BIOLOGY OF POTATO MIRID AND AUSTRALIAN CROP MIRID ON ASPARAGUS

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SUMMARY

Populations of potato mirid *(Calocoris norvegicus)* and Australian crop mirid *(Sidnia kinbergi)* (Hemiptera:Miridae) were observed in asparagus *(Asparagus officinalis)* in Waikato. Potato mirid was univoltine and bred successfully on asparagus. Hatching of eggs coincided with the harvest period leading to possible contamination of export produce by early nymphal instars. There were two or more generations of Australian crop mirid, but it occurred largely as adults on asparagus fern. Removal or breakdown of crop residues during winter, and weed control in crops and adjacent verges are important control measures.

INTRODUCTION

The potato mirid (PM) and Australian crop mirid (ACM) were identified as species of potential significance to asparagus growers in Waikato because of their widespread occurrence on crops (Watson and Townsend 1981). Damage in asparagus by PM had earlier been recorded by Findlay (1975). In addition to foliar damage, contamination by nymphs of PM has caused the rejection of fresh asparagus exported from Waikato. Little has been published on the biology of either insect. Such information is a necessary prelude to determining pest status and development of appropriate controls.

In Europe, PM has minor pest status on brassicas (Hossfeld 1963), strawberries (Taksdal and Sorum 1971) and lucerne seed crops (Pelov and Shtereva 1961; Sedivy 1965). It was recorded in New Zealand in 1949 (Cumber 1953) and was considered of non-pest significance in pastures (Cumber 1959) and fodder crops (Eyles 1960) in the North Island. It has also been recorded from potatoes, beans, peas, dahlias, hops, Iceland poppies, rhubarb and various weeds (Findlay 1975; Ferro 1976; McFarlane *et al* 1981).

Australian crop mirid was first recorded in New Zealand affecting passionvines by Myers (1922). It occurred throughout the North Island on pasture (Cumber 1959) and was the most common Hemipteran taken on brassica fodder crops by Eyles (1960). Baker (1978) described damage and control in passionvines and strawberries and noted large numbers present on clovery verges adjacent to these crops. McFarlane *et al* (1981) considered forage legumes including *Trifolium* spp and white sweet clover *(Melitotus alba)* to be preferred breeding hosts, although nymphs were found on wireweed *(Polygonum aviculare)*, fathen *(Chenopodium album)* and thistles *(Cirsium* spp).

Both PM and ACM were considered as important pests of lucerne *(Medicago sativa)* and lotus *(Lotus corniculatus)* seed crops in the South Island (McFarlane 1970; McFarlane and Pottinger 1976; McFarlane *et al* 1981). Development of an integrated control programme for mirids in forage legume seed crops has been initiated (Donovan 1981; Wightman and Whitford 1982).

Mirids are characterised generally by over-wintering in the egg stage, development through five nymphal instars, and a mobile winged adult. Oviposition is by insertion of eggs into herbaceous or woody tissues of plants. Population of PM and ACM in Waikato asparagus were monitored during the 1981/82 growing season to determine their life history and biology on asparagus. The results are reported in this paper.

METHODS

A monitoring programme using sticky traps and sweep net sampling was undertaken on asparagus sites monitored previously by Watson and Townsend (1981). Sticky traps were of 25.5 cm acetate sheeting, coated with "Stikem Special", wrapped around yellow painted, 10 cm diameter, drainpipe. The traps were mounted 1.5 m above ground level in lines of five traps at 5 m spacing in asparagus crops. The acetate sheets were replaced every 2 weeks. Sweep net sampling involved sweeping the fern for a 20-30 second period with a net of 25 cm diameter. Quantitative sampling was not possible because of the variety in fern height and density.

Random spear samples were taken during the harvest period and examined for the presence of insects. Samples of at least 50 asparagus stems, covering all ages, were taken in late January and assessed for mirid oviposition. This involved the microscopic examination of stems and branches for oviposition sites which can be mistaken for lentice, fungal lesions or abrasions on the stems. Weeds in asparagus were also examined for the presence of mirid eggs. Both weeds and asparagus were re-sampled in May on one site.

