

Observations on the winter survival of the praying mantis, *Orthodera ministralis* (Mantodea: Mantidae), in Auckland

TREVOR K. CROSBY

Entomology Division, DSIR, Private Bag, Auckland, New Zealand

Abstract

Adult and nymphal stages of the praying mantis, *Orthodera ministralis* (F.), successfully survived the 1983 winter outdoors in Auckland. Their survival was not correlated with the drier than normal winter. Nymphs overwintering were not disadvantaged, and 1 male, on reaching maturity, was observed mating with an overwintering female of the previous generation. Individuals moved no more than a few metres from their initial sites of discovery over a period of several months. Oothecae were produced by some overwintering females between August and October. Some adult females probably survived for at least 7 months. It is likely that mantids regularly survive winters unnoticed in the Auckland and Northland regions.

Keywords: Mantodea; Mantidae; *Orthodera ministralis*; adults, nymphs; adult longevity; nymphal growth; winter survival; movement.

INTRODUCTION

The praying mantis, *Orthodera ministralis* (F.), is a common Australasian species which lives in low shrubs in the sunniest parts of gardens or fields. General accounts of

The garden is open to the sun at all times. It is exposed to winds from the northerly quarter, but the house protects it from strong southerly winds. It is partly protected from strong easterly and westerly winds by a fence and a neighbouring house. The northern margin is a 0.5-1 m high concrete retaining wall abutting the street. The wall, together with the large rocks and scoria in the garden, release absorbed heat at night. Adjoining gardens do not have a continuous layer of shrubby vegetation suitable for mantids.

RECOGNITION OF INDIVIDUALS

All adults but 1 had wear marks or damage on their wings, and 1 had in addition a black damage mark on its hind femur. The characteristic patterns these marks formed meant individual adults could be recognised without needing to mark them in any manner. The 5 nymphs could not be individually recognised, but they were always in the groups of 2 and 3 at opposite ends of the garden (Fig. 1, 1 & 3).

RESULTS AND DISCUSSION

Number of mantids present

The best time to ascertain the total number of mantids present was between 1100 and 1400 h N.Z. Standard Time on sunny days (their most active period). A reliable count took at least 15 minutes, and the area had to be scanned 2 or 3 times. Counts were usually lower under suboptimal weather conditions as some individuals remained concealed. Specimens in the open proved difficult to find at times, even though they remained close to their previous position, because their coloration blended with their surroundings. Reliable counts could not be made during evenings or under poor light conditions. Other observers had varying degrees of success in finding the same individuals.

The number of mantids present was high for the small area of the garden. 10 adult females and 5 5th-instar nymphs (Suckling 1984) were counted on 28 July (at the end of an extended sunny period). This is about 3 times the number of adults that could be expected to be found in such an area in a normal summer/autumn period. 9 of the females had damage marks on their wings, or wing damage, indicating that they had survived into the winter from the summer/autumn period. 1 female was unmarked and fresh-looking, and it had the appearance of a recently emerged adult. By 2 November, 4 adults were known to be still alive, 2 of the 5 nymphs had moulted and become adult males, and the remaining 3 nymphs were in their final instar. In addition, there were numerous 1st instar, and some 2nd instar, nymphs present, even on plants which previously had no mantids. By mid November, 2 of the old females and the 2 new males were still present. Unexpectedly, though, there was no sign of the 3 final instar nymphs; it is possible that they may have dispersed to neighbouring properties. The 3 final instar individuals being observed at Mt Albert Research Centre also disappeared at this time.

Nymphal growth

The 5 nymphs on the golden conifers (Fig. 1, 1 & 3) were all 5th instars when found in July, and they may have been survivors from a group, probably 3rd instars, seen while trimming the bamboo at the beginning of May. (In May, I assumed these individuals would soon die with the onset of winter (Bennett 1981), and regrettably made no further observations on them.) Between 20 September and 12 October 4 of the 5th instar nymphs moulted to the final instar. Thus despite the protracted period of growth for individuals during the winter period when food supply may have been limited their growth rate remained relatively synchronous, as occurs normally in the species. The growth of the 3 nymphs being observed at Mt Albert Research Centre during the same period also remained in synchrony. This shows that the growth rate of

O. ministralis individuals of the same generation remain relatively constant. This is in contrast to the other mantid found in Auckland, *Miomantis caffra* Saussure, in which individuals from the same ootheca can grow at different rates (Ramsay 1984).

