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A new species of *Rallidens* (Ephemeroptera: Rallidentidae) from New Zealand

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ABSTRACT

A new species of mayfly, *Rallidens platydontis*, from the South Island of New Zealand is described. The principal life stages are included and associated. Notes on ecology are given and a distribution map provided. Diagnostic characters of the new species are illustrated and compared with those of *Rallidens mcfarlanei*. Keys are provided for egg, larval and adult life stages.

KEYWORDS

Ephemeroptera; key; mayflies; mayfly; Rallidentidae; new species; taxonomy.

INTRODUCTION

The genus *Rallidens* is represented in New Zealand by the monogeneric species *R. mcfarlanei* (Penniket, 1966). Initially Penniket (1966) proposed a new subfamily of the Siphonuridae, the Rallidentinae, to receive *Rallidens mcfarlanei*. Subsequent workers, Demoulin (1969), Edmunds (1972, 1975), Landa (1973), Riek (1973), McCafferty and Edmunds (1979), Landa and Soldan (1985) and more recently Kluge *et al* (1995) and Kluge (1998) have debated the justification for familial status. A further species is added here.

MATERIALS, METHODS AND CONVENTIONS

Larvae and winged stages of both *Rallidens* spp. were collected throughout New Zealand by several collectors. Larvae and their respective winged stages have been associated by rearing, proximity and comparison of egg chorionic patterns. Specimens, including type species, were stored in 80% ethanol.

SEM: All scanning electron microscopy of larvae was obtained from late instar larvae. Dissected mouthparts, legs and eggs were dehydrated through a stepwise immersion in ethanol and acetone, then dried by critical point drying. The mounted material was coated with a 20 nm Au/Pd layer and examined with a Cambridge Stereoscan 250 MK 2 scanning electron microscope at 10kV.

Light microscopy: material used for drawings was dissected, mounted on microscope slides, embedded in Euparal and viewed with a light microscope at 100-400x magnification.

Collecting sites are grouped into regions of New Zealand using the two letter code system proposed by Crosby *et al* (1998) as follows: **BR** - Buller; **KA** - Kaikoura; **MB** - Marlborough; **NC** - North Canterbury; **OL** - Otago Lakes; **SC** - South Canterbury; **SL** - Southland.

Abbreviations in site descriptions: Ck - creek, Forest, i - imago, R - river, Rd - road, si - subimago, Stm

- stream. Map references and altitudes (in metres above sea level) are taken from the topographical map series NZ GD 2000/WGS84.

Collections: Where stated, material is held at the following locations:

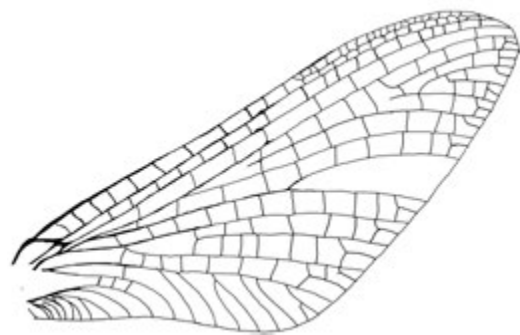
NMNH: National Museum of Natural History, Washington D.C., USA.

SMNS: Staatliches Museum für Naturkunde Stuttgart, Germany.

Otherwise it is deposited at:

CMNZ: Canterbury Museum, Christchurch, New Zealand.

Collectors: TRH: T R Hitchings; JBW: J B Ward; JGP: J G Penniket; JandG: J B and G M Ward; MTG: M T Gillies; NIWA: Staff of National Institute of Water and



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Figures 1, 2. Fore- and hind wing of male imago of *Rallidens platydontis*

Atmosphere; OSF: O S Flint Jr; SJM: S J Morris; Tand J: T R and J A Hitchings; TTR: Tim, T R and R W Hitchings.

Terminology: Wings are described according to the terminology of Edmunds and Traver (1954), labia according to Snodgrass (1935). Egg terminology is based on Koss and Edmunds (1974).