Life history studies were largely conducted at the MAF Horticultural Research Area, Rukuhia. This included regular sampling and examination of individuals to determine age structure. Females were dissected to determine ovarian status. Damage attributed to mirids (Findlay 1975; Watson and Towsend 1981) was confirmed by confining different densities of mirids under netting on freshly growing foliage.

RESULTS

Potato mirid

The life cycle of PM in asparagus is represented in Fig. 1. Emergence of first instar nymphs from the overwintering eggs commenced early to mid-October and continued until late November. Observations in pasture indicated continued emergence from eggs until late December. There were five nymphal instars with body lengths ranging from 1.3-5.0 mm (Fig. 1). The 1st and 2nd instars lacked wingbuds but were differentiated by the darkened thoracic sclerites of the former. Wingbuds were visible under magnification in the 3rd instar, with the fore and hind wingbuds not yet over-lapping. On the 4th instar wingbuds over-lapped and extended to the posterior margin of the 1st abdominal segment, while on the 5th instar these extended to the posterior margin of the 3rd abdominal segment. Successive nymphal instars appeared at regular intervals during spring with the first adults appearing in early November. In screen-house rearing on potato, egg hatch to adult was completed in 4 weeks. No immature stages were seen after the last 5th instars in late January, indicating that PM is univoltine.

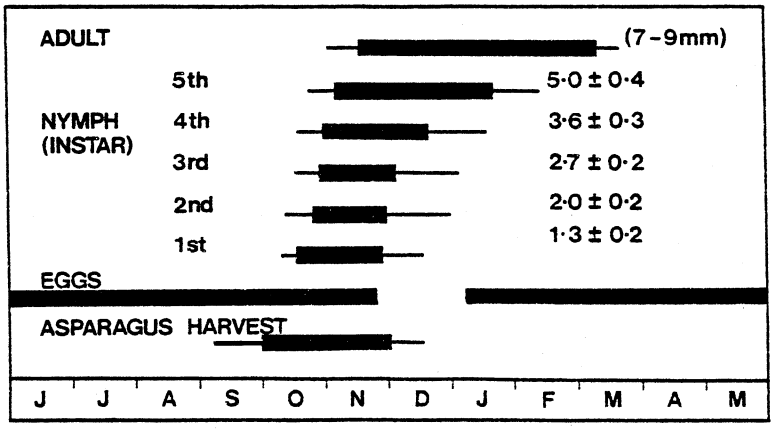

Fig. 1: Potato Mirid lifecycle in asparagus and lengths of nymphal instars (mm ± SE, tip of rostrum to tip abdomen).

Adults were described by Findlay (1975). They were found on asparagus from mid November. Peak numbers on sticky traps occurred in late December/early January (Fig. 2), thereafter numbers declined to virtually disappear by mid March.

Maturing eggs were found in dissected females within 2 weeks of emergence although no egg laying was observed in the field or laboratory until late December. Recruitment of immature females, those containing no mature eggs, into the population reached a peak in the latter half of December and declined to zero in early February (Table 1). There was an apparent rapid disappearance of females after the completion of egg laying as no aged females were found without eggs. A marked increase in the male/female ratio occurred in the later part of the season.

TABLE 1: Fecundity of PM and ACM females dissected between November 1981 and March 1982.

Sampling period	No. females dissected	No. females within fecundity groups 0	1-20	21-40	41-60	60-80	Fecundity (no eggs/egg bearing female) mean ± SE	Range
Potato mirid								
1-14 Dec	28	10	3	8	5	2	35.2 ± 16.7	9-60
15-28 Dec	31	16	3	7	4	1	31.8 ± 18.1	1-74
29 Dec-11 Jan	19	4	3	11	1	0	26.3 ± 9.0	11-40
12-25 Jan	29	2	8	15	3	1	27.8 ± 14.4	4-63
26 Jan-11 Feb	9	0	2	6	1	0	25.2 ± 10.9	4-40
Australian crop mirid								
25 Nov-17 Dec	17	0	10	7	0	0	17.2 ± 6.7	6-31
5-29 Jan	29	5	15	9	0	0	17.7 ± 8.4	7-37
3 Feb-22 Mar	14	0	10	4	0	0	13.5 ± 9.0	1-29

Fecundity, as indicated by numbers of mature eggs in the oviduct, averaged about 30 eggs/female, while one individual contained 74 eggs. There was little overall variation in egg numbers in females during the season (Table 1).

