Four new species of the caddis genus Philorheithrus (Trichoptera: Philorheithridae) from New Zealand

Article · January 2006

CITATION
1

READS
20

2 authors, including:

Ian Malcolm Henderson
Massey University
36 PUBLICATIONS **390** CITATIONS

SEE PROFILE

Records of the Canterbury Museum, 2006, Vol. 20: 21-33

FOUR NEW SPECIES OF THE CADDIS GENUS *PHILORHEITHRUS* (TRICHOPTERA: PHILORHEITHRIDAE) FROM NEW ZEALAND

IAN M HENDERSON[1] AND JOHN B WARD[2*]

[1]Institute of Natural Resources, Massey University, Private Bag 11-222, Palmerston North 4442, New Zealand
[2]Canterbury Museum, Rolleston Avenue, Christchurch 8013, New Zealand
[*]Corresponding author: jandgward@clear.net.nz

ABSTRACT

Four new species of caddis belonging to the endemic New Zealand genus *Philorheithrus*: *P. litoralis*, *P. aliciae*, *P. latentis* and *P. harunae*, are named and described.

KEYWORDS

New Zealand; Trichoptera; Philorheithridae; *Philorheithrus*; new species

INTRODUCTION

The Philorheithridae is a small Gondwanan family of about thirty species known from endemic genera in New Zealand, Australia, South America (Chile) and Madagascar. New Zealand has six species in the endemic genus *Philorheithrus* Hare, 1910 (*P. agilis* (Hudson, 1904), *P. lacustris* Tillyard, 1924 and the four described herein). The centre of distribution of the known family members is Australia, where there are fourteen named species in the five genera *Aphilorheithrus* Mosely, 1936; *Austreithrus* Mosely, 1953; *Kosreithrus* Mosely, 1953; *Ramiheithrus* Neboiss, 1974; and *Tasmanthrus* Mosely, 1936. Chile has five species in two genera *Mystacopsyche* Schmid, 1955 and *Psilopsyche* Ulmer, 1907 (data from Morse 2006). The Australian and two New Zealand species are figured by Neboiss (1986) in his *Atlas of the Trichoptera of the SW Pacific – Australian Region*. In addition, studies of Australian Philorheithridae larvae have revealed the probable existence there of two further genera, both currently unnamed, and of larvae tentatively placed into the New Zealand genus *Philorheithrus* (St Clair 1997; Dean et al. 2004). Recently, an unnamed genus containing three species has been discovered in Madagascar (Weaver et al. 2006).

A shared specialised feature of most male Philorheithridae (but not in *Austreithrus*, *Ramiheithrus* or *Psilopsyche*) is the presence of a pair of un-jointed appendages named pilifers (of unknown homology) above the maxillary palpi. Others are a sclerotised lobe at the base of the anal margin in the forewing, a setose nodule on the first segment of the maxillary palpi, and, in several genera, of an extra (fourth) anal vein that has been named "post-anal" (Schmid 1964, p.328). Mosely (1953) does not mention this vein, but Kimmins' (1953) figures 119 and 121 clearly show it for *Philorheithrus agilis* and *P. lacustris*.

Philorheithrus agilis and *P. lacustris*

These two fairly similar species have been confused in some earlier work. Kimmins' (1953) figures 120a-d, supposedly of the male genitalia of *P. agilis*, are clearly those of *P. lacustris*. McFarlane (1966, p. 152) drew attention to this, figured the male genitalia of *P. agilis* from a North Island specimen, and explained the differences between the two species. The inferior appendage upper branch in lateral view has a "dilation to the rear end terminally" in *P. agilis* (he showed this in his figure 38). In *P. lacustris* this dilation is lacking and the upper branch is curved posterad, as shown in Kimmins' (1953) figure 120a (see also Figures 1e and 1f, this paper). There is some variation in the precise shapes, however. Thus Cowley (1978) reported, "Male [*Philorheithrus*] pupae have been collected from several localities in the South Island. Their genitalia range from the *P. agilis* extreme at Totaranui [NN] to the *P. lacustris* extreme at Cass [MC] yet larvae collected from these same localities appeared to be identical". From this result, Cowley concluded that only one species was involved.

We disagree with his conclusion. There are additional characters, such as forewing size and shape, not studied by Cowley, which enable clear separation of the two species. As previously noted by Tillyard (1924), *P. agilis* has a relatively broader forewing than does *P. lacustris*, and the angle between the anterior margin (costa) and outer margin (termen) is greater. For *P. agilis*, forewing length/width (L/W) typically = 2.9-3.3;

angle = 45°-55°; for *P. lacustris*, the values are 3.65-4.2 and 40°-50° respectively (these measurements are defined in Fig. 2). There is a slight sexual dimorphism in the forewing venation; in males of both species, apical fork 4 (M3+4 fork) is absent. It is also nearly always absent in *P. agilis* females, but (in our experience) always present in females of *P. lacustris*. This difference, combined with the relatively narrower wings, makes the *P. lacustris* female forewing venation appear denser than that of *P. agilis*. A further character separating these two species is the presence of thickened, scale-like hairs (androconia) on the hind wing of *P. lacustris*, but not *P. agilis* (Kimmins 1953).

Using these criteria, we have re-examined catches from each known site. The resulting distribution maps for these two species are shown in Figure 3. There are no North Island records of *P. lacustris*. Within the South Island, each species shows a rather patchy distribution, with generally only one present at any one site. However, at MB Hell's Gate, Wairau River Gorge, male and female adults of both species were caught in the same light-trap on two different occasions (Ward and Henderson 1993).

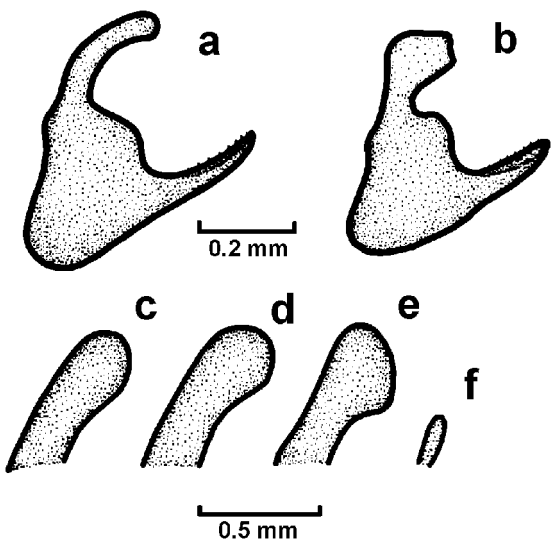

Figure 1. a-f *Philorheithrus* species. **a-b** male genitalia, inferior appendage, lateral of **a** - *P. lacustris*; **b** - *P. agilis*. **c-f** pilifers, lateral of **c** - *P. agilis*; **d** - *P. lacustris*; **e** - *P. litoralis*; **f** - *P. aliciae*.

