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Radumeris tasmaniensis (SAUSSURE, 1855), the first record of a scoliid wasp from New Zealand

(Hymenoptera, Scoliidae, Campsomerini)

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Abstract

Radumeris tasmaniensis (SAUSSURE, 1855) (= *Campsomeris* (*Dielis*) *tasmaniensis* (SAUSSURE)) (Hymenoptera, Scoliidae) is newly recorded from New Zealand. A brief description of male and female adults is provided. The taxonomy, biogeography, hosts and natural enemies are discussed.

Keywords: Hymenoptera, Scoliidae, *Radumeris tasmaniensis* (SAUSSURE), *Elis tasmaniensis* SAUSSURE, *Campsomeris* (*Dielis*) *tasmaniensis* (SAUSSURE), yellow flower wasp, new record, hosts, Rutelinae, Melolonthinae, Dynastinae, Scarabaeidae, New Zealand.

Zusammenfassung

Zum ersten Mal wird für Neuseeland ein Vetreter der Scoliiden nachgewiesen: *Radumeris tasmaniensis* (SAUSSURE, 1855) (= *Campsomeris* (*Dielis*) *tasmaniensis* (SAUSSURE)) (Hymenoptera, Scoliidae). Männchen und Weibchen werden kurz beschrieben. Ihre Taxonomie und Biogegraphie, dazu ihre Wirte und Feinde, werden vorgestellt und diskutiert.

Introduction

In February 2000 a male scoliid, subsequently identified as *Radumeris tasmaniensis*

(SAUSSURE, 1855), was collected from Te Paki, Northland, the first record of a scoliid wasp from New Zealand. Prior to the collection of this specimen, similar wasps were seen swarming over sand dunes at two sites in Northland: Cape Maria van Diemen and North Herekino Head (Map 1, sites 1 and 2 respectively). Both collection sites were situated immediately behind the foredunes, in soft sandy areas covered with *Spinifex* grass. In early May 2000, further specimens, including females, were collected from North Herekino Head. The collected wasps were curled up, buried 3 to 8 cm below the sand surface, while other wasps were flying in a sheltered area between the dunes. These collection sites are separated by approximately 130km. The following spring (November 2000) a further female specimen was collected dead on sand at Whareana Bay (Map 1, site 3).

Description

Male: Body 15-19 mm; entirely covered in dense, long vestiture, mostly erect but some closely appressed to body, colour ranging from silvery white to brown.

Antennae black. Head black, except: a pair of oblique yellow bars on vertex from eye to lateral ocellus, yellow border outside eye and into malar space, clypeus yellow with central black spot, triangular pale yellow patch between inner eye and clypeus; mandible red-brown apically, yellow basally. Mesosoma black except: pronotum dorsally yellow and with an anterior lateral longitudinal yellow bar; mesoscutum and metanotum each with transverse yellow bands. Metasomal tergites 1 to 6 black anteriorly and yellow posteriorly; sternite 1 black, sternite 2 yellow posteriorly, with a yellow rectangular patch produced anteriorly and medially almost to base of sternite, sternites 3 to 6 black anteriorly, yellow posteriorly. Legs black except: coxa 1 yellow ventrally, femur 1 dorsally yellow at apex and with a lateral yellow spot, femora 2 and 3 laterally yellow, tibiae 1 and 2 dorsally yellow, tibia 3 laterally yellow. Tarsi 1 and 2 yellow to dark brown, tarsi 3 black; hind tibial spurs pale. Wings infumate.

Antennae filiform, longer than head and thorax combined, flagellomeres longer than broad; eyes deeply indented opposite antennal insertions.

Female: Body length 17-29 mm. Vestiture shorter and denser than that of male, absent in places; thick and white to slightly tinged with brown on clypeus and face. Vertex with scattered orange setae, occiput fringed with white grading to orange setae. Metasoma dorsally covered with thick white to orange setae, excepting scantly setose on declivous face of propodeum. Declivous face of T1 covered in dense light setae, all metasomal tergites posteriorly fringed with dense rows of orange setae.