SYSTEMATIC SECTION

Order EPHEMEROPTERA Hyatt and Arms, 1891

Family Rallidentidae Penniket, 1966

Genus *Rallidens* Penniket, 1966

Type species *R. mcfarlanei* Penniket, 1966

For comparison, some morphological characters of *R.*

mcfarlanei have been refigured as follows:

Fig 3 ventral and lateral views of male genitalia; Fig 6 Sterna VII-X of female imago; Fig. 8 Habitus mature larva; Fig 12 SEM Right mandible; Fig 15 SEM Labium; Figs 21, 22 SEM eggs; Fig 25 Imago, dorsal abdominal body pattern

Description of species

Rallidens platydontis Staniczek and Hitchings, new species Figs 1, 2, 4, 5, 7, 9, 10, 11, 13, 14, 16, 17, 18, 19, 20, 23, 24, 26. Map 2.

Dimensions (mm)

Male imago: body length 14.0-15.3 (14.9); forewing 13.0-13.8 (13.2); hind wing 5.8-6.1 (6.0); mature male larva: body length 12.5-14.2 (13.4).

Female imago: body length 13.9-16.1 (15.3); forewing 13.5-16.8 (14.5); hind wing 5.9-6.5 (6.2); mature female larva: body length 14.2-14.3 (14.3).

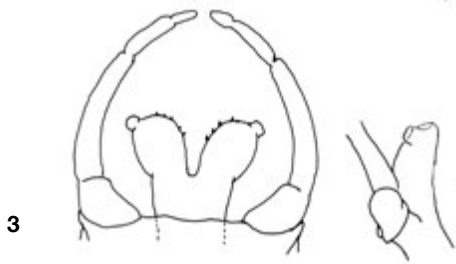
Male imago

Head slightly opisthognathous, (Fig 10); yellowish white, eyes greyish, darker below. Antennal scape yellowish.

Thorax: pronotum yellowish white, mesothorax and metathorax darker. Scutum whitish with dark brown paired parasagittal swellings. Scutal sutures darker. Scutellum dark brown. Thoracic sterna yellowish brown, darker at margins and sutures. Furcasternum with dark mesial groove. Legs: forelegs yellowish with dark brown bands at the distal articulations of the tibiae and tarsi. Tibiae and tarsi 1-4 with scattered spines, coarser on tarsi. Length ratios of the foreleg segments (femur: tibia: tarsomeres 1-5): 1.00-1.08:1.00 (2.7-3.0 mm): 0.62-0.65: 0.34-0.38: 0.17-0.19. Tarsal claws of a pair dissimilar, one blunt, the other hooked, without an opposing hook (Fig. 19)

Wings (Figs. 1, 2): forewing width 0.40-0.48 (0.44) x length. Hind wing width 0.68-0.70 (0.69) x length and length 0.44-0.50 (0.47) x length of forewing. Bulla at midlength on vein R4+5 usually present. In the hind wing vein Rs symmetrically forked at about 2/3 the length from base to margin. Vein MA forked at about 2/3 the length and vein MP at about 3/4 the length from base to margin.

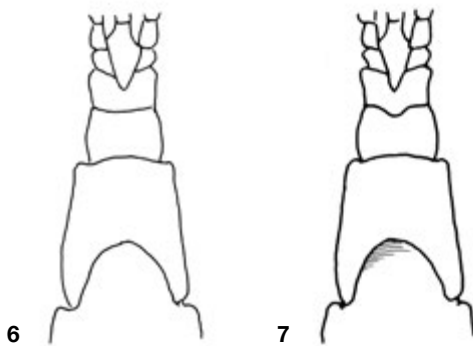
Abdomen (Fig 26): terga yellowish white. Terga I-VI or VII each with paired mid lateral brown maculae and more diffuse posterior maculae. Terga II-VI or VII with paired parasagittal submedian crescent shaped marks. Sterna yellowish grey. Cerci yellowish, darker basally. Genitalia (Fig 4): forceps yellowish brown, darker



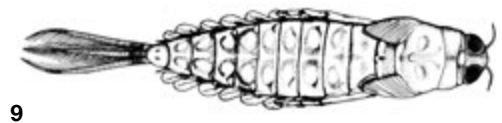
Figures 3, 4. Ventral and lateral views of male genitalia of (3) *Rallidens mcfarlanei*; (4) *R. platydonis*