SPECIMEN REPOSITORIES AND OTHER ABBREVIATIONS

ALEX:	Alexandra Museum, Alexandra, New Zealand;
CMNZ:	Canterbury Museum, Christchurch, New Zealand; GH: GV Hudson Collection, held in Te Papa Museum, Wellington, New Zealand;
IHPC:	Ian M Henderson's personal collection, Massey University, Palmerston North, New Zealand;
NMNH:	National Museum of Natural History, Smithsonian Institution, Washington DC, USA;
NZAC:	New Zealand Arthropod Collection, Landcare Research, Auckland, New Zealand;
OMNZ:	Otago Museum, Dunedin, New Zealand.

Storage medium: alc = 80% SDA (industrial ethanol); pin = dry pinned

Collector's names: GV Hudson = GVH; Ian M Henderson = IMH; Brian H Patrick = BHP; John B and Geraldine M Ward = J&G; John B Ward = JBW.

Two-letter codes for regions in New Zealand (Crosby et al. 1998): BR: Buller, CO: Central Otago, DN: Dunedin, FD: Fiordland, MK: Mackenzie, NC: North Canterbury, NN: Nelson, OL: Otago Lakes, SL: Southland, WD: Westland, WN: Wellington.

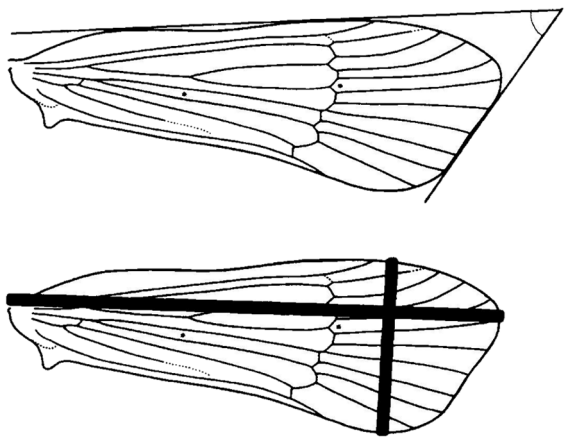

Figure 2. Definition of the wing length/width (L/W) ratio and the angle between costa and termen. W is the maximum width measured perpendicularly to L.

Grid references to collection localities are in terms of the NZMS 260 metric grid, to a precision of 100 m. Altitudes are given in metres (m) above sea level. The notation used to describe the form of the maxillary palpi consists of the relative lengths of the segments followed by the total length. Nomenclature for wing venation follows Mosely (1953).

SYSTEMATIC SECTION

Order TRICHOPTERA Kirby, 1813
Family PHILORHEITHRIDAE Mosely, 1936

Genus *Philorheithrus* Hare, 1910
Type species *Pseudoeconesus agilis* Hudson, 1904 (monobasic)

***Philorheithrus aliciae* sp. nov.**
Figures 4, 5

Derivation of name

This species is named for Alicia Scott in recognition of her support of this research.

Diagnosis

Males are distinct from all other species in the genus by their genitalia and by their small, finger-like pilifers. Both sexes can be identified by the deep hindwing apical fork1 (R2+3 fork), and by the rather broad costal space towards the base of the forewing.

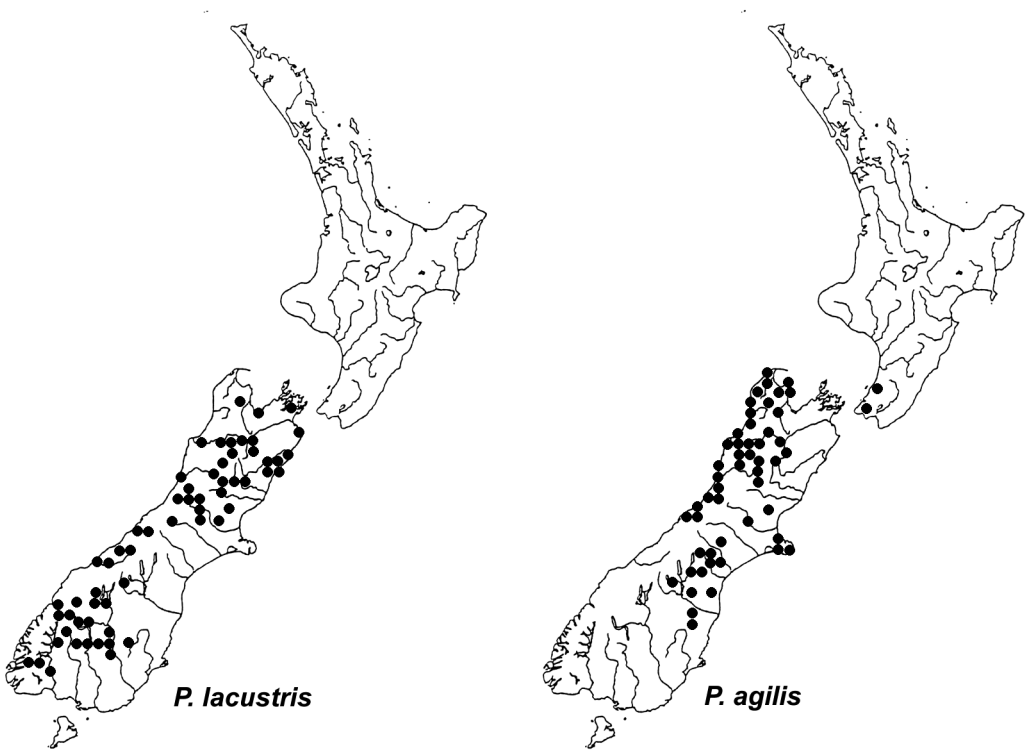

Figure 3. Maps of the known distributions of *Philorheithrus agilis* and *P. lacustris*. Points are rounded to the nearest 20 km.

