INSECTS AFFECTING LUCERNE SEED PRODUCTION

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Summary

The geographic distribution, type of plant damage, and possible significance of a seed chalcid, six species of caterpillar, six species of bugs, and two species of thrips which reduce lucerne seed production in the South Island are discussed. At present these pests have less effect on lucerne seed production than the low level of pollination.

INTRODUCTION

Investigations into the role of insects in lucerne seed production made by Myers (1921), Timlin (Palmer-Jones and Forster 1958), and Avery (1963) in Marlborough concentrated on pests. The significance of pollination was examined in various New Zealand seed growing areas by Hadfield and Calder (1963) and Palmer-Jones and Forster (1965). This paper describes the results of surveys undertaken to determine the species of insects that affect lucerne seed production in the South Island.

METHODS

Between 1967 and 1976 30 lucerne fields in flower and 14 fields at the seed-pod stage of development were examined extensively between mid-January and early April. Eighteen fields were surveyed in Marlborough, 11 in Canterbury and two in Otago. All the fields were quantitatively sampled for herbage and litter fauna at flowering and prior to harvest, by taking 9-48 quadrats, 0.018 m² for litter fauna and 0.135, m² for the plant fauna. The number of stems per m², racemes per stem, pests per raceme or seed pod, and seed pods and flowers per raceme were recorded from the pre-harvest samples.

RESULTS

All the fields quantitatively sampled had high populations of stems without racemes (44.7%, range 26.4-63.5%). Many racemes lacked seed pods (38.6%, range 19.8-77.6%) or had only one pod (15.9%, range 9.1-20.2%). Only 12.2% of the 41 228 racemes examined had 6 or more pods (about 50% of the flowers on each raceme). It was estimated that about 15-20% of the flowers capable of setting pods actually produced pods. In addition many pods (54%, range 45-69%) were a third or less their full size due to self pollination. About 20-25% of the available seed was lost during harvest. The nine fields surveyed produced an average 212 kg/ha of seed, more than twice the national average. Failure to produce seed pods was largely due to a lack of sufficient pollinators.

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Geographic distribution of the pests

Of the 300 or so insect species found associated with lucerne in this survey, 15 appeared to be pests of lucerne seed fields in the South Island. These included, green vegetable bug (*Nezara viridula*), grey flatid hopper (*Septhena cinerea*), tomato fruitworm (*Helicoverpa armigera*), blue butterfly (*Zizera labradus*), silver Y moth (*Chrysodeixis eriosoma*), and winter moth (*Zermizinga indocilisaria*). The first two species were rare south of Christchurch. Winter moth which occurred throughout New Zealand was abundant in central and southern parts of the South Island. The other species occurred throughout the South Island but were more abundant to the north. The lucerne seed chalcid (*Bruchophagus roddi*) was collected in Otago and Canterbury, in addition to Marlborough and Nelson, where it previously has been recorded. The other pests which included thrips, caterpillars, and bugs occur throughout New Zealand.

Sucking pests

Thrips were the most numerous insect pests in flowering lucerne (Table 1). Estimated populations varied between 200-300/m² or one thrips/3-5 racemes. The commonest species was *Isothrips confusus*. Onion thrips (*Thrips tabaci*) dominated the thrips fauna in one crop. Thrips are the least conspicuous of the insects damaging lucerne flowers. Their feeding results in white areas with small black dots, a common type of damage. Thrips also cause abscission of flowers, blasting of seedheads, to a limited extent death of buds, and reduced flower and nectar production. The populations of thrips measured in the quantitative survey were too low to cause extensive damage.

TABLE 1: ABUNDANCE OF SUCKING PESTS IN LUCERNE SEED FIELDS

Species	Quantitative sampling		All sampling	
	No./m ² in fields with Flowers	Seed pods	% frequency in fields with Flowers	Seed pods
Pest thrips	30.6	0.02	100	17
Australian crop mirid	0.65	0.34	90	83
Potato bug	0.02	—	28	—
Miridae n. sp	—	—	17	8
Nysius	0.40	—	52	17
Brown shield bug	0.05	—	48	41
Green vegetable bug	—	—	—	17
Grey flatid hopper	—	0.09	45	58
Aphids	0.15	—	28	—

Most of the seven species of sucking bugs became more abundant as the lucerne flowered and set pods. Aphids (e.g. potato aphid, *Aulacorthum solani*) and the potato bug (*Calocoris norvegicus*) were more common from October-December prior to flowering. The Australian crop mirid (*Eurystylus australis*) with estimated populations of about 5-10/m² was the most abundant bug at flowering. Nysius (*Nysius huttoni*) was common in seed fields, but unlike the other species it only occurred in open patches on the ground. The Australian crop mirid, potato bug, Miridae n. sp, grey flatid hopper, nysius, green vegetable bug and brown shield bug (*Dictyotus caenosus*) all feed on developing racemes and/or seed pods. As a consequence, racemes attacked at early bud stage become blasted and light brown in colour, the seeds shrivel and assume a black or brown rather than the normal yellow colour. Blasted racemes do not

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produce seed pods. In some fields the potato bug, the Australian crop mirid, and possibly the new mirid species were abundant enough to prevent areas of lucerne from flowering. Because most of the damaged seed is discarded during heading and seed cleaning growers are unaware of the full extent of the losses due to sucking insects. Two small samples contained 44 and 47% bug-damaged seed respectively.