Figure 5. Paraproct of male imago of *R. platydonis*



Figures 6, 7. Sterna VII-X of female imago of (6) *Rallidens mcfarlanei*; (7) *R. platydonis*



Figures 8, 9. Habitus: mature larva of (8) *Rallidens mcfarlanei*; (9) *R. platydonis*



Figure 10. Head and prothorax: lateral view of larva: *Rallidens platydonis*

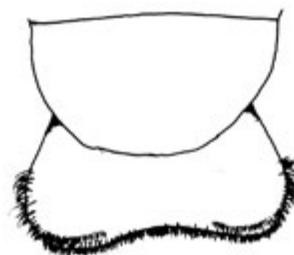


Figure 11. Clypeus and labrum of *Rallidens platydonis*



Map 1. Collection sites of *Rallidens mcfarlanei*

laterally. Penes white, brownish laterally, divergent at midlength and V-shaped at the place of divergence. The apex of each lobe expanded distally and slightly concave mesially. A curved row of 9-10 tapering spines on each apical surface. Swelling with small spine usually visible near mid length on the ventral surface of each paraprot (Fig 5).

Female imago

As in the male imago except as follows: Vertex darker at the margin. Thoracic sterna whitish. Furcasternum darker at the anterior and posterior margins only. Wings: forewing width 0.33-0.40 (0.38) x the wing length. Hindwing width 0.62-0.72 (0.68) x length and length 0.39-0.45 (0.43) x forewing length. Legs: femur I sometimes with a faint dark band at midlength. Sternum VII extending 1/3 the length of VIII and with irregular folds appearing as lateral striations (Fig 7). Sub anal plate distinctly emarginated. The swelling on the paraprot of segment XI usually smaller than in the male.

Subimago

Male unknown. The female (reared) as in the imago, except as follows: Eyes blackish. Thorax whitish, reddish



Map 2. Collection sites of *Rallidens platydotis*

brown at the sutures. Notum whitish, scutellum with paired reddish brown maculae. Pleura and sterna whitish. Wing membranes uniformly greenish, becoming grey in alcohol. Crossveins of C and Sc dark brown, other veins greyish. Tergae I-VI as in the imago but marks yellowish brown, darker at the margins. Caudal filaments white, dark brown at the annulations.

Late instar larva

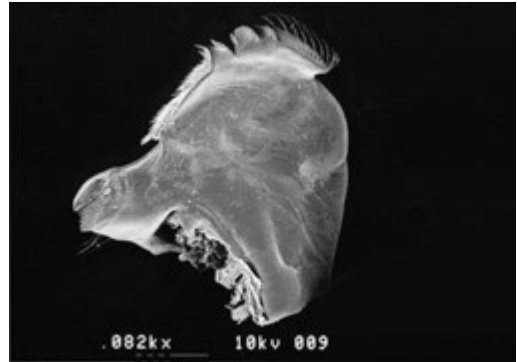
(Fig 9): head whitish, including clypeus and labrum, the latter with black markings near the lateral corners of the basal margin. Antennae white, eyes grey.

Mouth parts: labrum (Fig 11): length 0.90-1.00 (0.93) x length of the clypeus and width 1.09-1.20 (1.16) x width of the clypeus. Mandible (Fig 13): proximal lobe of incisor 1/2 or less than the thickness of the mesial lobe at base. The lateral surfaces of the proximal and adjacent mesial lobes show serrations. The prostheca three pronged, two of the prongs narrow to apically diverging points. Proximal to the prostheca a clump of long setae and a thick row of shorter pinnate setae extend more than half way along it. Molar surface 10-16 parallel ridges and denticles. Maxillae (Figs 17, 18): maxillary lobes fused to form a galea-lacinia. Lacinia expanded



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Figures 12, 13. Right mandible: SEM of (12) *Rallidens mcfarlanei* and (13) *R. platyodontis*



