

## Where does the New Zealand praying mantis, *Orthodera novaezealandiae* (Colenso) (Mantodea: Mantidae), deposit its oothecae?

Matthew K. Bowie<sup>1</sup> and Mike H. Bowie<sup>2</sup>

<sup>1</sup> 4 Roblyn Place, Lincoln, Canterbury.

<sup>2</sup> Ecology & Entomology Group, Soil, Plant and Ecological Sciences Division, P.O. Box 84, Lincoln University. [bowie@lincoln.ac.nz](mailto:bowie@lincoln.ac.nz)

### Abstract

Oothecae of the praying mantis *Orthodera novaezealandiae* were collected from trees in Lincoln, Canterbury. Aspect, height, branch thickness, bark temperature and light intensity where oothecae were located were measured. Additional oothecae were collected from fences and walls to measure their dimensions and count the number of opercula. Fifty percent of the oothecae faced within 15° of true north on open sunny branches and tree trunks. The bark beside oothecae was significantly warmer compared with the opposite side of branches. Oothecae collected in Lincoln were significantly longer (3.4 mm) than oothecae in an earlier Palmerston North study.

**Keywords:** praying mantis, *Orthodera novaezealandiae*, oothecae, aspect

### Introduction

The praying mantis *Orthodera novaezealandiae* (Colenso) (Mantodea: Mantidae) is widely distributed in both islands but is absent from the West Coast of the South Island (Ramsay 1990). The morphology and biology of this species have been well documented in Ramsay (1990) and Suckling (1984) reared *O. novaezealandiae* (as *O. ministralis*) in the laboratory to study its embryonic and nymphal development, predation rate and cannibalism. Although the dimensions and morphology of oothecae (egg cases) have been investigated (Ramsay 1990; Suckling 1984), there has been no study of the location and micro-habitats of the oothecae. Oothecae are often found on exposed parts of branches and man-made structures such as fences and posts (Walsby 1996).

This paper reports an investigation into site factors that influence where praying mantids deposit their oothecae.

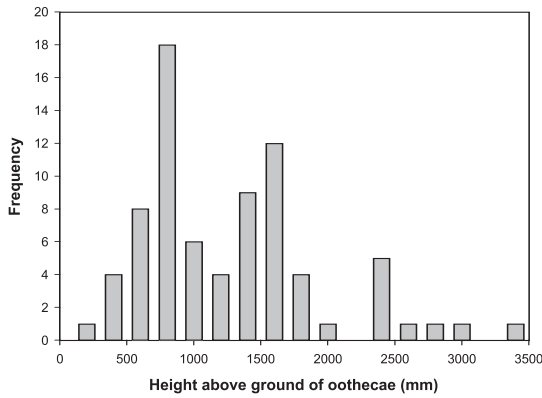
### Methods

Garden trees in Lincoln, Canterbury (172°29.127'E 43°38.238'S, elevation 14 m above

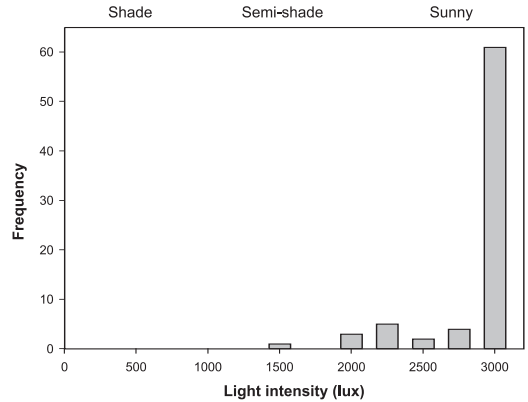
sea level), were searched for the presence of oothecae. Aspect, height, light intensity, tree limb diameter, tree species and bark temperature were recorded for each egg case. Light intensity at the oothecae was measured with a lux meter (Yew type 3281 Yokogawa). Tree bark temperature was measured with a 3M Scotchtrak heat tracker (model number IR-1000) in the presence of sunlight. A two-sample paired t-test was used to compare the temperature next to the egg case, with that on the opposite side of the branch. Additional oothecae were collected from fences and walls to determine size and number of opercula (egg cavities). Vernier callipers were used to measure the tree limb diameters and the length, width and height of the oothecae. A 9X-magnification lens was used to count the number of opercula. The Z test (Minitab 1991) was used to determine significance between Lincoln and Palmerston North (Suckling 1984) oothecae. A magnetic compass was used to measure the aspect (the direction the oothecae were facing) to the nearest 5°. The distribution of the oothecae aspects was plotted using a radar plot (Microsoft® Excel 97 SR-2).

### Results

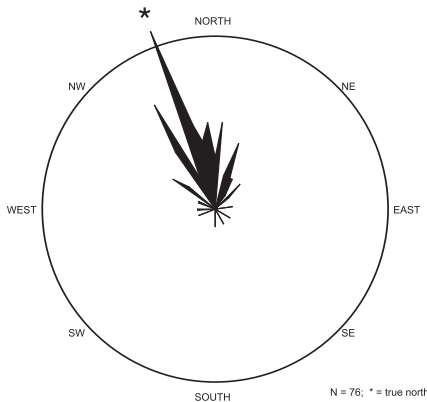
Oothecae were found on trees from 200 mm to 3400 mm above ground (Fig. 1), with a median and mean height of 1055 mm and 1167 mm respectively; 80.3% of the oothecae found on trees were at light levels of 3000 lux or greater (Fig. 2). Most oothecae were orientated between north and north-west, with the mode (11 oothecae) at an aspect of 340° (true north) (Fig. 3). The four most frequently used plants for depositing oothecae were kowhai (*Sophora microphylla*), native broom (*Carmichaelia* sp.), lancewood (*Pseudopanax crassifolius*) and cabbage tree (*Cordyline australis*), representing 28%, 20%, 18% and 12% of the oothecae respectively. Over half (56.6%) of all oothecae were found on tree limbs 50 mm or less in diameter (Fig. 4). The mean temperatures next