Oviposition occurred on the upper main stem and on branchlets down to 1 mm in diameter. Only freshly expanding foliage, where feeding was also concentrated, was selected for oviposition. The 1.3-1.5 mm long, slightly curved eggs were inserted at an angle into the plant tissue. The only visible external sign of oviposition was a small slit in the epidermis of the frond. Where large numbers of eggs were inserted, the soft tissue tended to die back leaving a brownish area dotted with insertion scars. Smaller egg groups or even single eggs were deposited along the small branches. Eggs showed no sign of physiological development until late autumn when the outer end became markedly darker in colour.

There were large differences in numbers of eggs per frond on different sites in late January (Table 2). These reflect adult populations in both the current and previous seasons. On Site 1, asparagus fern was mulched on the surface, leaving a residue of trash into the next harvest period. High egg numbers therefore carried through from the previous season. Weekly sprays of dichlorvos applied by the grower during October 1981 gave a short term reduction in nymphal numbers but had little effect on subsequent adult numbers. Higher numbers of eggs on site 1A compared with 1B were attributable to the proximity of an adjacent verge of rank grass, weeds and clover. This provided an additional infestation source and a refuge for mirids during the harvest.Site 2 was top-worked during the winter resulting in almost complete breakdown and incorporation of trash before spring. It was however, adjacent to a verge of rank clover and weed growth and produced a moderate adult population. Egg numbers on site 2 were lower than anticipated due to the crop being shut up early and therefore a high proportion of stems were unsuitable for mirid oviposition. On site 3 winter top-working combined with cultivation of the verges produced very low 1981/82 adult and egg

populations. On site 4, the small experimental block at Rukuhia, fern was maintained intact over winter to encourage mirid infestations for life history work. Intensive sampling of PM would have significantly reduced the 1981/82 breeding populations, and hence egg numbers in January.

Eggs were recovered from only two weed species, Australian fireweed *(Senecio bipinnatisectus)* and docks *(Rumex obtusifolius)*. The relative absence of egg laying and feeding on alternative hosts indicate that asparagus is a favoured host for the insect.

Damage to asparagus caused by PM adult feeding, as described by Findlay (1975), was significant only on site 1. This was the only site where high adult numbers coincided with the period of major fern growth at the end of the harvest.

TABLE 2: Seasonal catches of adult PM and ACM on sticky traps, and egg numbers on asparagus fern, January 1982.

Site	Adult No/sticky trap				Egg Numbers			
	1980/81*		1981/82		mean no./frond		Highest no./frond	
	PM	ACM	PM	ACM	PM	ACM	PM	ACM
1A	51.8	15.4	57.4	4.2	99.0	0.29	790	8
1B	-	-	-	-	61.5	0.02	480	1
2	1.8	16.8	22.4	22.8	2.3	2.24	65	22
3	0.1	11.2	4.6	6.1	0.0	0.17	0	7
4	-	-	55.3	8.9	21.3	0.00	528	0

* 1980/81 trapping period began in late December, 1981/82 trapping period began in mid November.

Australian crop mirid

Adult ACM are smaller than PM, averaging 4 mm body length. Colour varied markedly from a pale green to brown or brick-red. Adults were first found on asparagus during November. Nymphs occurred only once on spear samples during spring, and were rarely found on asparagus fern. Adults either flew into asparagus from surrounding pasture and verge growth or remained as nymphs on more favourable weed growth within the asparagus before moving onto the fern as adults. There was no marked seasonal peak in adult numbers on sticky traps; populations declined in late March but continued onto May (Fig. 2).

Dissected females, taken from asparagus, contained fewer eggs than PM (Table 1) and the eggs were found in lower numbers on asparagus (Table 2). The stems of a number of weeds were equally or more favoured for oviposition by ACM. These included Californian thistle *(Cirsium arvense)*, red root *(Amaranthus powellii)*, black nightshade *(Solanum nigrum)*, prostrate amaranth *(A. deflexus)*, willow herb *(Epilobium erectum)*, clammy goosefoot *(Chenopodium pumilo)* and willow weed *(Polygonum persicaria)*. The pale yellow 0.9 mm long curved egg has a circular or catseye shaped cap which protrudes above the surface after insertion into the host. A proportion of the eggs had hatched before the January (40%) and May (55%) egg sampling. A further small proportion (2.5%) was parasitised by a chalcid *(Polynema* sp. Mymaridae).