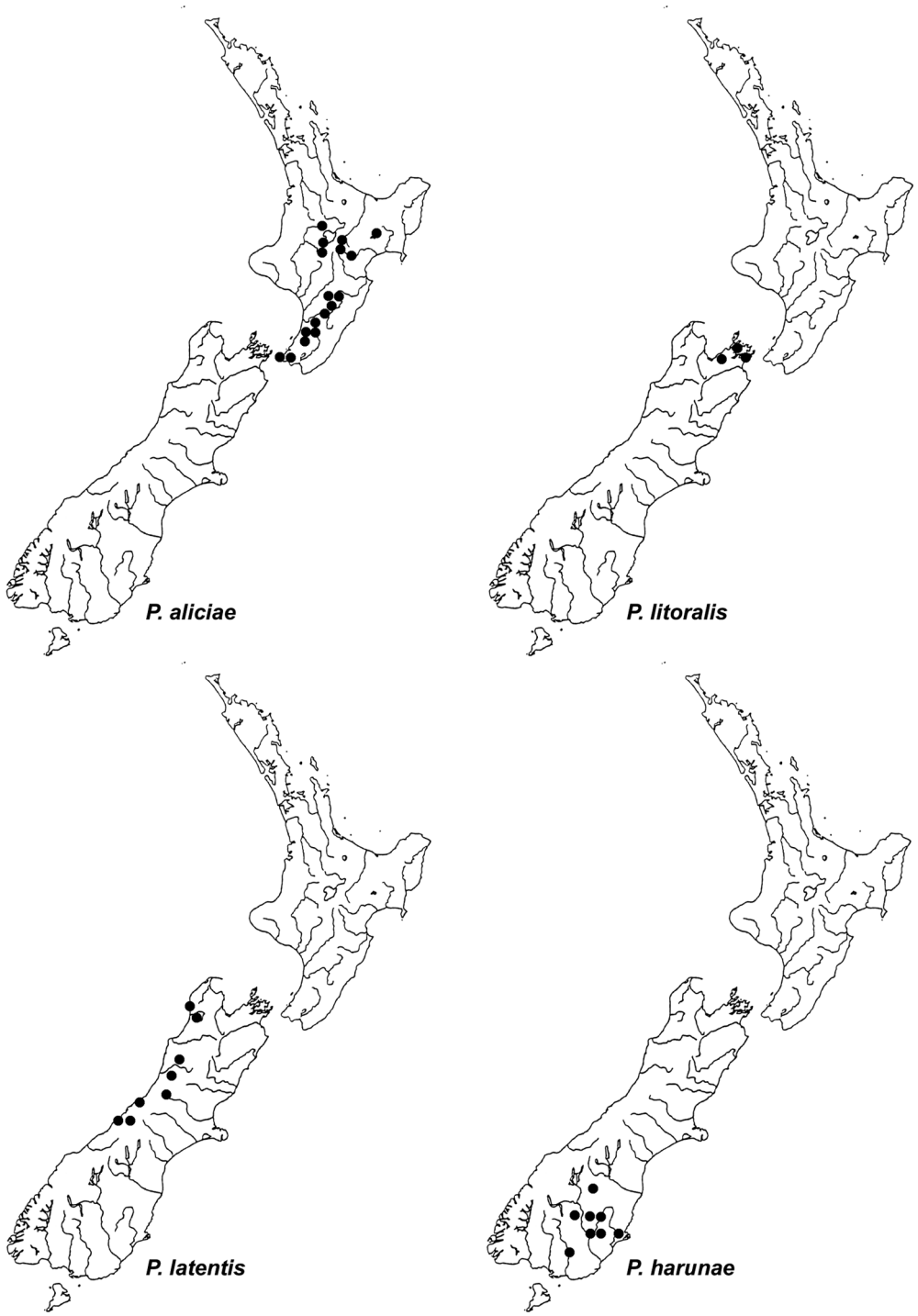

Figure 4. Maps of the known distributions of *Philorheithrus aliciae*, *P. litoralis*, *P. latentis* and *P. harunae*. Points are rounded to the nearest 20 km.

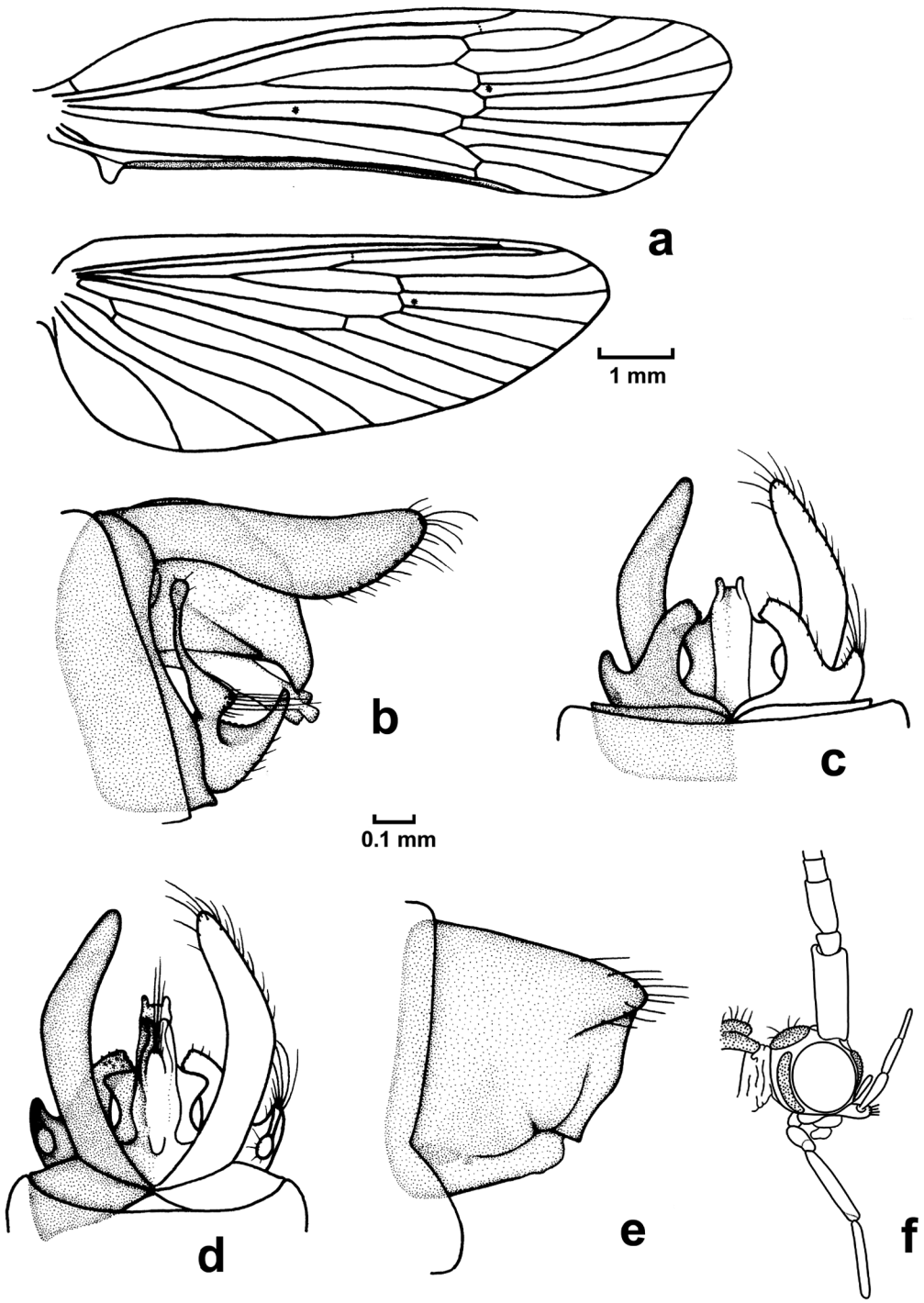

Figure 5. *Philorheithrus aliciae* sp. nov.: **a** - male wings; **b** – male genitalia lateral; **c** – same, ventral; **d** – same, dorsal; **e** - female genitalia lateral, **f** – male head lateral.

