THE YELLOW FLOWER WASP, *RADUMERIS TASMANIENSIS* SAUSSURE (HYMENOPTERA: SCOLIIDAE): POTENTIAL THREAT TO NEW ZEALAND NATIVE FAUNA

B.I.P. BARRATT[1], B.E. WILLOUGHBY[2], D. WILSON[2] and A.M. BOOTH[3]

[1]*AgResearch, Invermay Agricultural Centre, Private Bag 50034, Mosgiel*
[2]*AgResearch, Ruakura Research Centre, Private Bag 3123, Hamilton*
[3]*Department of Conservation, Whangarei*

ABSTRACT

The yellow flower wasp, *Radumeris tasmaniensis* Saussure, was first reported in Northland, New Zealand in February 2000. *Radumeris tasmaniensis* is a solitary wasp which occurs naturally in Australia and Papua New Guinea. It is an ectoparasitoid of scarabaeid larvae. A survey was carried out during February and March 2001 to determine the distribution and potential host range of *R. tasmaniensis* in Northland. This confirmed that *R. tasmaniensis* was present at the three sites from which it was first reported in 2000, but appeared not to have established more widely. A small extension to its known range was discovered in a further survey in March-April 2002. Parasitised scarabaeid larvae were not detected by soil sampling, but *Pericoptus* spp. (Scarabaeidae: Dynastinae) was the species most commonly found. The rationale and methodology of the survey is presented, and the conservation implications of the establishment of this species in New Zealand are discussed.
Keywords: *Radumeris tasmaniensis* Saussure, yellow flower wasp, parasite, Scarabaeidae, *Pericoptus* spp.

INTRODUCTION

The yellow flower wasp, *Radumeris* (=*Campsomeris) tasmaniensis* Saussure (Hymenoptera: Scoliidae), was first reported in Northland, New Zealand in February 2000. Department of Conservation staff observed the wasps swarming at North Herekino Head and Cape Maria van Diemen. A further dead specimen was collected in November 2000 from Little Whareana, south of North Cape.

Radumeris tasmaniensis is a solitary ectoparasitoid of scarabaeid larvae. It occurs naturally in Australia (mainly Queensland) and Papua New Guinea (Krombein 1963). Adult females (up to 30 mm long) and males (up to 20 mm long) feed on nectar and honeydew (Illingworth 1921). Females, which can detect and burrow to locate hosts in the soil to depths of 1.2 m (Illingworth 1921), sting and oviposit on the paralysed scarabaeid larva. The wasp larva develops in 6-10 days followed by a 35-41 day pupal period in Queensland conditions (Yeates et al.1999). Females live for about 50 days and they produce up to 2 eggs a day (Illingworth 1921).

Radumeris tasmaniensis parasitises 2-3rd instar larvae of a number of Australian scarabaeid species including melolonthines (cane grubs), rutelines and dynastines, requiring larvae in the size range 1-5 g (D. Logan, pers. comm.). Logan (1999) recorded field parasitism of cane grubs by *R. tasmaniensis* to be less than 2% although Illingworth (1921) recorded parasitism levels as high as 60%.

The arrival of *R. tasmaniensis* in New Zealand raises concerns that New Zealand native Scarabaeidae may be at risk. Species of *Pericoptus* (Dynastinae), *Stethaspis* and larger species of *Odontria* (Melolonthinae) could be suitable hosts for *R. tasmaniensis* in New Zealand. This study aimed to determine the current distribution of *R. tasmaniensis*

in Northland and identify current and potential scarabaeid hosts of *R. tasmaniensis* in New Zealand.

METHODS

The three sites where *R. tasmaniensis* had been recorded in 2000, were sampled in 2001 to delineate the distribution around these sites (Willoughby et al. 2001). Sample sites were established at positions approximately 1, 2 and 5 km in both directions along the coast and inland from each of the three known sites. A further eight sites were located on the west coast and five on the east coast of Northland (Fig. 1), in coastal dune habitats similar to those where *R. tasmaniensis* was already known to occur.

