ORIENTAL FRUIT MOTH IN NEW ZEALAND

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SUMMARY

Pheromone trapping shows that oriental fruit moth (*Cydia molesta*) now occurs in Auckland, Northland, Waikato, Bay of Plenty, Poverty Bay and Hawkes Bay. In Auckland moths may be collected from August to June, and there are four generations per season. Larvae cause severe fruit losses in Auckland home gardens but orchardists can achieve control through regular use of azinphos-methyl. A small trial showed that acephate could significantly reduce fruit damage in home gardens.

INTRODUCTION

Oriental fruit moth (OFM), a close relative of codling moth (*Cydia pomonella*), is a cosmopolitan pest of stone and pip fruits which was first recorded in New Zealand in 1976 (Cox and Dale 1977). Since then the Ministry of Agriculture and Fisheries has monitored the distribution of OFM in New Zealand and undertaken an intensive survey in the Auckland area. This paper reports the results of these surveys with reference to the distribution, biology, economic importance and control of OFM.

METHODS

Some details of the biology of OFM in Auckland and its distribution throughout New Zealand were determined by using pheromone traps baited with a synthetic sex pheromone mixture of (E)- and (Z)-8-dodecenyl acetate. The traps, each containing a rubber capsule loaded with 0.5 μ l of the pheromone, were hung in stone or pip fruit trees at a height of 1-1.5 m from the ground, following the method of Gentry *et al* (1974). Commercially made Pherocon traps were used wherever possible; when they were not available it was found that equally effective traps could be made by stapling two metal pie plates together, coating the inside of one of them with "Tack-trap", and leaving a gap of 2 cm between them for moths to enter.

In the Auckland survey 23 traps were used in 12 home gardens which were known to have had problems with OFM. Twenty-two further traps were placed in 10 commercial orchards to the north and west of Auckland city. The traps, which were in operation from January 1980 to May 1982, were checked for OFM once a week. Pheromone capsules were replaced with fresh ones every 6 weeks. The distribution of OFM in other parts of the country has been monitored since 1976 by small numbers of pheromone traps, usually in February when maximum moth numbers could be expected.

Collections of larvae were made from damaged shoots of nectarines and peaches, and from pip and stone fruits in Auckland home gardens. To assess fruit losses due to OFM and also to find a satisfactory method of control in home gardens, total numbers of damaged and undamaged fruits of 22 peach trees and 17 apple trees were counted. Seventeen of the peach trees and 11 of the apple trees were sprayed at fortnightly intervals, from the end of November 1981 to the end of March 1982, with acephate at a rate of 4 ml of 19.5% formulated product per litre. The trees were sprayed to run-off with a small home garden "Cambrian" spray unit. All larvae collected from fruit were identified in the laboratory and numbers of OFM and codling moth were recorded.

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RESULTS AND DISCUSSION

Distribution in New Zealand

The first record of OFM established in New Zealand was a larva from a home garden in Papatoetoe, South Auckland, in March 1976 (Cox and Dale 1977). Subsequent pheromone trapping revealed that the moth was also present on the North Shore of Auckland in 1976 and it has since spread to Albany, Paeroa, Pukekohe and Hamilton (1977); Whangarei, Te Kuiti and Bay of Plenty (1978); Kerikeri and Taupo (1980); Kaitia and Dargaville (1981); and now Gisborne, Hastings and Napier (1982). The first record on a commercial orchard was at Albany in March 1977.

OFM is extremely abundant in Auckland home gardens where trap catches of over 50 per week have often been attained during peak flight periods (December to March). It is far less common in commercial orchards, even those in built up areas, although catches exceeding 20 moths per trap per week have been found on a few occasions where orchardists have neglected their spray programmes. It is still quite scarce in the orchards to the west of Auckland at Kumeu and Huapai, and has not yet been recorded in any commercial orchards more than 80 km from Auckland city. Away from Auckland the highest trap catches have been received from gardens in Gisborne (up to 10 per trap per week) and Te Kuiti (up to 8).

Fruit damage attributable to OFM has been found in all districts where pheromone trapping has recorded its presence although the Hawkes Bay record of fruit damage is based on a single, mutilated larva from Hastings.

The fact that OFM has only been found outside of the Auckland area in cities and towns suggests that the present distribution has been strongly aided by human activities. The moth is known to fly only short distances (Omelyuta 1974) and physical barriers such as the Urewera National Park, Kaingaroa Forest and the Ahimanawa Range, which have few host plants, should have prevented a natural spread to Gisborne and Hawkes Bay areas. The most likely way for the moth to extend its range is through the transport of home garden fruit, particularly Golden Queen peaches, nectarines, and late season apples and pears. Mature larvae emerging from such fruit are very mobile and would easily find overwintering sites in or around a house. Transport of overwintering larvae on nursery stocks is also possible though a much less likely method of distribution as there are few overwintering sites on young trees, and nurserymen have been made aware of the pest almost since its discovery.

Biology

The adult is a small (5-6 mm), greyish, nocturnal moth which has been caught in pheromone traps in every month except July (earliest record 21.8.81; latest record 5.6.81). Trap results in Auckland have shown that three main flight periods occur in December/January; February; and March. Larvae resulting from the March flight overwinter in the prepupal stage and give rise to a generation which flies from August to November. It is now considered, therefore, that there are four generations per year and not five as previously recorded (Baker 1982). The long duration of moth emergence observed throughout the spring has also been reported in California (Summers 1966).