Description

Male: maxillary palpi, 4-segmented, 2:3:3:4, 1.1 to 1.3 mm. Pilifers very small, finger-like.

Venation: in the anterior wing only two anal veins are present, which coalesce very early (proximal to the anal lobe). In the posterior wing R1 and R2 join near wing margin, and the base of apical fork 1 (R2+3 fork) overlaps the radial cell by one-third to one-half the length of the cell. Anterior wing length: 9.3- 10.6 mm.

Genitalia: segment X apex recurved, directed ventrad, a pair of triangular flaps oriented horizontally arising from the ventral margin. Superior appendages with concave dorsal margin. Inferior appendage upper branch long, erect, a triangular expanded process near the base, slight curve posterior, apex dilated. A small pointed process to sternite VI (not present in other species of *Philorheithrus*).

Female: maxillary palpi, 5-segmented, 2:5:4:4:3, 2.5 mm.

Venation: apical fork 4 with foot stalk present in anterior wing. Posterior wing, three anal veins present, apical fork 1 overlaps radial cell as in male. Anterior wing length: 11.7- 12.3 mm.

Genitalia: dorsal processes short and rounded, no lateral processes or concavities. A small pointed process to sternite VI.

Remarks

The habitat at the type locality is a small seepage, which has since dried during a drought. This population is presumed extinct, because a thorough search of the locality has not yielded any larvae or further adults.

Type material

Holotype male (CMNZ, alc), WN Wilton Bush, Wellington, 26570 59919, 100 m, IMH, 7 Nov 1979. Paratypes 2 males, 2 females, 2 larvae (IHPC, alc), WN Kahuterawa Stream tributary, 27305 60778, 260 m, IMH, 24 February 1993. Paratypes 1 male, 1 female(CMNZ, alc), TO Kakaho stream, Pureora State Forest 27496 62889, 480 m, IMH,14 Feb 1983. Paratype male (GH, pin, GV Hudson label 88b), WN Campbells Stream, Karori, Wellington, GVH, 16 November 1913. Paratype male (GH, pin, GV Hudson label 88c), WN Karori, Bush Hill, GVH, 9 November 1920. Paratype male (NMNH, pin), TO Mangatawai Stream, 20 km south of Turangi, 27490 62440, 810 m, OS Flint Jr, 3 January 2004. Paratypes 2 male, 1 female (NZAC, alc), RI Moorcock Stream, tributary, 27801 61358, 600 m, IMH, 28 December 1996. Paratype female (CMNZ, pin), HB Ngaheranui Stream, Kaweka Range, 28045 62069, 940 m, BH and H Patrick, 5 January 1995. Paratype female (GH, pin, GVH label 88a), WN Wainuiomata, GVH, Christmas 1906. Paratype female (CMNZ, pin), TK Ohangai, A Castle, 18 December 1927.

Other material studied

Females (IHPC, alc), TO Boyd Hut, Kaimanawa, 27839 62229, 1040 m, IMH, 17 January 1982. Males, females (IHPC, alc) TO Kakaho Stream, Pureora 27468 62896, 480 m, IMH, 14 February 1983. One larva (IHPC, alc) WN Karori Reservoir, upper dam, 26558 59883, 200 m, JBW, 26 November 1994. Larvae (IHPC, alc), RI Limestone Creek near Sixtus Lodge, 27668 61324, 560 m, IMH, 29 January 2000. Females (IHPC, alc), HB Makahu Hut, Kaweka, 28039 62075, 980 m, IMH, 19 February 1981. Larvae (IHPC, alc), GB Mangapuwerawera middle 28723 62663, 760 m, IMH, 21 February 1981. Larvae (IHPC, alc), GB Mangapuwerawera top 28723 62670, 880 m, IMH, 9 February 1979. Two larvae (IHPC, alc), WN Manawatu Gorge Track, 27465 60951, 280 m, IMH, 15 February 1995. One female (IHPC, alc), WN Ngamaia Stream, 27242 60567, 400 m, IMH, 16 February 2001. Larvae (IHPC, alc), WN Ohau River, 27116 60556, 180 m, IMH, 8 April 1981. Larvae (IHPC, alc), WN Penn Creek, 27024 60317, 240 m, IMH, 14 March 1981. Larvae (IHPC, alc), RI Tamaki River, 27681 61163, 400 m, IMH, 23 February 1981. One larva (CMNZ, alc), TO Te Arero Stream, Clements Mill Road, 27893 62448, 740 m, W Crawford 3 August 2000. Two males (NIWA, alc), TO Tongariro River, Pillars of Hercules, 27536 62246, 640 m, K Collier and BJ Smith, 15 November 1994.

Philorheithrus litoralis sp. nov.

Figures 4, 6, 7

Derivation of name

From the Latin *litoralis* (adj), meaning of the shore, alluding to its distribution along the northern coastline of the South Island.

Diagnosis

Forewings are shaped rather like those of *P. lacustris*, but shorter and relatively narrower. Male maxillary palpi are four-jointed (not five).

Description

Male (Fig. 6): maxillary palpi, 4-segmented, 2:4:4:5, 1.9 mm. Pilifers large and asymmetrically clubbed (Fig. 1i).

Venation: anterior wing: apical forks 1, 2, 3 and 5 present and sessile, R1 joins R2 near wing margin. Posterior wing apical forks 1,2 and 5 present and sessile, Sc and R1 join near wing margin. Anterior wing length: 10.5 - 11 .5 mm.

Genitalia: segment IX reduced dorsally, segment X bulbous dorsally with a small setose protuberance dorso-posteriorly, bifid distal to this process and descending. Aedeagus generally lies between the lower arms of segment X. Inferior appendages two branched, lower branch strong, hooked upwards, inner margin with small protuberances, roughly triangular and apex rounded in ventral view. Upper branch weak, evenly curved posteriorly, posterior margin between these two processes slightly convex. Superior appendages dorsal margin straight, apex curving inwards slightly.

Female (Fig. 7): maxillary palpi, 5-segmented, 2:4:4:4:3, 2.6 mm.

Venation: as for male with the addition of apical fork 4 in the anterior wing (with footstalk about half the length of the fork), and in the posterior wing a cross-vein between R1 and R2 near confluence with Sc. Anterior wing length: 12.5 – 14.0 mm.

Genitalia: dorsal processes large and rounded, dorso-lateral area concave. Small but distinct lateral processes at the lower margin of the circular concavity on the lateral aspect of segment IX.