Antennae black. Head black with a short transverse yellow bar on vertex adjacent to eye, and another short bar medially on outer eye border; mandible dark red. Mesosoma black. Metasoma black except: T1 orange brown posteriorly, declivous anterior face black, T2 mostly orange brown except for an irregular anterior black band, T3 with posterior half orange brown, T4 with posterior third orange brown. Legs black, spines red brown. Wings infumate.

Antennae short and curled, about as long as longest head axis, flagellomeres broader than long, excepting last. All tarsi and tibiae spinose; hind femorae broad and flat, hind tibial spurs long, longest slightly clavate.

Material examined: 1 male, New Zealand ND, Te Paki, 22 Feb. 2000, A.M. BOOTH, on

dunes, Grid Reference NO2 816 462; 12 males, 1 female, New Zealand ND, Nth Herekino Head, 1 May 2000, A.M. BOOTH, flying above dunes, Grid Reference NO5 242 587.

Taxonomy

Radumeris tasmaniensis (SAUSSURE, 1855): BETREM in BRADLEY 1974
Tiphia radula FABRICIUS, 1775
Scolia 7-cincta FABRICIUS, 1775
Elis Tasmaniensis SAUSSURE, 1854
Elis (*Dielis*) *radula* SAUSSURE & SICHEL, 1864
Scolia (*Dielis*) *intrudens* SMITH, 1868
Scolia ehrendorferi DALLA TORRE, 1897
Campsomeris formosa var. *maculiceps* CAMERON, 1906
Campsomeris (*Dielis*) *radula* BETREM, 1928
Campsomeris (*Dielis*) *rosenbergi* BETREM, 1928
Campsomeris (*Dielis*) *tasmaniensis* BETREM, 1933
Campsomeris (*Radumeris*) *radula* BETREM, 1962
Campsomeris (*Radumeris*) *tasmaniensis* KROMBEIN, 1962

In their phylogenetic analysis of the Aculeata, BROTHERS & CARPENTER (1993) proposed the Scoliidae as sister group to the Vespidae. The family is divided into Proscoliinae and Scoliinae, and the Scoliinae is further divided into the tribes Campsomerini and Scoliini. *Radumeris tasmaniensis* (SAUSSURE) is placed in the Campsomerini, based on male genitalia, wing venation and other characters. Nomenclature at the generic level is still very problematic in all scoliids. Unfortunately the many works of J.C. BRADLEY and J.G. BETREM tended to intensify rather than clear the confusion. *R. tasmaniensis* is particularly problematic because it is very closely related to, or is possibly conspecific with *R. radula* (FABRICIUS, 1775). In 1775 FABRICIUS described two different scoliid species with the specific epithet *radula*: *Tiphia radula* F. and *Scolia radula* F. (BRADLEY 1964). The latter, a species from North America, was transferred into *Campsomeris*, as *Campsomeris* (*Dielis*) *radula* (F.) (current valid name: *Dielis plumipes* (DRURY, 1770)). The former, an Australian species, was mistakenly transferred (due to confusion of the subgenus *Dielis* SAUSSURE & SICHEL, 1864) by BETREM (1928) into *Campsomeris* (*Dielis*) *radula* (F.). To distinguish the different subgenera, BETREM (1962) introduced the subgenus *Radumeris*, placing the Australian species as *Campsomeris* (*Radumeris*) *radula* (F.). In 1974 *Radumeris* was raised to generic status by BETREM in BRADLEY. The species *tasmaniensis* (SAUSSURE) belongs to this genus.