Although adult emergence may commence when the temperature reaches 10° (Omelyuta 1976) oviposition does not occur below 15° (Omelyuta 1976, Summers 1966). These factors are responsible for the appearance of some moths in late winter and for the fact that the first generation flight is not seen until December. It has also been estimated from the Auckland pheromone trap data and prevailing day-degrees that a larva emerging from an egg in September could not produce a moth before December (D. Russell, pers comm). Thus even moths caught in late November are considered to have come from overwintering larvae.

Eggs, which are small white discs, are laid singly on leaves or sometimes in groups of two or three on buds, twigs or fruit. Larvae are white or pink with a dark head and microscopic examination is needed to distinguish OFM from codling moth at this stage (Peterson 1967). First and second generation larvae feed in the new shoots of stone fruit, boring out the stems for a short distance and killing the terminal buds. A single

larva will feed on three different shoots before pupating in a cocoon on the plant. The first sign of OFM infestation is the appearance of wilting terminal leaves of stone fruit during the spring (Baker and Dale 1980). Second to fourth generation larvae will be found increasingly in fruit, firstly in nectarines and peaches and later in apples, pears and quinces. Such larvae will often pupate on the fruit. Shoot infestations of mature trees are not seen after January but young nursery trees may be attacked throughout the season. In New Zealand OFM has been noticed feeding in the shoots of almond, nectarine and peach trees and in the fruits of apple, nectarine, peach, pear and quince. However, literature from other countries indicates that any stone or pip fruit will serve as host, including ornamental varieties (e.g. Summers 1966).

During the summer the development time from egg to moth is only 25-30 days. This can result in very high numbers of moths appearing in February and March (the highest single trap count in Auckland is 268 per week in March 1980) and devastating damage to late season fruit. Larvae resulting from the final moth flight mature in the fruit and then emerge to find a suitable overwintering site. This is often a crevice in the tree trunk or in the litter beneath the tree. The winter is passed in a silken cocoon and pupation occurs in the spring. Overwintering larvae are hardy, being able to withstand temperatures of -10° (Garcia and Touza 1969), and therefore there is probably no district in New Zealand which is climatically unsuitable for establishment of OFM.

Economic importance and control

Like codling moth, OFM attacks can result in very severe crop losses if control measures are not undertaken. In Auckland home gardens 100% destruction of Golden Queen peaches has been seen, and losses of late season apples and pears due to combined codling moth/OFM attacks have also reached 100% on some trees. Early varieties are not damaged so severely but 20-30% loss of nectarines and mid-season peaches could be expected in unprotected crops.

A small trial carried out in Auckland during the 1981/2 season showed that such severe losses can be avoided, even in home gardens where the range of chemicals and equipment is limited. The percentage of late season fruit damaged by OFM and codling moth was significantly reduced by application of acephate (Table 1), which is now available to home gardeners in a liquid formulation.

TABLE 1: Percentages of fruit damaged by OFM and codling moth.

	No. trees	% damage attributable to		Total
		OFM	Codling moth	
Peaches				
sprayed	17	11 $\pm$ 4	0	11 $\pm$ 4
unsprayed	5	61 $\pm$ 33	0	61 $\pm$ 33
Apples				
sprayed	11	1 $\pm$ 2	1 $\pm$ 2	2 $\pm$ 3
unsprayed	6	36 $\pm$ 15	34 $\pm$ 15	70 $\pm$ 27

In commercial orchards the economic importance of OFM is likely to be felt in increased spraying costs. Where OFM is abundant, as in the outskirts of Auckland city, regular spraying of stone and pip fruit is essential. In the 1981/2 season one grower, who applied only a single azinphos-methyl spray during January, suffered a 10% crop loss in Golden Queen peaches. Other potentially dangerous outbreaks of OFM in commercial orchards have been noticed (Baker 1982).

OFM is prevalent in some Auckland nurseries and this is a source of concern to growers purchasing new stone fruit stocks. Complete spray programmes throughout the season may be needed to eliminate OFM from nurseries and as a further precaution to delay the spread of OFM to other districts, fumigation or dipping of nursery stocks in a long lasting insecticide is recommended.

TABLE 2: Numbers of larvae collected from apples in Auckland home gardens 1980-1982.

Month	Total No. of OFM	larvae collected Codling moth	OFM as % of Total
January	14	117	11
February	121	174	41
March	235	233	50
April	146	24	86
May	18	0	100
	534	548	49

Collections of larvae from apples show that OFM is as abundant as codling moth in Auckland home gardens. The importance of OFM in apples, relative to codling moth, increases as the season progresses (Table 2) and is therefore very significant in late varieties such as Golden Delicious and Granny Smith.

No control trials have been reported in orchards in New Zealand. It is known that many insecticides will give satisfactory control including those most likely to be used in New Zealand such as azinphos-methyl, carbaryl and dichlorvos (e.g. Caltagirone and Barnett 1966, Reichart and Bodor 1967, Rings 1970, Pree 1979). In Auckland orchards no outbreaks of OFM have been reported where growers have used a regular programme of azinphos-methyl on peaches and apples. Spraying with azinphos-methyl needs to commence as soon after petal fall as practicable and continue until 2-3 weeks before harvest. If a close-to-harvest spray is considered desirable carbaryl could be applied.

CONCLUSIONS

OFM is known to occur in the North Island as far south as Hawkes Bay. It appears likely that it will continue to spread throughout New Zealand.

Pheromone trapping has successfully revealed details of the distribution of OFM in New Zealand.

Orchards in areas where OFM is known to occur need to be sprayed with azinphos-methyl from petal fall of stone fruit onwards.

Stone fruit in nurseries need protection throughout the season and stocks should be dipped or fumigated before being shipped to areas where OFM is not present.

Control in home gardens can be achieved by regular use of acephate.

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