Larvae: Cowley (1978) has described the family characteristics of larval Philorheithridae, and described and figured the larva of *Philorheithrus agilis*. Cowley's descriptions could apply to the present species. The colouration of the head and thorax is light yellow-brown dorsally and laterally, dark brown ventrally.

Pupae: similar to that described for *P. agilis* by Cowley (1976). Dorsal and ventral fringe of hairs on mid tarsi very poorly developed, dorsal fringe consisting of 5-10 widely spaced very weak hairs. Number of mandibular teeth 15.

Remarks

In addition to the characters noted in the main text, *P. litoralis* differs from the two published species in a number of minor characters noted here. The terminal palpomere is relatively longer in *P. litoralis* suggesting that the reduction in number is due to fusion of segments 4 and 5. Maxillary palpi of *P. agilis* 1:3:2:2:2, 2.6 mm; *P. lacustris* 2:4:4:4:3, 2.2 mm; *P. litoralis* is a little smaller: anterior wing lengths of *P. agilis* male 11.0- 12.8 mm; female 13.8-14.8 mm, and *P. lacustris* male 12.0-13.0 mm; female 14.0-15.5 mm.

Cowley's description of the colour of the *P. agilis* larva as "medium to dark brown, occasionally much paler", suggests that he may have collected more than one species. In our material only a few larvae are positively associated with adults via pupae, but it appears that *P. agilis* has dark brown bands along the ecdysal line and frontoclypeal sutures, with the lateral and central areas of the clypeus light brown. *P. lacustris* is almost uniformly dark brown, but with lighter brown patches in the centre of the clypeus and around the eyes. We can distinguish no other morphological differences between the larvae of these three species.

Larval habitat: the type locality is a small spring-fed stream ranging in altitude from sea level to 50 m. The stream is intermittent during summer. Other localities for this species are similar small streams or seepages. The larval habitat of *P. agilis* is large, swift mountain rivers, that of *P. lacustris* appears to be slower streams, but not in seepages.

Pupae are found in aggregations of up to 50 individuals under large stones. Tarsal hair fringes poorly developed in comparison to *P. agilis* in which there is a continuous dorsal fringe of 30-40 hairs. The mandibular teeth are fewer in number, cf. 25 in *P. agilis*.

Type material

Holotype male, paratype female (CMNZ, alc), SD Te Rua Bay, Tory Channel, 26164 59950, 10 m, 21 Oct 1979, IMH. Paratypes 2 male, 1 female, 20+ larvae(NZAC, alc), type locality, 17 Nov 1979, IMH. Paratype pupae (2 male, 1 female) (IHPC, alc), type locality, 16 Dec 1978, IMH. Three paratype males (CMNZ, alc), SD Maud Is, Pelorus Sound, 25850 60199, 30 m, 3-6 Dec 1979, GW Gibbs. One paratype male (NZAC, pin), NN Dun Mountain, 3000 ft, APH, 8 January 1922. Paratypes 5 males, 2 females (CMNZ, alc, 1 male pin), NN Coads Creek, 25387 59846, 800 m, 18 December 1996, RP Macfarlane. One paratype male, 2 paratype females (CMNZ, alc, slides 467, 468), NN Roding River tributary, 25387 59853, 710 m, 18 December 1996, RP Macfarlane.

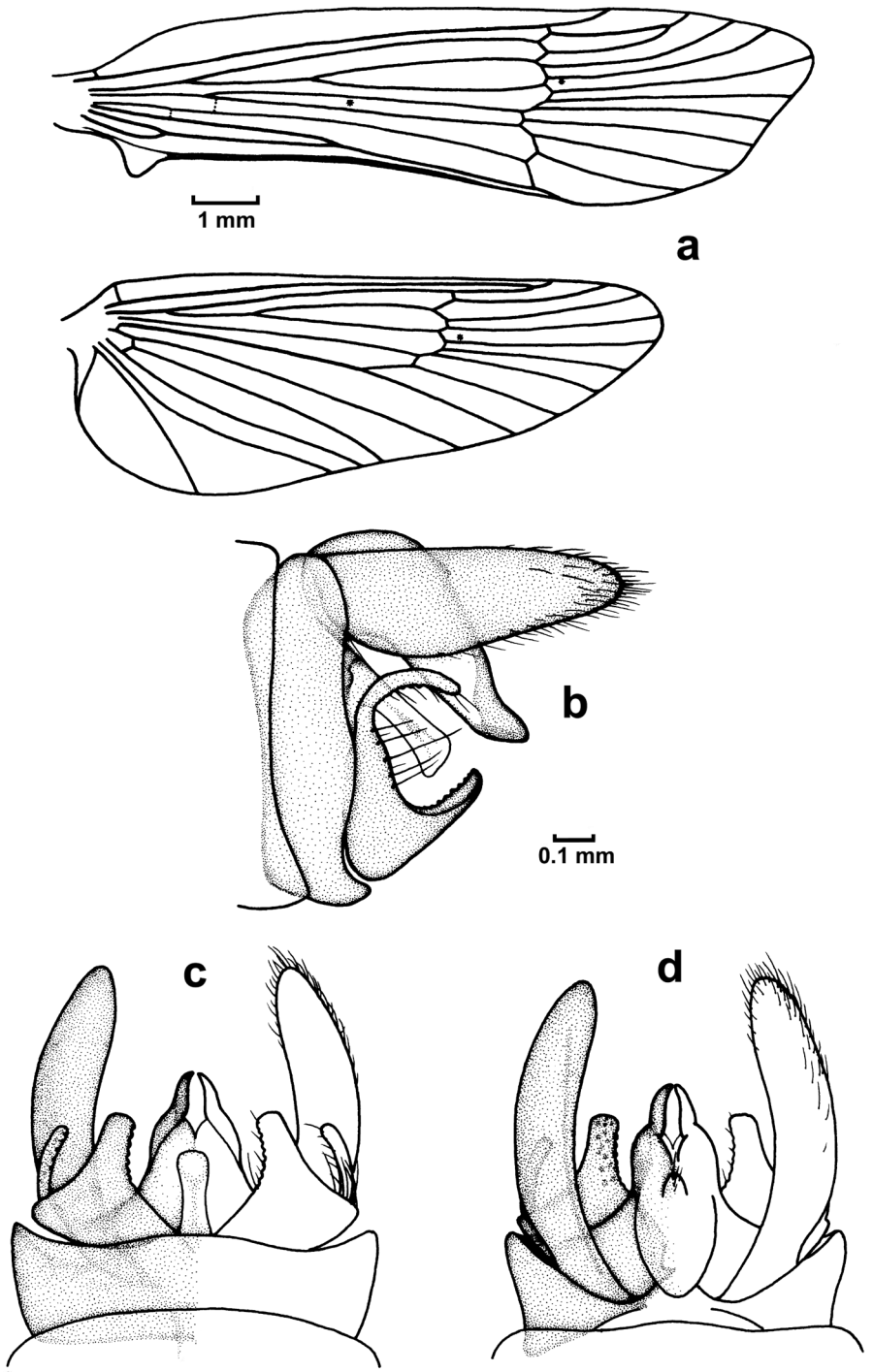

Figure 6. *Philorheithrus litoralis* sp. nov., Te Rua Bay paratype male: **a** - wings; **b** - genitalia lateral; **c** – same, ventral; **d** – same, dorsal.