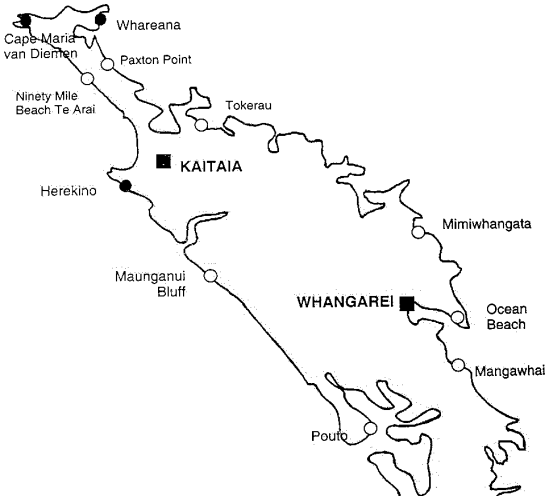

FIGURE 1: Map of Northland showing *Radumeris tasmaniensis* and scarabaeid survey sites. Closed circles indicate sites where *R. tasmaniensis* was found and open circles are survey sites where *R. tasmaniensis* was not found.

At each site, three trapping methods were used: one Malaise trap 1.5 m high and 2 m wide, five yellow sticky boards 200 mm x 240 mm positioned 0.5-1.0 m above ground, and five attractant traps containing 5 µl of pure technical grade anethole, known to be attractive to *R. tasmaniensis* (Allsopp 1992). The latter comprised 5 litre plastic screw-top bottles containing 50 ml glycerol, partly buried in the soil with 30 mm diameter access holes 100 mm above ground; the attractant was contained in foam plastic in a 20 ml vial attached to the lid. The different trap types were well spaced at each site to avoid interference between them. The traps were set in mid-February 2001 and removed in mid-March 2001. During each visit observations for wasp activity, and sweep net sampling for wasps was carried out subject to suitable weather conditions.

To sample for possible host species of *R. tasmaniensis*, at each site ten pitfall traps (80 mm diameter) were set in the soil to collect adult Scarabaeidae, and 20 spade samples 150 mm × 150 mm × 200 mm deep were taken near vegetation in mid-February and mid-March 2001. Soil samples were sorted in the field, and scarabaeid larvae preserved in 70% ethanol. In the laboratory, scarabaeid larvae were examined for external parasitoids and then sent to a specialist for identification.

In March-April 2002 further sampling using sticky traps at 35 sites, and visual searching was carried out to detect any further extension of *R. tasmaniensis* distribution from the 2001 sites.

RESULTS

Adult *R. tasmaniensis*

In 2001 all *R. tasmaniensis* trapped or observed in the field were in coastal dune habitats mostly within 3 km of the 2000 sites. The exception was at Herekino, where a wasp was trapped 6 km north of the original site (Table 1). Adult male flight activity was mostly observed near flowering plants when air temperature was above 20°C and wind speed below 10 km/h. Flowers of Canadian fleabane, *Conyza bilbaona* Remy, were commonly visited for foraging. Female *R. tasmaniensis* were less frequently observed in flight. If air temperature dropped below approximately 20°C, or the sun was obscured by cloud, flight was rapidly terminated and wasps landed and burrowed in the sand. Weather conditions, particularly during February 2001, were generally unfavourable for *R. tasmaniensis* activity, with extended periods of cool weather with wind and rain.

TABLE 1: The number of *R. tasmaniensis* (YFW) adults collected using sticky traps in 2001 and total Scarabaeidae collected by spade sampling at each site.

2001 sample sites in relation to 2000 observations[1]	YFW (no./5 sticky traps)	Scarabaeidae from soil sampling in February and March (no. samples)
	Cape Maria van Diemen[2]	
1 km inland	8	5 *Pericoptus* sp. larvae
3 km inland	3	4 *Odontria* sp. adults
2 km N	1	(n=320)
3 km N	12	
	Whareana[2]	
0.75 km N	4	2 *Pericoptus* sp. larvae
		1 *Odontria* sp. adults (n=320)
	Herekino[2]	
0.8 km inland	4	7 *Costelytra zealandica* (White) larvae
6 km N	1	5 *Heteronychus arator* (F.) larvae
		33 *Pericoptus* sp. larvae
		4 *Pericoptus* sp. adults
		4 *Odontria cassiniae* adults
		3 *Stethaspis longicornis* adults
		8 other larva (n= 360)
	Other sites	
Ninety Mile Beach	0	1 *Pericoptus* sp. larvae
		2 other larvae (n=40)
Paxton Point	0	1 *Pericoptus* sp. adult
		1 other larva (n= 40)
Tokerau	0	0 (n= 40)
Mimiwhangata	0	1 *Pericoptus* sp. larva (n= 40)
Maunganui Bluff	0	0 (n= 40)
Ocean Beach Whangarei	0	3 *Pericoptus* sp. larvae (n= 40)
Mangawhai	0	0 (n= 40)
Pouto	0	0 (n= 40)

[1]Only sites where *R. tasmaniensis* was recorded are shown.
[2]Sites where *R. tasmaniensis* was observed in 2000.