Biology

Host Biology: Scoliid larvae develop as solitary ectoparasitoids of large coleopterous larvae, usually scarabaeids (GAULD & BOLTON 1988). YEATES et al. (1999) report *Radumeris tasmaniensis* as the major scoliid parasite of canegrubs (Coleoptera: Scarabaeidae: Melolonthinae) in Queensland. Records from various sources (Table 1) show that *R. tasmaniensis* will attack canegrubs belonging to a number of different species and genera

within the Melolonthinae, and that there are also records of hosts from the scarabaeid subfamilies Rutelinae and Dynastinae. With one exception (see discussion), none of the recorded hosts are known to occur in New Zealand (P. ALLSOPP, pers. comm.) and the host(s) in this country is unknown.

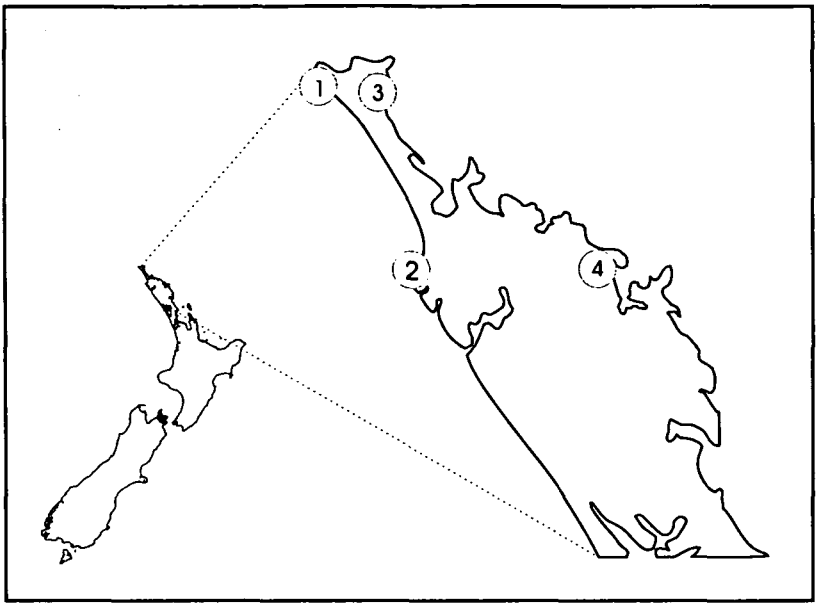
Table 1: Recorded Hosts of the Scoliid Wasp *Radumeris tasmaniensis* (SAUSSURE, 1855)

Host	Ad. size[1]	Main Reference(s)
Col.: Scarabaeidae: Melolonthinae		
Antitrogus consanguineus (BLACKBURN)	20-25 mm	LOGAN (pers.comm. 2000, from pot trial)
Antitrogus parvulus BRITTON	18-23 mm	LOGAN 1999
Dermolepida (= *Lepidoderma*) *albohirtum* (WATERHOUSE)	24-33 mm	YEATES et al. 1999, DODD 1917, ILLINGWORTH 1921
Lepidiota caudata BLACKBURN	21-34 mm	DODD 1917, ILLINGWORTH 1921
Lepidiota frenchi BLACKBURN	22-29 mm	DODD 1917, ILLINGWORTH 1921, YEATES et al. 1999
Lepidiota negatoria BLACKBURN	21-28 mm	YEATES et al. 1999, LOGAN 1999
Lepidiota noxia BRITTON	22-28 mm	YEATES et al. 1999, LOGAN 1999
Lepidiota rothei BLACKBURN	15-19 mm	DODD 1917, ILLINGWORTH 1921
Rhopea magnicornis BLACKBURN	21-30 mm	P. ALLSOPP (pers. comm.)
Col.: Scarabaeidae: Rutelinae		
Anoplognathus boisduvalii BOISDUVAL	21-27 mm	DODD 1917, ILLINGWORTH 1921
Anoplognathus porosus (DALMAN)	17-25 mm	LOGAN 1999
Col: Scarabaeidae: Dynastinae		
Dasygnathus spp.	17-32 mm	P. ALLSOPP (pers. comm.)