Adult longevity

All but 1 of the adults discovered at the end of July had wear and damage marks on their wings suggesting that they reached adulthood in the autumn probably as late as early April. If this is correct they would have been 4 months old when discovered, although they could have been 1 or 2 months older. By the beginning of November, the 4 surviving females were at least 7 months old. This is about twice the usual adult lifespan indicated in the literature for the species (Sharell 1982).

Hatching of oothecae

At the end of July 16 overwintering oothecae were counted in the garden area. These started to hatch in mid September, and most had hatched by mid November. In the cases which I observed all nymphs hatched from an ootheca within a day or two; hatching was not staggered over a period of several weeks as occurs in some mantid species (Heath 1980). In Auckland, therefore, overwintering oothecae can hatch at any time between September and November.

Between August and October a further 8 oothecae were found. These were fresh-looking (Sharell 1982), and most likely had been produced by the overwintering adults. Only 1 of these oothecae had hatched by 20 November, and this ootheca, probably about 2 months old, was in one of the sunniest positions in the garden.

Oothecae can hatch at other times of the year. For instance, the nymphs found in the bamboo in May were probably 3rd instars, which indicates they probably came from an ootheca which hatched about March. Bennett (1981) recorded in the laboratory the hatching of an ootheca in June which had been laid in March. These records demonstrate that oothecae are able to hatch in many different months of the year in Auckland, and this differs from the southern parts of New Zealand where the reported period of hatching is restricted to October (Sharell 1982).

Food

I did not provide the mantids with insects at any stage. During all months there was a wide range of insects available as potential food items for the mantids in the garden. Nearly all the mantids remained in their territories on non-flowering shrubs even though these plants were not apparently attracting as many insects as adjacent flowering plants. The yellow colour of the conifers (Fig. 1, 1 & 3) may have attracted some insects as food for the nymphs, as yellow is recognised to be attractant to some species of insects (Prokopy & Owens 1983).

Mantids were observed with prey on only 2 occasions in spite of many hours of observations: in mid October an adult was seen eating a honey bee, and at the end of October a final instar nymph was observed eating a fly. However, the mantids must have been obtaining enough food because the nymphs were able to moult and at least a few of the adults laid eggs in fully formed oothecae.

Movement of individuals

Both adults and nymphs nearly always limited their movements to the plant on which they were initially discovered, and they were seldom found more than 1 m away from their previous observation site. They were on the more open edges and tops of plants when the sun was shining. 4 adults were on the pohutukawa tree (Fig. 1, 2), and they remained on the eastern side throughout the winter; it was not until spring that individuals moved to the northern and western sides. The nymphs were confined to 2 small golden conifer shrubs; 2 on one and 3 on the other (Fig. 1, 1 & 3).

Some adults were seen at nearly every count, while others were seen only a few times. For example, 1 female with a badly battered wing was seen on 3 occasions at the end of July, but was then not seen again until 19 October when it was eating a honey bee. Others were often not seen for a week or more. Consequently when an individual could not be found after a period of adverse weather it was not certain whether it had died or if it was still concealed.

Effect of weather conditions on the mantids

Daily climatological records are taken at Owairaka station at the Mt Albert Research Centre, DSIR, about 2 km to the southeast of the study area. Table 1 is a summary of conditions for May to October 1983, the period in which mantids were unexpectedly found to be present in Auckland.

Compared with normal, May, July, and August were unusually dry months (Table 1) with a lower than normal number of days on which it rained; and these months also had a high number of cloudless days coupled with an unusually high number of ground frosts. However, temperatures were similar to normal. Several gales accompanied by heavy rain occurred and these lashed the study area.

1. REACTION TO PRECIPITATION

The mantids were often found with water droplets on their dorsal surface. On several occasions during quite heavy rain it was noted that they did not move from their exposed positions even though they had the opportunity to walk to a protected area a few body lengths away. Similarly at night they usually remained in their exposed positions and consequently got covered with dew. Mantids, therefore, can survive wetting even in cold temperatures when the moisture remains on them for extended periods.

