A SURVEY OF APPLE LEAFCURLING MIDGE (*DASYNEURA MALI*) IN THE NELSON DISTRICT

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ABSTRACT

A survey of 30 apple orchards was conducted on the Waimea Plains, Nelson, to determine the frequency and extent of apple leafcurling midge (ALM) (*Dasyneura mali* Diptera:Cecidomyiidae) infestations. Growers were questioned about pest control practices on their orchard and their opinion on the seriousness and importance of ALM. The percentage of leaves damaged per shoot by ALM was 21.2%, with a mean curling per leaf of 42.4%. The majority of growers ranked ALM as the most serious pest on their properties, with 63% perceiving ALM as a plant health problem. The implications of the findings from these surveys on the apple industry of New Zealand are discussed briefly.

Keywords: apple, apple leafcurling midge, *Dasyneura mali*, leaf damage

INTRODUCTION

The apple leafcurling midge (ALM) (*Dasyneura mali*) is now an established pest of apple trees in New Zealand. This insect was thought to have been introduced into this country accidentally on East Malling IX apple stock from the Netherlands (Morrison 1953).The larvae feed inside leaf rolls formed when developing leaves fail to unfold due to ALM infestation. Severely affected leaves may drop prematurely, potentially stunting shoot growth, especially on young trees. Contamination of fruit with pupal cocoons may occur when mature larvae, exiting leaf rolls, are caught in the stalk or calyx end of the fruit as they try to reach the soil for pupation (Lowe 1993).

In the past ALM was generally regarded as a secondary pest, with the conventional insecticide programme used against leafrollers and codling moth also providing adequate control of ALM. However, the incidence of ALM in commercial apples has been increasing in the last few seasons in most apple growing districts (Wilton 1994a, 1994b).This observation was further confirmed by Tomkins *et al.* (1994) who found over a quarter of apple trees sampled from 30 Waikato orchard blocks had 100% shoot damage.

The following paper reports on an investigation conducted on ALM populations on the Waimea Plains, Nelson during the summer of 1994/95.

METHODS

Shoot and leaf sampling

Thirty apple orchard blocks of various ages were examined from the Waimea Plains, Nelson, during December 1994 and January 1995. The main apple cultivars surveyed were 'Royal Gala' and 'Braeburn'. Orchard blocks were randomly selected from a list of 150 registered growers supplied by ENZA New Zealand (International). From each block, ten trees were randomly selected from which ten shoots (1-year-old wood) were sampled. Each shoot was chosen haphazardly from the tree with no regard for length or height. The shoot length and number of apple leaves curled per shoot were noted. The extent of curling of each leaf (ie. the percentage of the leaf rolled by ALM) was estimated by eye and recorded. From this information the percentage of leaves damaged per shoot, percentage mean curling of infested leaves and the leaf area lost due to ALM damage were determined for each block.

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Grower survey

A questionnaire was completed by interviewing 30 growers, during December 1994 and January 1995. Each grower was asked to answer a variety of questions relating to their property and pest control practices, including their opinion on the seriousness and importance of ALM. The number of growers using diazinon in this survey was compared to that found in an earlier study by June (1994).

RESULTS

Shoot and leaf sampling

From the thirty orchard blocks examined the percentage of leaves damaged per shoot by ALM ranged from 9.8 to 41.7% (Table 1). The grand mean for all orchard blocks sampled was 21.2% (±1.2). A large variation in the mean area curled per leaf was found between orchard blocks. The lowest level of leaf curling was 26.3% compared to the highest at 61.5%. The grand mean of all orchard blocks was 42.4% (±1.5). The orchard block with the lowest incidence of ALM lost 3% of the shoot's leaf area. By contrast, the orchard block with the highest incidence of ALM lost up to 16% (Table 1). Overall, the grand mean for leaf area lost was 9.1% (±0.7).

TABLE 1: Percentage of leaves damaged per shoot by apple leafcurling midge, the extent of leafcurling per apple leaf and the percentage of leaf area lost by the infestation.

Orchard	% of leaves damaged	Rank[1]	% curling/ leaf	Rank[1]	% of leaf area lost/shoot	Rank[1]
1	41.7	30	37.5	9	15.6	29
2	19.9	15	28.6	2	5.7	4
3	17.4	11	34.2	4	6.0	7
4	19.3	14	35.8	8	6.9	11
5	18.9	12	26.3	1	5.0	3
6	12.1	2	34.4	5	4.2	2
7	25.4	22	61.5	30	15.6	28
8	14.3	5	40.4	13	5.8	5
9	20.1	17	45.7	20	9.2	17
10	25.5	23	57.8	29	14.7	27
11	17.0	9	35.0	6	6.0	6
12	20.0	16	35.1	7	7.0	12
13	15.1	6	46.9	23	7.1	13
14	17.2	10	41.9	16	7.2	14
15	9.8	1	30.6	3	3.0	1
16	28.0	26	43.0	3	12.0	23
17	18.9	13	41.9	17	7.9	16
18	15.7	7	39.0	11	6.1	8
19	25.8	24	41.5	14	10.7	22
20	27.3	25	37.6	10	10.3	20
21	23.6	21	40.3	12	9.5	18
22	22.3	19	46.8	22	10.4	21
23	23.3	20	55.3	28	12.9	24
24	13.9	4	44.3	18	6.2	9
25	16.7	8	45.9	21	7.7	15
26	30.2	28	47.7	24	14.4	26
27	22.1	18	44.6	19	9.8	19
28	13.7	3	50.0	26	6.8	10
29	30.9	29	53.9	27	16.7	30
30	28.9	27	48.4	25	14.0	25

[1] Ranks the columns values from the lowest(1) to the highest (30).