13



14

Figure 14. Hypopharynx: SEM: anterior view of *Rallidens platyodontis*

medioapically forming a lamina with a single row of setae subapically on each surface. A scattered cluster of 8-14 spines in the mediobasal corner of the aboral surface of the lacinia and 5-10 on the corresponding oral surface. Apex of the galleolacinia with three massive parallel sclerotised prongs terminating in fine mesially directed points. Maxillary palp segment 2 1.2 x as long as segment 1 and segment 3 1.1 x as long as segment 2. Segments 2 and 3 with sparsely scattered setae. On the aboral surface between the cardo and stipes a membranous extension (bloodgill *sensu* Penniket, 1966 and small fingerlike gill *sensu* Kluge 1998). Labium: (Fig 16): glossae and paraglossae basally of equal thickness, glossae curved to bluntly tapering points; palps with weak setation in the apical two thirds. Palp segment 2 about two thirds the length of segment 1, and segment 3 about three quarters of segment 2. Segment 1 expanded laterally at each end into a pair of knob-like protuberances. Segment 2 and particularly segment 3 with long scattered setae. Hypopharynx (Fig 14): lingua triangular, flattened laterally and at its widest subapically, the expanded apical margin well covered with setae. Each superlingua oval shaped, twice as long as wide

and with a mesial subapical protuberance, the latter thickly supplied with mesially directed apical setae. Each superlingua with five parallel longitudinal somewhat curved rows of setae on the aboral surface. Segment 3 with a small knob-like protuberance.

Thoracic terga (Fig 9): pleura and sterna whitish. Medioparapsidal sutures of the scutum with dark brown maculae tapering apically. Legs whitish, each segment dark brown distally and at mid length of the femur. Tarsi and tarsal claws dark brown proximally (Fig 20). Tarsal claws without denticles. Abdomen white, dorsally washed with brown and with darker paired sub circular marks, similarly developed on all terga. Abdominal ganglia not pigmented. Gills on segments I-VII each double, one lamellate, the other fibrous. Each dorsal lamella oval with dendritic tracheae and, except for lamella I, a costal rib. Gills III-VII, each with a row of 5-7 spines on the apical costal margin. Each fibrous gill consists of a bunch of 5-20 filaments attached ventrally to the base of a lamella. Gill I about half the size of gills III and IV, which are the largest. Paired subapical spines on the ventral surfaces of the paraprocts more developed than with the adults. Sterna white. Cerci 0.31-0.32 x as long as

the body. Cerci and terminal filament white with blackish bands medially and mid proximally. Each segment of the terminal filament and cerci bounded by a coaxial ring of denticles directed posteriorly. The cerci with longer paired denticles directed posteriorly on the distal margin of each segment.

Egg: (Figs 23, 24): large mesh reticulation widely distributed across the egg surface. Multiple micropiles distributed on distinct elevations. Hexagonal structures visible at egg poles.



Figure 15. Labium: SEM: Aboral view of *Rallidens mcfarlanei*

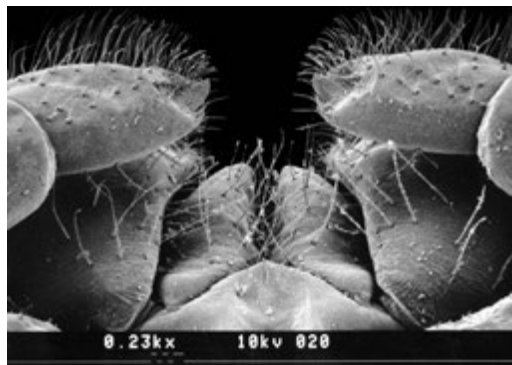
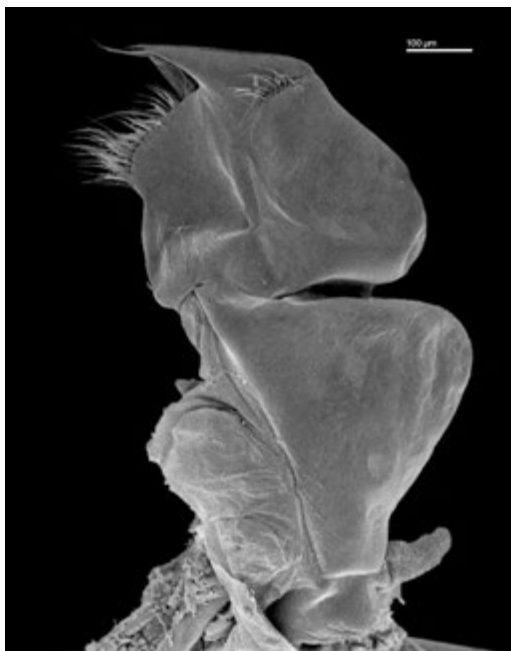