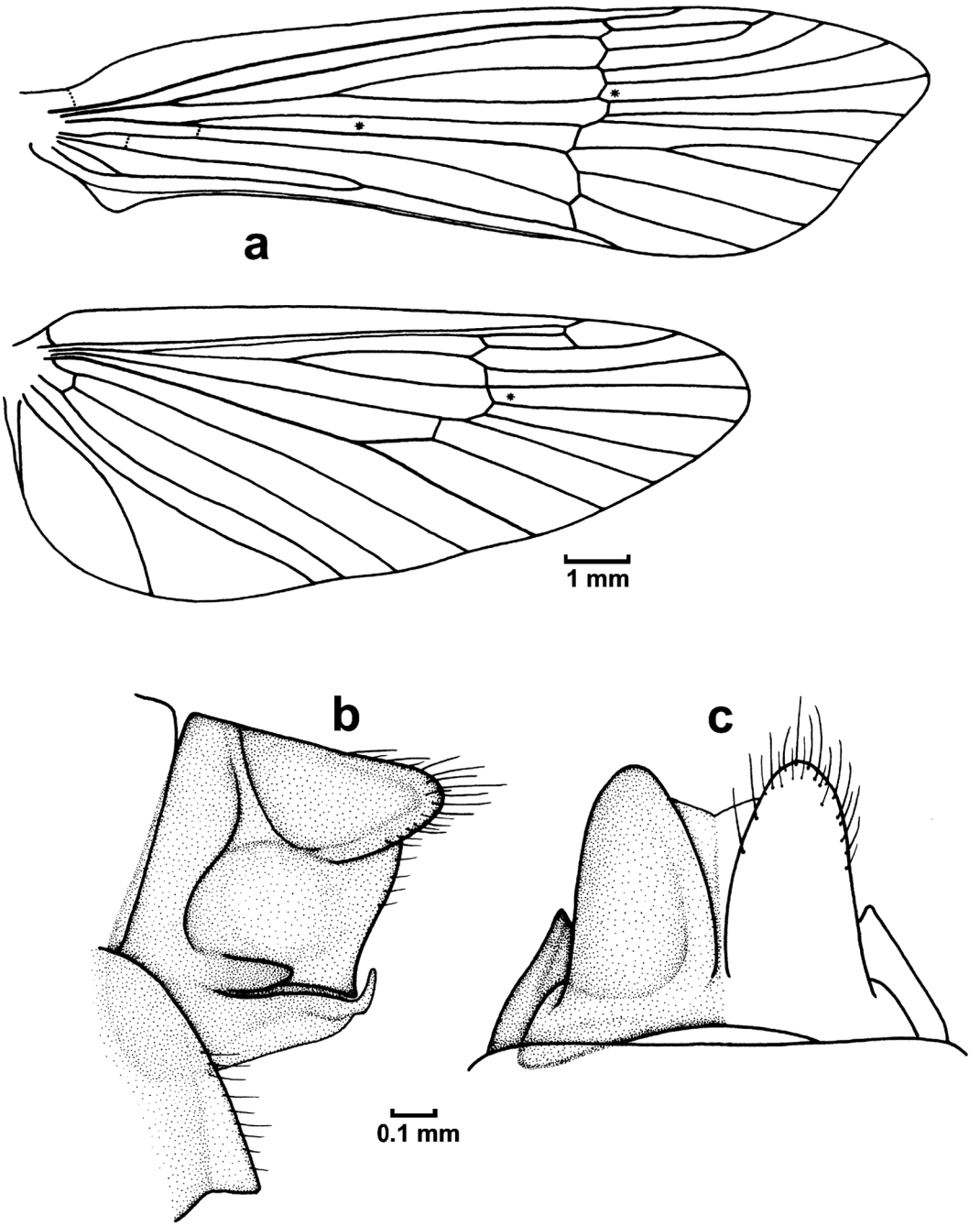

Figure 7. *Philorheithrus litoralis* sp. nov., Te Rua Bay paratype female: **a** – wings; **b** - genitalia lateral; **c** – same, dorsal.

Other material examined

Larvae, pupae (IHPC, alc), SD Te Rua Bay, Tory Channel, 26164 59952, 10 m, IMH, 21 October 1979. Males, females, larvae, pupae (IHPC, alc), MB Wakamarina River tributary at road end, 25594 59813, 80 m, IMH, 13 February 1993.

***Philorheithrus latentis* sp. nov.**

Figures 4, 8, 9, 10

Derivation of name

From the Latin *latens* (adj), meaning hidden or secret, alluding to its unexpected presence in smaller, stony, forested streams.

Diagnosis

Small species with rather blunt forewings. Male maxillary palpi three-segmented, the third segment long and densely clothed with androconia (Fig. 9).

Description

Male: Maxillary palpi 3-segmented, 1:1:3-4, 1.3-1.5. Terminal segment thicker than the others, densely clothed with androconia and apparently extensible. Pilifers very large and convex, covering most of the face. Behind the pilifers is a median finger-like process, upturned at the tip.

Venation: Forewing A1 fused basally with Cu, R1 terminates at, or just before, wing margin, apical fork 4 absent. Wing tip blunt, apical angle 54. Length 8.4 - 8.6 mm. Hind wing radial cell short, equal to or shorter than it footstalk (Rs).

Genitalia: Inferior appendage lower branch thin, obliquely truncate in ventral view. Upper branch vertical, slightly sinuous. Segment X with a small acute projection ventrally.

Type material

Holotype male (CMNZ, pin), WD Franz Josef, Tatare Track, first stream, 22821 57539, 260 m, J&G, 10 December 1999. Two paratype males (CMNZ and ALEX, alc) WD Acrobat Creek and tributaries, 22720 57573, 350 m, JBW, 18 January 1996.