[1] Adult size ranges are from MILLER & ALLSOP 2000 (Melolonthinae), CARNE 1957 (Rutelinae), and ENDRÖDI 1985 (Dynastinae).

Life history: All known life history details appear to refer to the female. *Radumeris tasmaniensis* females are powerfully built wasps which can tunnel in the soil searching for hosts in their earth cells, which they then sting and paralyse. A single egg is laid on the host which hatches in 2 to 3 days, and the larva completes its development within the cell of the host in 7 to 10 days. Pupation usually takes 35 to 42 days, but may be longer in winter (ILLINGWORTH 1921). Under laboratory conditions ILLINGWORTH (1921) found an average of 2 eggs are laid a day, with a maximum of 95 eggs recorded laid by a captive female. Adults have been observed to live for an average of 51 days (ILLINGWORTH 1921). In Queensland, four generations a year have been observed, with the last three generations overlapping (JARVIS 1929 sensu KROMBEIN 1963). Adult wasps feed on nectar and honeydew (ILLINGWORTH 1921) and pollinate flowers including macadamias (ALLSOPP 1992). Females appear to be able to detect scarab larvae below the soil surface and can burrow to depths of 1.2 m (ILLINGWORTH 1921).

Distribution: KROMBEIN (1963) recorded *R. tasmaniensis* from Australia and New Guinea. He noted that the type locality of *Elis Tasmaniensis* SAUSSURE, 1855 is Tasmania, but considered this (the only record of the species from Tasmania) to be erroneous. According to Dr. P. MCQUILLAN, University of Tasmania (pers. comm.), *R. tasmaniensis* does not occur in Tasmania. The mainland Australian distribution is throughout eastern Australia to South Australia, with a few records from inland and north-western Australia (ALLSOPP 1992).



Map 1. Collection localities for *Radumeris tasmaniensis* (SAUSSURE, 1855) and *Dasygnathus dejeani* MACLEAY: 1 = Cape Maria van Dieman (*R. tasmaniensis*); 2 = North Herekino Head (*R. tasmaniensis*); 3 = Whareana Bay (*R. tasmaniensis*); 4 = (Kerikeri (*D. dejeani*).

Natural enemies: YEATES et al. (1999) describe and discuss the life history of the bee fly, *Ligyra satyrus* (F.) (Diptera: Bombyliidae), a parasitoid of *R. tasmaniensis* through a number of different canegrub species in Queensland. ILLINGWORTH (1921) recorded bombyliid and rhipiphorid (Coleoptera) parasitoids of *R. tasmaniensis*. YEATES et al. (1999) found very low rates of parasitism by the bee fly, compared to relatively high rates reported in the early 1900s by JARVIS (1915). The fungus *Metarhizum anisopliae* attacks the eggs and larvae of *R. tasmaniensis* and also the host coleopteran larvae (JARVIS 1922 sensu BETREM 1928).

Discussion

Aculeate hymenopterans are very poorly represented in New Zealand. Only 13 families have been recorded, including this, the first record of the family Scoliidae. BERRY (in press) recognised around 130 species of aculeates, from a world total of 49.000 (GASTON in LASALLE & GAULD 1993). Around 40% of the aculeate species recorded from New Zealand are exotic, and four families - Vespidae, Scoliidae, Apidae and Megachilidae - have no endemic members. Some aculeates have been introduced deliberately (as polli-

nators or biological control agents) but most of the exotic species have arrived accidentally. Some, vespid wasps and ants in particular, are thought to have had a marked impact on New Zealand's existing biodiversity. These species are generally predators and/or scavengers. The impact of parasitoids such as *R. tasmaniensis* on the native (and introduced) fauna is less easy to predict or quantify. We are assuming that *R. tasmaniensis* has established permanently, as it has been collected from widely separated localities (>100 km, Map 1) for two consecutive summers. Hosts in New Zealand are currently unknown, so it is not known whether *R. tasmaniensis* is likely to pose a significant risk to indigenous species. The known hosts belong to three scarabaeid (Coleoptera: Scarabaeidae) subfamilies, the New Zealand representatives of which are discussed below.