Grower survey

The analysis of the questionnaire responses showed that 50% of growers either ranked ALM alone or first equal with mites as the most serious pest on their properties (Table 2). In comparison, fewer growers ranked leafroller and mites alone (ie., 23% and 17% respectively) as the most serious pest on their property. Ten percent of growers classed all pests of equal seriousness on their property (Table 2).

TABLE 2: Ranking of the most serious arthropod pest, perception of the importance of apple leafcurling midge and the use of diazinon from 1992 to 1995 by growers participating in a survey.

	Number of growers	Percentage of growers
Ranking of pest species		
ALM	10	33
Leafroller	7	23
Mites	5	17
ALM/Mites[1]	5	17
All equal[2]	3	10
Importance of ALM		
Reduces yield	3	10
Quarantine pest	6	20
Affects plant health	19	63
All equal[2]	2	7
Use of diazinon		
1992[3]	NA	8.2
1993[3]	NA	9.4
1994[3]	NA	12.6
1995	24	80.0

[1]Both pest of equal seriousness
[2]All three pests/categories of equal seriousness/importance
[3]Data from June (1994).
NA Information not available

When growers were asked to state whether they considered ALM was more important as a plant health problem, a quarantine risk or a cause of reduced yield. The majority (63%) of growers ranked ALM as a plant health problem (Table 2). Only two growers classed all three categories of equal importance.

Growers were asked to state whether they had used or were intending to use diazinon at any time during the current season specifically to control ALM. A survey conducted by June (1994) showed that an increasing percentage of Nelson growers questioned were using diazinon for ALM control (Table 2). This current survey showed a dramatic increase in the percentage of growers that had used or were intending to use diazinon (Table 2).

DISCUSSION

The percentage of leaves damaged per shoot (9-40%) by ALM found in this investigation was similar to that found in the Waikato by Tomkins *et al.* (1994). In that investigation 2-30% of leaves per apple shoot were found to be damaged by ALM. The severity of ALM damage in Nelson therefore appears to be comparable to that found in other major apple growing areas of New Zealand.

Although up to 16% of the shoot's leaf area may be lost due to ALM injury in some blocks, an effect on yield of mature trees in the short term would be unlikely. This is because fruit have a priority over any photosynthates produced, and in commercial apple production there is usually an excess of foliage available compared to that required for fruit production, especially following crop thinning (R.N. Rowe, pers.

comm.). The impact of ALM injury on young non bearing trees and grafted stock, however, could be considerable. The more leaf area that is available, the greater the potential for photosynthates production and thus potential tree growth. ALM damage could therefore result in tree stunting or the failure of graft extension or success.

The high percentage of growers ranking ALM as their most serious pest is in contrast to a survey conducted in Hawkes Bay in 1992 (Stewart *et al.* 1993). In that investigation 50 growers were asked which pest they considered troublesome (ie., control level not to their satisfaction) in the previous five seasons (87/88-91/92). Only 4% of growers mentioned ALM, with European red mite and mealy bug being the main concerns (34 and 36% respectively). Wilton (1994a) in his review of the 1993/94 season classed it 'as the one where ALM got out of control', although no plausible explanation of the cause of this problem was provided. ALM in the past few seasons would, therefore, appear to have increased dramatically and it is now rated as one of the main pest concerns of many commercial apple growers. This view is clearly supported by the results of this current survey in Nelson.

The high proportion of growers ranking ALM as a plant health problem is possibly due to the very visual nature of ALM damage on apple shoots, especially on young trees and recently grafted plants. Those growers who classed ALM as quarantine risk either may have experienced incidences where ALM was present on fruit during packing or have realised the implications of this pest for exports with a current nil tolerance level as in Japan or a 5% tolerance level as in Russia, Taiwan, Tahiti and Cook Islands.

The high percentage of growers using diazinon found in this investigation is similar to that determined by Tomkins *et al.* (1994) where 74% of orchard blocks in the Waikato district had been treated with one or more applications of diazinon by the end of the 1993/94 season.

The implications of these findings for the New Zealand apple industry are significant. The recent increase in ALM appears to be widespread and not isolated to one region or province. This is despite an increase in the use of insecticides specifically to control this pest. These factors in conjunction with the clear concern shown by growers towards ALM and its significance as a quarantine problem, highlights the current importance of this pest and the economic impact it is already having. Further research on pest phenology, spray timing, effectiveness of insecticides and cultural practices will need to be conducted if continuing problems with ALM in subsequent seasons are to be avoided.

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