antero-lateral metasternal margin, tapering inwards. Mesosternal interspace wide. Tegmina small and extending no further than half way to the second abdominal segment. **Abdomen.** First eight abdomen terga with medial carina. Ninth tergum projecting above abdomen. Epiproct shield-shaped and slightly longer than broad. Cerci rounded or point apically. **Foreleg and Midleg.** Tibia 1 posterior sublateral ventral spine and 5 posterior submedial ventral spines. **Hindleg.** Tibia with 7 to 8 anterior spines and 8 to 9 posterior spines. **Genitalia.** Epiphallus lophus saddle-like in shape. Mesal protuberances of the lophi smooth and rounded. Epiphallus bridge narrow. Cingulum zygoma generally curved. Apodeme of cingulum projecting into a rounded point.

**Female -** Figs 9, 11, 13, 15.

**Head.** Same as male. **Thorax.** Same as male. **Abdomen.** First nine abdomen terga with medial carina. Epiproct shield-shaped and longer than broad. Caudal margin of epiproct rounded and smooth. Caudal margin of cerci rounded. Dorsal valves slightly upcurved in lateral view. Ventral valves gently downcurved in lateral view. **Foreleg and Midleg.** Tibia 1 posterior sublateral ventral spine and 4 to 5 posterior submedial ventral spines. **Hindleg.** Tibia 8 anterior spines and 9 posterior spines. **Genitalia.** Caudal margin of subgenital plate with one mesal rounded tooth.

**Holotype data.** (Male). Takahe Valley, FD, 1430 m, 20903E 55346N, 13 February 2003, ID No. 456 & Gen. Coll., Andrew Smart, PC Taylor & Caren Shrubshell (AS, PCT & CS), CMNZ.

**Paratypes.** (4 females, 6 males) Plateau Creek, 1100 m, 20805E 55382N, 7 November 2001, ID No. 331, Ros Cole, 1 female (SMNZ); Dana Peaks, 1430 m, 20883E 55408N, 13 March 2003, ID No. 452, Megan Willans & Mark Mawhinney (MW & MM), 1 female (CMNZ); Dana Peaks, 1260 m, 20869E 55390N, 13 March 2003, ID No. 453 & Gen. Coll. (cingulum and phallic complex lost), MW & MM, 1 male (SMNZ); Dana Peaks, 1430 m, 20866E 55383N, 13 March 2003, ID No. 454, MW & MM, 1 female (SMNZ); Dana Peaks, 1430 m, 20868E 55400N, ID No. 445, 13 March 2003, MW & MM, 1 male (SMNZ); Takahe Valley, 1430 m, 20903E 55346N, 13 March 2003, ID No. 456, AS, PCT & CS, 1 female & 1 male (OMNZ), 1 male (CMNZ), 1 male (SMNZ).

**Distribution.** The distribution of *S. takahe* is not known to overlap with that of any other grasshopper species. *S. takahe* is known only from

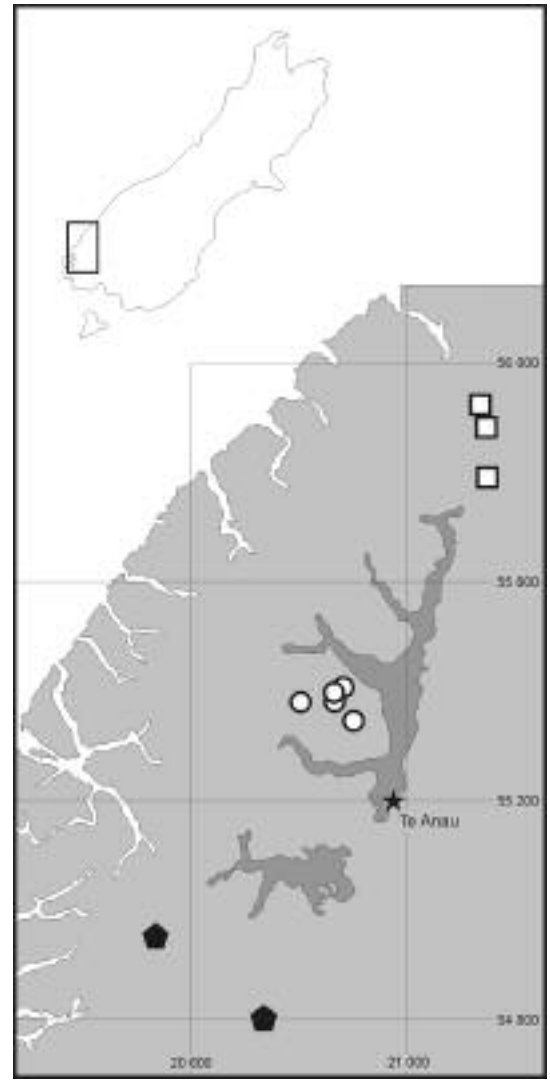


**Fig. 25.** Map of northern Fiordland showing known distribution of *S. homerensis* (white square), *S. takahe* (white circle) and sites where the genus *Sigaus* is not known from (black pentagon).

**Fig. 26.** The male Holotype of *S. homerensis* (gold morph) from Homer Tunnel, Fiordland.

the Murchison Mountains (Fig. 25). Two additional searches for *S. takahe* south of Lake Manapouri were undertaken in February of 2003. A search on Mount Burns resulted in no *Sigaus* being found, however the grasshopper *A. tumidicauda* is established here and specimens were taken. Mount Memphis was also searched but no species of Acrididae were found. The soils in the alpine zone on Mount Memphis were especially boggy and this may indicate why the search was unsuccessful.

**Habitat and Sites.** The author has not visited any of the sites, therefore no conclusions can be drawn about its habitat preferences. *S. takahe* is expected to like similar, open and sunny habitats as *S. homerensis*.

**Coloration.** The author has seen no fresh specimens of *S. takahe*. As New Zealand Acrididae lose their original colours promptly after being killed, no colour morph is described.

**Suggested Common Name.** Te Ana-au grasshopper.

## Acknowledgements

I am grateful to John Ward (Canterbury Museum) for reviewing and answering the many questions I asked while writing this manuscript. I thank: the Canterbury Museum for use of their resources; Brian Patrick (Otago Museum) for information about grasshoppers in Fiordland and letting me examine his collection; Eric Edwards (DOC, Invercargill) for information about the insect fauna of Fiordland; the Department of Conservation, Te Anau Takahe Recovery Staff (Megan Willans, Mark Mawhinney, Andrew Smart, PC Taylor, Caren Shrubshell and Hannie Treadwell) for collecting the specimen of *S. takahe*. A special thanks goes to Dave Crouchley (DOC, Te Anau) for helping me organise the collecting of the specimens that I needed from the Murchison Mountains Specially Protected (Takahe) Area.

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