2. REACTION TO COLD

In the early frosty mornings of July the mantids remained completely immobile while they were being observed. The 3 nymphs on the golden conifer close to the lawn (Fig. 1, 3) were within 30 cm of heavy ground frost temperatures, and it appeared that on 3 or 4 occasions as if in fact the dew on them had frozen. However, later in the day when it was warmer they all could follow the movements of the observer, and they could move quite freely. Low temperatures, therefore, immobilised the mantids which reduced their ability to catch the insects present.

Cold is the usual reason given for mortality of adults of the praying mantis (e.g. Sharell 1982). For these overwintering adults, however, cold was not a cause of mortality.

Table 1. Weather observations at Mt Albert Research Centre (Owairaka) May-October 1983 (station 41 m above sea level).

	May	Jun	Jul	Aug	Sep	Oct
Mean maximum temp. (°C)	16.4	14.6	13.3	14.9	16.7	17.7
Mean minimum temp. (°C)	9.6	8.2	4.8	7.6	9.3	11.3
Average temperature (°C)	13.0	11.4	9.1	11.3	13.0	14.5
Difference from normal	-0.2	+0.4	-1.0	+0.6	+0.9	+0.7
Maximum air temp. (°C)	20.0	17.1	16.2	17.1	20.1	21.0
Minimum air temp. (°C)	3.4	0.9	0.3	1.6	1.6	5.1
Days with ground frost	2	3	12	5	0	0
Rainfall (mm)	66	166	42	48	110	179
Difference from normal	-71	+19	-103	-102	+8	+65
Days with rain	17	22	9	14	17	18
Maximum 24 h fall (mm)	11	48	29	29	34	47

Mating between individuals of different generations

At 1500 h on 13 November a male that had emerged about 3 weeks beforehand from an overwintering nymph was observed mating with an overwintering female (recognised by the black damage mark on its hind femur) on the pohutukawa. This demonstrates that there is a possibility for the exchange of genetic material between the overlapping generations. On 20 November a fresh-looking ootheca was found on the pohutukawa, and it was most likely laid by that female.

Other Auckland records for 1983

At the beginning of August I asked colleagues at Mt Albert Research Centre to check for mantids in their gardens. Adults and nymphs were found in 8 widely separated localities in the suburbs of Milford, Ponsonby, Mt Eden, Mt Roskill, Mt Albert, Avondale, and Titirangi. Between 1 and 3 individuals were reported for each locality. Most were on shrubs in areas protected from the worst effects of strong winds and rain. Pesticides were seldom used in their gardens to control pests and diseases. It is clear from these reports that *Orthodera ministralis* was present in many localities in Auckland, and that the discovery of individuals surviving winter in my garden was not an isolated incident.

Miomantis caffra, only recently discovered in Auckland (Ramsay 1984), can also survive winter outdoors. Two females were recorded from Glen Eden in August and September, and in August a 1st instar nymph was seen in Mt Eden. One of the females has subsequently produced oothecae.

CONCLUSIONS

It is likely that adults and nymphs of *O. ministralis* regularly overwinter in Auckland in low numbers. Evidence for this view comes from 2 sources. First, there is a record of a moribund adult female found on a *Hebe* in the grounds of Mt Albert Research Centre on 10 September 1979; its survival was then regarded as exceptional, and it was thought that it may have been in a favourable habitat such as a glasshouse for much of the time. It is now thought that it survived the winter outdoors although the 1979 winter was wetter than average. Secondly, colleagues at Mt Albert Research Centre did not report the presence of mantids until they were asked to look for them. Some had noticed mantids around during the winter period, but had not realised the significance of their observations in relation to published information on the praying mantis life history.

The mantids survived outdoors in winters that were both wetter and drier than normal. Further observations are now needed to see if overwintering can occur every year in Auckland.

Finally, as mantid adults and nymphs can survive outdoors throughout the year in Auckland, it is likely that they will be found in winter in many areas of the Auckland and Northland region where there are suitable shrubby habitats. In an urban environment, it seems as if they are more likely to survive in gardens which are protected from strong winds and which are seldom, if at all, sprayed with pesticides.

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