Malaise traps collected only one male *R. tasmaniensis* at Cape Maria van Diemen even though other Hymenoptera (e.g. *Vespula germanica* (F.) and *Polistes chinensis* F.)

were trapped frequently. The attractant dispensers trapped male *R. tasmaniensis* at 3 sites: Herekino (1 wasp), Cape Maria van Diemen (3 wasps) and Whareana (1 wasp). The sticky traps were more effective in trapping adult *R. tasmaniensis* (Table 1).

In 2002 the only additional site record for *R. tasmaniensis* was in coastal dunes near Te Paki, about 10 km south of the southermost Cape Maria van Diemen site.

Scarabaeidae

Pitfall traps failed to collect adult Scarabaeidae at any site. Spade sampling for scarabaeid larvae revealed a predominance of *Pericoptus* spp. (Table 1), particularly in the vicinity of spinifex (*Spinifex sericeas* R.Br.) roots. No evidence of parasitism by *R. tasmaniensis* was detected, and no paralysed scarabaeid larval cadavers or *R. tasmaniensis* pupal cocoons were found. *Pericoptus* species cannot be identified in the larval stage, but there are at least two species present in Northland, *P. truncatus* (F.) and a smaller unidentified species (R. Emberson, pers. comm.). All the adults collected in the survey were assigned to the latter species. Similarly *Odontria* spp. larvae cannot be identified to species with certainty, but *O. cassiniae* Given was identified from Herekino.

DISCUSSION

Of the three trapping methods used in 2001, sticky traps were the most effective in trapping *R. tasmaniensis* adults. Observation and sweep-netting was effective, especially for foraging males, but dependent upon favourable weather conditions.

Although soil sampling failed to detect parasitised scarabaeid larvae, circumstantial evidence would indicate that *Pericoptus* might be an important host for *R. tasmaniensis* in New Zealand. This conclusion is based on the apparent requirement of *R. tasmaniensis* for larvae in the range 1-5 g, the results from soil sampling and the largely coastal duneland distribution of the wasp in Northland.

Odontria cassiniae, known from coastal dune environments in association with *Cassinia* spp. (Given & Hoy 1952), has been recorded from the west coast of Northland down to upper Muriwai Beach (G. Hall & S. Thorpe, pers. comm.). This and other *Odontria* species were found in small numbers during the survey. Other species with limited distribution in Northland include *O. sandageri* Broun described from Motohinau Island, *O. carinata* Given from the Three Kings Islands and an undescribed species from the Poor Knights Islands (S. Thorpe, pers. comm.). *O. xanthosticta* White from Whangarei (Given & Hoy 1952) could also be at risk from *R. tasmaniensis* if it expanded its current range to the south. *Stethaspis longicornis* (Arrow) found at Herekino would also have larvae of sufficient size to support *R. tasmaniensis* development. This species is widely distributed throughout the North Island (Given & Hoy 1952; G. Hall, pers. comm.), but there is a very similar undescribed species of *Stethaspis*, currently known only from Te Paki (S. Thorpe, pers. com.), which could be at risk from *R. tasmaniensis*.

Heteronychus arator (F.) was not commonly found during the survey, but this species is common in Northland pastures. The larvae are thought to reach a sufficiently large size to support *R. tasmaniensis* larval development. This might facilitate *R. tasmaniensis* establishment inland and reduce their reliance on coastal environments and possibly on native species. This could also result in larger numbers of *R. tasmaniensis* in the environment given a relatively abundant pest species as a host. *Heteronychus arator* is univoltine and larvae are present in the soil from December to February, which could be concurrent with *R. tasmaniensis* oviposition periods.

CONCLUSIONS

Sampling in 2001 and 2002 has indicated that *R. tasmaniensis* has remained confined within about 10 km of the three sites where it was observed in 2000. *Pericoptus* spp. are probably the main host for current *R. tasmaniensis* populations. Species of *Odontria* and *Stethaspis* represent potential native hosts and *H. arator* a potential exotic host. Assessment of risk to specific native Scarabaeidae is limited by lack of knowledge of the species present in Northland and their distribution. Climate modelling will be required

to determine the potential distribution of *R. tasmaniensis* in New Zealand, and define further the native species potentially at risk.

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