Figure 16. Labium: SEM: Aboral view of *Rallidens platydontis*



Figures 17. Left maxilla: SEM: galeo-lacinia; oral view of *Rallidens platydontis*



Figures 18. Left maxilla: SEM: galeo-lacinia; aboral view of *Rallidens platydontis*

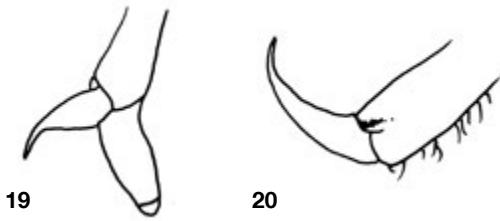
Type data

Holotype: male imago, SC, Otaio R, trib., The Hunters Hills, New Zealand, 44°35.0'S, 170°53.2'E, 440 m, 16 February 1998, Simon J. Morris, Canterbury Museum, Christchurch, New Zealand.

Allotype: female imago, same data as holotype, (CMNZ).

Paratypes: CMNZ- 1 male imago, 1 female imago, 1 larva. NZAC- 1 male imago, 1 female imago, 1 larva.

SMNS- 1 male imago, 1 female imago, 1 larva. NMNH- 1 male imago, 1 female imago, 1 larva.



Figures 19, 20 Claws: (19) Imaginal claws; (20) larval claws; *Rallidens platydontis*

Material examined: The following non-type specimens: KA ♂ im, Puhipuhi R, Trib., 42°13.1'S, 173°45.3'E, 420 m, 8 Jan 2004, OSF.

MB larvae, Pelorus R, at Br, 41°17.9'S, 173°34.3'E, 30 m, 7 Mar 1966, JGP; ♀ subim, Pelorus R, at Tinline Br, 41°18.8'S, 173°30.2'E, 60 m, 30 Jan 2004, TRH; larva, Wairau R, at Tuamarina, 41°26.3'S, 173.57'E, 5 m, NIWA; larvae, Wakamarina R, 41°21.6'S, 173°36.9'E, 30 m, 15 Dec 2000, J and G; larva, Wakamarina R, 41°20.8'S, 173°38.2'E, 70 m, 16 Jan 2002, TRH.

NC larvae, Hurunui R, at Br., 42°54.4'S, 173°16.5'E, 10 m, 3 Jan 2012, TTR.

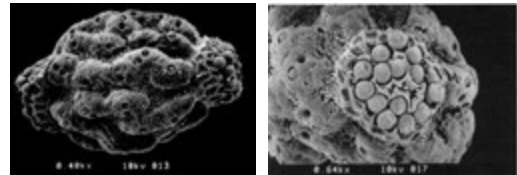
NN ♀ im, Pariwhakaoho R, 40°48.5'S, 172°43.1'E, 80 m, 8 Feb 2010, T and J.

OL larvae, Eyre Ck, at Br, 45°30.5'S, 168°33.5'E, 270 m, 5 Feb 1995, MTG.

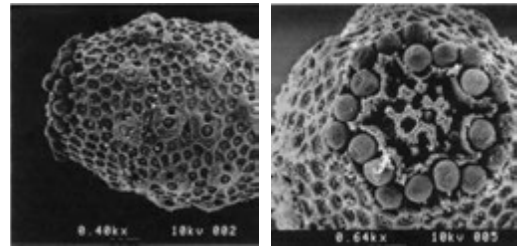
SC ♀ im, Otaio R, headwaters, 44°30.9'S, 170°53.1'E, 430 m, 30 Jan 1999, TRH; larvae, Otaio R, 44°34.7'S, 170°53.5'E, 420 m, 7 Feb 2000, TRH; ♂ im., larvae, Otaio R, Trib, 44°34.9'S, 170°53.2'E, 440 m, 16 Feb 1998, SGM. SL larvae, Aparima R, Affleck Rd, 45°46.9'S, 168°10.6'E, 250 m, 6 Feb 1995, MTG; larvae, Aparima R, Avondale, 45°50.8'S, 168°07.8'E, 200 m, 1 Jan 2004, TRH; larvae, Oreti R, at Lady Barkly, 46°04.7'S, 167°53.3'E, 60 m, 4 Feb 1995, MTG.