1. Scarabaeidae Melolonthinae: Most recorded hosts of *R. tasmaniensis* are from the Melolonthinae. This is by far the largest of the scarabaeid subfamilies in New Zealand, with 103 native species in 10 genera (KLIMASZEWSKI & WATT 1997). These include many species which are recognised agricultural pests, for example the grass grub, *Costelytra zealandica* (WHITE). However, other endemic melolonthines, for example species of the flightless genus *Prodontria* are considered to be vulnerable to habitat modification and one, the Cromwell chafer *Prodontria lewisi* BROUN, is listed as an endangered species. *P. lewisi* is known only from rough grassland in a restricted area of Central Otago (South Island), and has had a nature reserve established for its conservation.

All of the recorded hosts of *R. tasmaniensis* are relatively large beetles, all more than 15 mm and most over 20 mm in length, despite the fact that many smaller species of melolonthines occur within its native range. Given the large size of the adult parasitoids, we suggest that a host able to support the parasitoid through to adult emergence would also need to be fairly large, i.e. 15 mm long, or longer. This requirement would exclude a number of New Zealand melolonthines from suitability, for example the genera *Costelytra*, *Pyronota*, *Sericospilus*, *Gnaphalopoda*, and all species of *Odontria* and *Prodontria* except the very largest (GIVEN 1952). Some genera, such as *Prodontria* and *Scythrodes* can also be excluded from present consideration by their distribution - limited to the southern South Island, Stewart Island and the Snares Islands. Thus the only genera of New Zealand melolonthines currently likely to be exposed to parasitism are *Stethaspis* and large species of *Odontria* such as *O. magna* GIVEN or *O. carinata* GIVEN. There is at least one species of *Stethaspis*, *S. longicornis* (ARROW) in Northland, which could be a suitable host. It is 19-24 mm in length and a common forest inhabiting species.

Given that *R. tasmaniensis* is not known from Tasmania, it would appear that even if *R. tasmaniensis* were to spread throughout most of New Zealand, *Scythrodes* would be unlikely to be affected, due to its montane habitat, and the large species of *Prodontria* should be safe from parasitism, since they are restricted to montane areas of Stewart Island and to the Snares Islands.

2. Scarabaeidae Rutelinae: This subfamily is not known from New Zealand.

3. Scarabaeidae Dynastinae: The Dynastinae is represented by 5 species in the endemic genus *Pericoptus*, which are potential hosts for *R. tasmaniensis*. They are found in sandy soils and *P. truncatus* (FABRICIUS) (22-26 mm in length) has been collected from beaches in Northland in exactly the habitat where *R. tasmaniensis* has been found.

There are also three adventive dynastine species in exotic genera (KLIMASZEWSKI &

WATT 1997). One, the accidentally introduced Australian *Dasygnathus dejeani* (MACLEAY 1819), was first recorded from Kerikeri in Northland, relatively close to the collection site of *R. tasmaniensis* in 1974 (Map 1, site 3) (COX & DALE 1977). *D. dejeani* (17-23 mm in length) is a possible host for *R. tasmaniensis*, particularly since *R. tasmaniensis* has been recorded from *Dasygnathus* species in Australia (P. ALLSOP pers. comm.). A second exotic dynastine, the black beetle *Heteronychus arator* (F.), endemic to South Africa, has become an important pasture pest in New Zealand. In 1976 the scoliids *Cathimeris capensis* (SAUSSURE, 1858) and *Micromeriella atropos* (SAUSSURE, 1859) were imported from South Africa into New Zealand for the biological control of black beetle, but no females survived quarantine (CAMERON & THOMAS in CAMERON et al. 1989). *H. arator* is present in Australia, but has not been recorded as a host of *R. tasmaniensis*, suggesting that it may not attack this pest species in New Zealand.

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