1 paratype male (IHPC, alc), BR Arnold River tributary, Lake Brunner, 23842 58471, 90 m, IMH, 13 November 2002. One paratype male (CMNZ, alc), BR Devils Creek, 24170 58935, 290 m, B Cowie, 24 January 1978. One paratype female (IHPC, alc), WD Franz Josef Glacier, NE side, 22808 57490, 230 m, GW Gibbs, [date

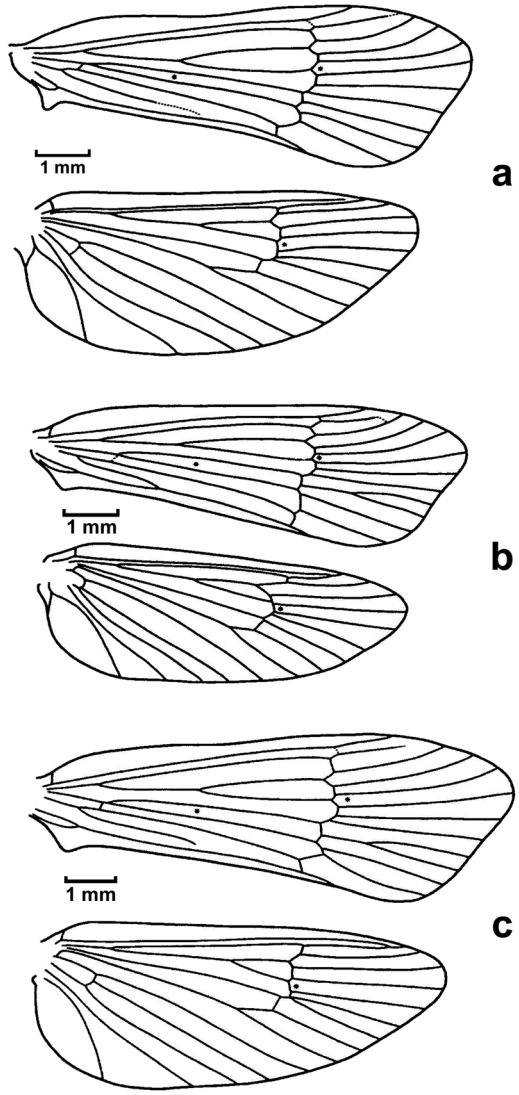

Figure 8. *Philorheithrus latensis* sp. nov. wing venation: **a** - male, Acrobat Creek; **b** - female, Karamea River tributary; **c** - female, Franz Josef.

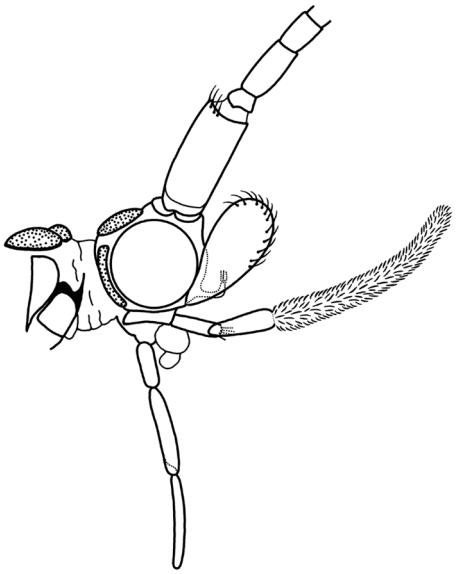

Figure 9. *Philorheithrus latensis* sp. nov. Acrobat Creek male: head, lateral.

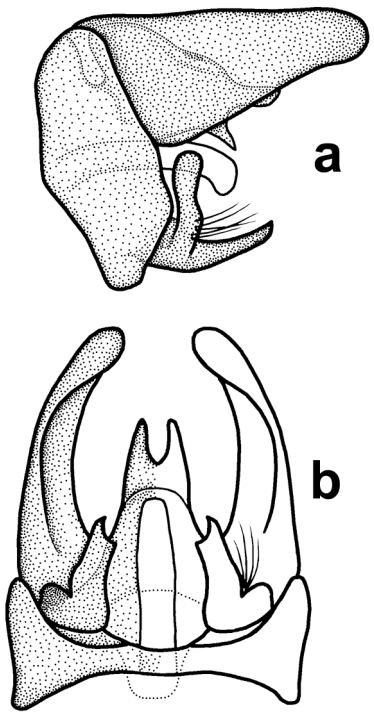

Figure 10. *Philorheithrus latensis* sp. nov. Acrobat Creek male: genitalia; **a** - lateral, **b** - ventral.

Figure 11. *Philorheithrus harunae* sp. nov. holotype male: habitus.

not given]. Two paratype males (CMNZ and NZAC, alc), 1 paratype male (OMNZ, pin), WD Harihari, ridge to south, seepage 23113 57810, 160 m, J&G, 7 December 1999. One paratype female (CMNZ, alc), NN Karamea River, small tributary 24447 59945, 30 m, JBW, 10 January 1991. One paratype female (CMNZ, alc), NN Kohaihai Bluff, small streams, 24347 60115, 100 m, JBW, 5 January 1991. One paratype female (CMNZ, alc), WD Lake Kaniere, Dorothy Creek Falls, 23603 58167, 155 m, J&G, 4 December 1999. One paratype male (CMNZ, alc), BR Murray CreekTrack, first tributary, 24183 58967, 290 m, J&G, 3 January 2001.

***Philorheithrus harunae* sp. nov.**
Figures 4, 11

Derivation of name

Named for Haruna Murayama, in appreciation of her keen interest in the New Zealand flora and fauna, her encouragement of Brian and Hamish Patrick in their collecting and her active involvement in numerous invertebrate surveys.

Diagnosis

A short-winged species of upland DN and CO, extending into SL. Male genitalia similar to that of *P. lacustris*, but distinct on wing venation with apical fork 4 absent from forewings and hindwings in both sexes.

Description

Forewing sub-oval; length, males: 7.4-7.6 mm, females 7.2-7.4 mm. Male and female forewing venation similar: apical forks 1, 2, 3, 5 present, 4 absent. Hindwing apical forks 1, 2, 5 present in both sexes. Forewing: post-anal

vein present in both sexes, very faint, running close to hind margin. Male inferior appendage upper branch very small and weak but highly variable in shape.

Type material

Male holotype (CMNZ, pin), 14 male, 3 female paratypes (CMNZ, NZAC and ALEX, alc), CO Rock & Pillar Range, McPhees Rock, 22753 55222, 1250 m, BHP, 6 February 1991. Two male, 2 female paratypes (OMNZ, pin), 7 male, 1 female paratypes (CMNZ, alc), CO Rock & Pillar Range, McPhees Rock, 22753 55222, 1250 m, BHP, 26 February 1993. One female paratype (CMNZ, alc), DN Black Rock Stream, 22743 54886, 450 m, E Edwards, 17 February 1993. Twenty male, 2 female paratypes, including pair in copula, 10 larval cases, (CMNZ, alc), 2 male, 2 female paratypes(OMNZ, pin), 5 male, 2 female paratypes (ALEX, alc), CO Lammermoor Range, 22588 54993, 1100 m, BHP, 11 January 1991. Nine male paratypes (CMNZ, alc), CO Styx Creek, 22776 55254, 1060 m, E Edwards, 29 January 1993. One female paratype (CMNZ, alc), SL Whisky Creek, Croydon Bush Scenic Reserve, 21882 54522, 220 m, J&G, 23 January 2000. One female paratype (OMNZ, pin), CO South Rough Ridge, 22569 55322 1050 m, BHP, 28 February 1993.