Chewing pests

Five species of caterpillars (Table 2) damaged lucerne fields, but despite their size they are not obvious because of their colour. The number of caterpillars collected in sampling was modest. Silver Y moth which periodically damages lucerne seed crops occurred at insignificant levels in the survey fields. The smallest caterpillars, of all species, feed on ovules while the larger caterpillars feed on buds, terminal shoots, flowers and developing pods. Australian leaf-roller (*Epiphyas postvittana*) caterpillars prevent pollination by tying leaves and racemes together for protection. In this survey only 0.05% of the racemes were affected by Australian leaf-roller and 0.1% of the seed pods were chewed by caterpillars. The authors have observed more severe field damage by winter moth, tomato fruitworm and Australian leaf-roller than was measured in this survey, but it is of a sporadic nature.

TABLE 2: ABUNDANCE OF CATERPILLARS IN LUCERNE SEED FIELDS

Species Relative	No. collected by all sampling methods in fields with Flowers	Seed pods
Tomato fruitworm*	100	0
Blue butterfly	26	8
Phrissogonus laticostatus	12	18
Winter moth	2	3
Australian leaf-roller	0	8

* Populations averaged 0.17/m²

The lucerne seed chalcid which completes most of its life within the seed is the only pest in New Zealand which feeds only on lucerne. Adults (mainly females) were collected in 8 of the 30 fields sampled in flower. The chalcid was present in all samples of seed 'seconds' examined and was present in seed pods in 8 of the 9 fields quantitatively sampled. Lucerne seed chalcids emerged from 3% of a seed sample taken from one of the survey fields. The female lays eggs in green seed pods at the withered flower stage. The grub develops within the seed pod and damage can only be detected after the adult has emerged and left a small hole in the seed and/or pod.

DISCUSSION AND CONCLUSIONS

This survey has revealed that sucking bugs such as the Australian crop mirid and potato bug may be serious pests of lucerne seed production. Caterpillars such as tomato fruitworm and winter moth sporadically cause severe damage, while the significance of other pests such as lucerne seed chalcid, brown shield bug and nysius is not clear. Experimental work should be initiated to establish the seasonal changes in populations, the extent of damage and the economics of controlling these insects.

Most species of caterpillars and some bugs considered in this survey were in New Zealand when Europeans first arrived. The lucerne

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seed chalcid and the Australian leaf-roller established accidentally prior to 1921. Since Myers (1921) examined lucerne seed fields Australian crop mirid, green vegetable bug, potato bug and the new mirid species have probably established here. Many important lucerne seed pests have not reached New Zealand e.g. *Helicoverpa punctigera* and *Etiella behrii* (both O. Lepidoptera) (Pottinger and Macfarlane 1967), *Lygus* spp and *Adelphocoris* spp (both O. Heteroptera) and blister beetles (*Epicauta* spp), (App and Manglitz 1972). Continued vigilance against accidental introduction of such pests is required.

The blue-green lucerne aphid (*Acyrtosiphum kondoi*), the meadow spittle bug (*Philaeus spumarius*), and sitona weevil (*Sitona humeralis*), which have all been recorded from the South Island for the first time in the past 12 months, and white-fringed weevil (*Graphognathus leucoloma*) could all adversely affect lucerne seed production.

The survey has shown that red clover thrips (*Haplothrips leucanthemi*) and the slender capsid (*Stenotus binotatus*) are not associated with lucerne seed crops as previously thought (Pottinger and Macfarlane 1967).

The greatest single factor limiting seed production in New Zealand is still the low level of pollination. In districts in the USA with adequate numbers of pollinating insects, average yields 10 times those in New Zealand are achieved. Entomology Division, DSIR, has introduced the lucerne leafcutter bee (*Megachile pacifica*) and the alkali bee (*Nomia melanderi*) from North America to improve lucerne pollination and is conducting research on their establishment, multiplication and management (Donovan 1975). In addition the senior author is working on factors which affect the large earth bumble bee (*Bombus terrestris*) as a pollinator of lucerne. These studies suggest higher and more consistent lucerne seed yields may be a distinct possibility.

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