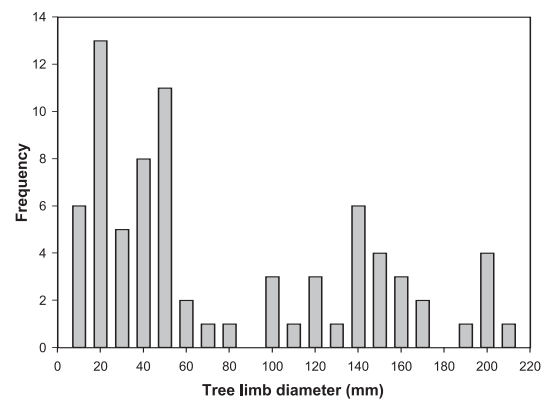
**Fig. 1.** Height above ground of *O. novaezealandiae* oothecae found on trees at Lincoln, Canterbury.



**Fig. 2.** Light levels (lux) at *O. novaezealandiae* oothecae found in trees at Lincoln, Canterbury.



**Fig. 3.** Frequency distribution of aspect (compass bearing) of *O. novaezealandiae* oothecae found in trees at Lincoln, Canterbury. The circle represents 10 individuals.



**Fig. 4.** Tree limb diameter at the site of *O. novaezealandiae* oothecae on trees at Lincoln, Canterbury.

to the oothecae were significantly higher (13.58°C) than those on the opposite side (9.51°C) ( $p < 0.001$ ,  $df = 75$ ).

The oothecae ranged in length from 6.0 to 25.5 mm with a mean (SEM) of 14.68 (0.28) mm. Both

width and height ranged from 5.0 to 7.0 mm and the means were 6.3 (0.04) and 6.0 (0.05) mm respectively. Oothecae contained between 6 and 28 opercula with a mean (SEM) of 19.5 (0.40) (Table 1).

**Table 1. Comparison of *O. novaezealandiae* oothecae dimensions and opercula number between Lincoln and Palmerston North (Suckling, 1984) populations.**

Parameter	Lincoln			Palmerston North		
	Mean	SE	N	Mean	SE	N
Length (mm)	14.68	0.28	114	11.32	0.20	136
Width (mm)	6.32	0.04	114	5.77	0.06	136
Height (mm)	5.99	0.05	114	5.96	0.05	136
Opercula	19.52	0.40	114	17.90	0.40	110

## Discussion

*O. novaezealandiae* deposited its oothecae in open, sunny positions. Oothecae tended to be more numerous on trees with unshaded trunks such as kowhai, broom, lancewood and cabbage tree, than on shady, leafy trees such as *Pittosporum tenuifolium*. Egg case height was influenced by *O. novaezealandiae* not laying in the shade of low shrubs and higher branches. Although there were few large trees in the study area, *O. novaezealandiae* appeared to prefer narrower trunks or branches on which to deposit their oothecae. The direction faced by oothecae was concentrated around true north, which presumably maximised sunlight and heat, and hastened egg development.

The oothecae collected at Lincoln in this study were significantly ( $Z = 4.1$ ,  $p < 0.05$ ) longer than those of Palmerston North specimens (Suckling, 1984) (Table 1). The larger size of the Lincoln oothecae maybe explained by Bergmann's rule (Dajoz 1977), where organisms in cooler environments have larger body size than the same species in warmer climates. Although this rule has mostly been applied to homeothermic animals such as birds and mammals having reduced heat loss through smaller surface area/volume ratio, the same may apply to invertebrates. The increased length and width meant that Lincoln oothecae could accommodate two more opercula than the Palmerston North, giving the southern mantids a reproductive advantage.

Modern New Zealand houses are usually built to face true north ( $23^\circ$  west of magnetic north) to capture more light and heat. As a consequence, north-facing surfaces such as walls and fences often have large numbers of *O. novaezealandiae* oothecae because their aspect, height, light levels and temperature are best to maximise egg hatch.

The other praying mantis species in New Zealand, *Miomantis caffra* Saussure, from South Africa, tends to lay its oothecae in more sheltered places and to have larger oothecae than *O. novaezealandiae* (Walsby 1996). A comparable analysis of oothecal sites of *M. caffra* in New Zealand would be useful.

## Acknowledgements

We thank Dr Sue Worner and Dr Chris Frampton for statistical assistance and Prof. Steve Wratten, Dr Scott and Dr Adrian Paterson (Lincoln University) for their useful comments on the manuscript.

## References

- Dajoz R. 1977.** *Introduction to ecology*. Hodder and Stoughton, London.
- Minitab. 1991.** *Minitab Reference manual*. PC version, release 8. Minitab Inc. State College, PA, USA.
- Ramsay GW. 1990.** Mantodea (Insecta) with a review of aspects of functional morphology and biology. *Fauna of New Zealand* 19: 1-96.
- Suckling DM. 1984.** Laboratory studies on the praying mantis *Orthodera ministralis* (Mantodea: Mantidae). *New Zealand Entomologist* 8: 96-101.
- Walsby J. 1996.** On a wing and a prayer. *New Zealand Geographic* 29: 100-116.