Other material studied

Three larvae (CMNZ, alc), CO North Dunstan Mountains, Lauder Creek, 22462 55920, 1375 m, BHP, 9 December 1993. Larvae, pupae, (CMNZ, alc), CO North Dunstan Mountains, Donald Stuart Creek, 22463 55854, 1300 m, BHP, 7 December 1993. Two larvae (CMNZ, alc), CO Old Man Range, Fraser River Tributary, 1550 and 1410 m, 22117 55327, 1410 m, SJ Morris, 27 January 1997. Two larvae (CMNZ, alc), same, but 18 November 1997. One male, 2 pupae, (CMNZ, alc), DN Pay Office Creek, creek to east, Taieri River Gorge, 23014 54959, 100 m, BHP, 26 October 1993. Three larvae (CMNZ, alc), CO Rock & Pillar Range, upper Styx Creek, 22782 55228, 1225 m, AD Huryn, 29 January 1993. One pupa (CMNZ, alc), CO Rock & Pillar Range, Stonehenge, 22780 55224, 1100 m, BHP, 1 December 1993. One female, 1 larva, 2 pupae, (CMNZ, alc), CO South Rough Ridge, 22569 55322 1050 m, BHP, 28 February 1993.

Habitat and behaviour

Brian H Patrick (Alexandra Museum) provided us with the following account,

> "The flightless caddis *Philorheithrus harunae* is a fast-moving species of swift upland streams in the Taieri catchment of eastern Otago. The long-legged adults hide by day on shaded moss-covered stream sides, being active by night. Typically the species is found in headwater streams of the Lammermoor and Rock and Pillar Ranges above 1100 m within the narrow-leaved snow tussock (*Chionochloa rigida*) zone, but surprisingly a population was found in the upper Taieri Gorge near Hyde at 200m. The species emerges as adults in early to mid-summer at high altitude and can be locally common in streams emerging from the multitude of moss-bogs of these ranges."

Note that *Philorheithrus harunae* is "*Philorheithrus* new species" in Patrick et al. (1993) and in Peat and Patrick(1995, p.105).

ACKNOWLEDGEMENTS

Ian Henderson thanks his wife, Alicia Scott and daughters Zoe and Sarah for their support for this research and assistance with fieldwork and maintenance of his collection. Numerous colleagues have provided specimens, especially George Gibbs (Victoria University). John B Ward thankfully acknowledges generous gifts of specimens, positive criticism of his output, and company in the field from his colleagues, especially his wife Geraldine, Brian and Hamish Patrick (who discovered and collected nearly all the material of *Philorheithrus harunae*) and Haruna Murayama, Brian J Smith (NIWA Hamilton), Eric Edwards (DOC Southland Conservancy), Oliver S Flint, Jr (NMNH, Smithsonian Institution), Terry R Hitchings (CMNZ), Rod P Macfarlane (who re-discovered *Philorheithrus litoralis* in the Dun Mountain area, where it was captured by Alfred Philpott 74 years previously); the late E Graeme White; and Simon Morris (CMNZ). He also acknowledges the Mason Foundation for financial support, and Canterbury Museum for continued support of his work and access to its collections.

REFERENCES

Cowley DR (1976) Family characteristics of the pupae of New Zealand Trichoptera. *New Zealand Journal of Zoology* 3:99-109.

Cowley DR (1978) Studies on the larvae of New Zealand Trichoptera. *New Zealand Journal of Zoology* 5:639-750.

Crosby TK, Dugdale JS, Watt JC (1998) Area codes for recording specimen localities in the New Zealand subregion. *New Zealand Journal of Zoology* 25:175-183.

Dean JC, St Clair RM, Cartwright DI (2004) *Identification keys to Australian families and genera of caddis-fly larvae (Trichoptera)*. Co-operative Research Centre for Freshwater Ecology Identification Guide no.50. Albury, Australia.

Hudson GV (1904) *New Zealand Neuroptera*. West, Newman and Co, London.

Kimmins DE (1953) In: Mosely ME, Kimmins DE *The Trichoptera (caddis-flies) of Australia and New Zealand*. British Museum (Natural History), London.

McFarlane AG (1966) New Zealand Trichoptera (Part 6). *Records of the Canterbury Museum* 8:137-161.

Morse JC (ed) (2006) *Trichoptera World Checklist*. http://entweb.clemson.edu/database/trichopt/index.htm. Consulted 2006.

Mosely ME (1953) In: Mosely ME, Kimmins DE *The Trichoptera (caddis-flies) of Australia and New Zealand*. British Museum (Natural History), London.

Neboiss A (1977) A Taxonomic and Zoogeographic study of Tasmanian Caddis-flies (Insecta: Trichoptera). *Memoirs of the National Museum of Victoria* 38:1-212.

Neboiss A (1986) *Atlas of Trichoptera of the SW Pacific - Australian Region*. Dr W Junk Publishers, Dordrecht, The Netherlands.

Neboiss A (2002) New genera and species, and new records, of Tasmanian Trichoptera (Insecta). *Papers and Proceedings of the Royal Society of Tasmania* 136:43-82.

Patrick B H, Barratt BIP, Ward JB, McLellan ID (1993) Insects of the Waipori Ecological District, Lammerlaw Ecological Region. *Otago Conservancy Miscellaneous Series* 16:1-42.

Peat N, Patrick BH (1995) *Wild Dunedin: enjoying the natural history of New Zealand's wildlife capital.* University of Otago Press, Dunedin, New Zealand.

Schmid F (1964) Contribution à l'étude des Trichoptères néotropicaux. *Tijdschrift voor entomologie* 107:307-339.

St Clair RM (1997) *Preliminary guide to the identification of late instar larvae of Australian Philorheithridae, Calamoceratidae and Helicopsychidae (Insecta: Trichoptera)*. Co-operative Research Centre for freshwater ecology Identification Guide no.12. Albury, Australia.

Tillyard RJ (1924) Studies of New Zealand Trichoptera, or caddis-flies. No. 2. Descriptions of new genera and species. *Transactions and Proceedings of the New Zealand Institute* 55:285-314.

Ward JB, Henderson IM (1993) The New Zealand Trichoptera database. *The Weta* 16:10-11.

Weaver JS III, Gibon F, Chvojka P (2006) A new genus of Philorheithridae (Trichoptera) from Madagascar: The first philorheithrids recorded from the Afrotropical Region. In: Tanida K, Rossiter A (eds) Proceedings of the 11th International Symposium on Trichoptera, Sakai, Osaka and Kutsuki, Shiga, Japan, 12-19 June 2003. Tokai University Press, p.468.