Nymphs are distinguishable from those of PM by their smaller and stouter appearance. Body lengths for instars 1-5 were 0.7-0.9; 1.3-1.7; 1.7-2.2; 2.2-2.7; 2.5-3.5 mm. Nymphal antennae were banded alternately red and pale green compared with a uniformly green colour in PM. Although nymphs were not present on asparagus they were abundant on several weed species. All stages from 1st instar to adult were found on prostrate amaranth in mid March, and later instar nymphs were also present during April.

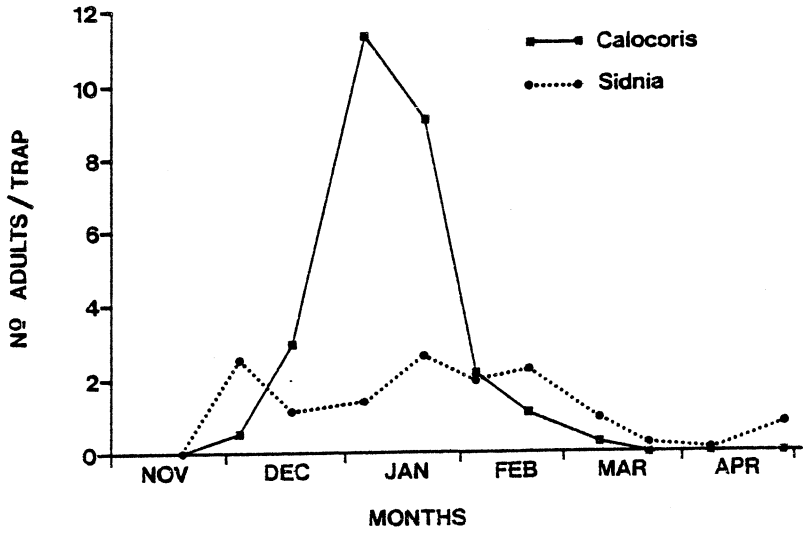

Fig. 2: Adult Hemiptera on sticky traps in Waikato 1981/82.

DISCUSSION AND CONCLUSIONS

Asparagus is a favoured host for PM, which can successfully breed on the crop. Nymphs emerge through the harvest period and constitiute a quarantine risk on export produce. Peak adult numbers coincided with the conclusion of harvesting, when there was an abundance of fresh growth for feeding with subsequent foliar damage and oviposition. Large numbers of eggs laid on asparagus foliage can perpetuate the infestion into the following season if measures are not adopted to reduce egg populations over the winter.

As egg hatching occurs over a protracted period in spring, it is unlikely that successful control will be obtained from using transient chemicals during the harvest period. Dichlorvos is the only chemical presently registered for use in asparagus during this period. Site 1 (Table 2) remained heavily infested with PM in spite of a short term reduction in numbers after each application of dichlorvos. Should the use of chemicals become necessary, it is likely that an application shortly after picking, and immediately prior to egg laying (Fig. 1), would give an effective reduction in the following season.

Asparagus was less favoured by ACM, which had a wider range of alternative hosts. Nymphal stages were not generally found on asparagus. The adults are smaller than potato mirids, but their feeding can produce a similar stunting effect on foliage. The effects of ACM feeding on foliage produced during the later summer and autumn is probably less important than the damage caused by PM immediately following the cessation of harvesting.

This study showed that numbers of both pests can be effectively contained or reduced with appropriate management of asparagus crops. Infestations of PM can be reduced by the removal of stubble carrying the eggs, or by its breakdown and incorporation during winter top-working. Weed control in asparagus would reduce breeding by ACM. Control of rank weed and clover growth around the verges of asparagus stands would remove a source of infestation of both pests.

Such measures should eliminate the requirement for insecticidal controls against mirids. Application of pesticides in the field will not reduce the requirement for stringent post-harvest inspection of export produce, and the need for reliable washing procedures for ensuring its freedom from contamination by quarantine pests. A large

fauna of predatory and parasitic invertebrates occurs in asparagus and undoubtedly contributes to the control of pests (Townsend unpublished). This fauna might not function as efficiently under insecticidal spray regimes.

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