Distribution and habitat

Rallidens platydontis appears to be restricted to the eastern and southern South Island with the greatest populations in some of the larger rivers of Marlborough. It is also found in the upper reaches of the Otaio River, Canterbury, a region of tussock grassland and sub alpine herbfield. In Eyre Creek, Southland it was found on a sandy bottom at a depth of 1 metre (M T Gillies *pers. comm.*).



21 22
Figures 21, 22. Egg: *Rallidens mcfarlanei*, SEM: (21) egg; (22) polar region



23 24
Figures 23, 24. Egg: *Rallidens platydontis* SEM: (23) egg; (24) polar region

Larvae are commonest in pools and the slower parts of riffles and runs of third to fifth order rivers. Sometimes they are to be found clinging to the surfaces of boulders and bedrock.

Remarks

The imago of *R. platydontis* can be distinguished from *R. mcfarlanei* by: in the male, the forewings longer than 12 mm., the penes separated by a V-shaped divergence and a curved row of 9-10 spines on their apical surfaces; in the female the subanal plate distinctly emarginated. In the mature larva of *R. platydontis* the mesial lobe of the mandible incisor is more than twice the thickness of the proximal lobe at the base whereas in *R. mcfarlanei* these are approximately equal in width at the base. The apical shapes of the upper mandible lobes are quite variable, probably influenced by wearing and nutritional factors and hence not a reliable character for identification. The lateral surfaces of the labial glossae are bounded by convex curves and tapering to blunt apices compared with those of *R. mcfarlanei*. The lateral surfaces of the latter are linear and taper smoothly to well defined points. The setation of the labial palps of the former is sparse compared with that of *R. mcfarlanei*, which is pronounced.

Etymology

platydontis Gr. platy = broad, dons = a tooth, with reference to the broad mesial lobe compared with the proximal lobe of the maxillary incisor of late instar larvae.

Discussion

The distribution of *R. mcfarlanei* in both the North Island and the north western part of the South Island may have taken place at a time when both islands were connected. The land connection is generally agreed to have occurred between northwest Nelson and Taranaki.



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Figures 25, 26. Imago: dorsal abdominal body pattern of (25) *Rallidens mcfarlanei* and (26) *Rallidens platydontis*

This is compatible with the present known distribution of the species. Similar distributions have been found for other mayfly species, such as *Siphlaenigma janae*, *Zephlebia dentata* and *Zephlebia versicolor* (Hitchings 2001). The distribution of *R. platydontis* may have resulted from the isolation of an ancestral population in the eastern and southern South Island during a time of intense glaciations of the Southern Alps.

KEY TO THE SPECIES OF RALLIDENS

Imago

In the male, forewing length <12mm, penes separated by a rounded cleft; the apex of each penis lobe with 1 prominent lobe and 5-6 smaller spines. In the female the subanal plate usually not, or barely emarginated

.....**mcfarlanei**

In the male, forewing length >12mm, penes separated by a V-shaped cleft; the apex of each penis lobe with a curved row of 9-10 spines. In the female, the subanal plate distinctly emarginated.....**platydontis**

Late instar larva

Mesial lobe of the mandible incisor <twice the thickness at the base of the proximal lobe;lateral surfaces of labial glossae linear and tapering smoothly to well defined apices. Pronounced setation of labialpalps.....**mcfarlanei**
 Mesial lobe of the mandible incisor >twice the thickness at the base of the proximal lobe; labial glossae with convex lateral surfaces curved and tapering to blunt apices; sparse setation of labial palps.....**platydontis**

Eggs

Hexagonal reticulation of the chorion largely restricted to round the poles.....**mcfarlanei**
 Hexagonal reticulation of the chorion distributed over the entire surface.....**platydontis**

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