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A PRELIMINARY EXAMINATION OF PESTS IN FODDER BEET IN CANTERBURY

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Summary

The insect fauna on beet (*Beta vulgaris*) was monitored throughout the growing season 1979-80 in Canterbury. Damage to the crop was noted and, when possible, the causative agent identified. Attempts to control aphid-borne virus by insecticide applications were only partly successful. The implications of virus in this crop are discussed.

INTRODUCTION

Beet represents one of the more promising potential sources of biomass feedstock for ethanol-based liquid fuel production in Canterbury. Accordingly, a multidisciplinary study has been conducted to examine the costs and performance of this crop in order to permit in-depth economic appraisal of its potential as an energy source. In view of the problems caused by aphid-borne diseases in European and North American beet crops it was felt necessary to conduct a preliminary examination of the impact of insects and insect-borne disease on the Canterbury crops. Very little was known of the effects of the cosmopolitan pest species on beet in New Zealand, while even less was known of the damage potential of the native insects.

This paper presents some of the findings of a preliminary study and discusses their implications.

METHOD

The experimental crop consisted of 8 x 40 m blocks of Dutch 'Monoblanc' fodder beet grown on border-dyked Templeton silt loam. The coated monogerm seed was drilled on 27.9.79 at a rate of 160,000 seeds/ha in rows 0.5 m apart. The seed bed had been prepared 2 weeks earlier and in view of its earlier history of cereal production was fertilised at a rate of 720 kg/ha with a 3:2:1 mixture of boron super, calcium ammonium nitrate and potassium chloride.

Within each of the eight blocks were two 3 x 5 m plots which were randomly designated as protected or unprotected. The protected plots were treated each week from 6.11.79 with the equivalent of 62 g demeton-S-methyl in 100 litres water, applied weekly by knapsack sprayer as a drenching spray to obtain maximum protection against aphids and other susceptible insects. Also within each block were four 1 x 1.5 m plots which were used to assess seedling survival.

Two pitfall traps of 105 mm diameter were installed in each block and 600 mm high wind-vane traps were installed in two blocks.

RESULTS AND DISCUSSION

Table 1 is a taxonomic summary of the arthropod fauna collected in the beet crop between October 1979 and May 1980. Obviously many of the species listed were not detrimental to the crop and some may have survived on volunteer wheat plants (e.g. Argentine stem weevil) within the trial plots.

However, a small number of species warrant further attention, including several not recorded in the traps, particularly if it is planned to grow the crop in large blocks on a tight rotational basis.

After seedling emergence in early October considerable damage was incurred by sky-larks (*Alauda arvensis*) which nipped off 10% of the beet seedling emerging cotyledons. Later greasy cutworm (*Agrotis ipsilon ansituma*) was observed to be

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TABLE 1: Monthly insect trap results

COMMON NAME	SCIENTIFIC NAME	PITFALL TRAPS (16)						WIND VANE TRAPS (2)									
		Oct	Nov	Dec	Jan	Feb	Mar	April	May	Oct	Nov	Dec	Jan	Feb	Mar	April	May
spiders	various	many	96	153	318	204	92	57	123					2	1	1	
lucerne fleas	<u>Smiththrus viridis</u>	69	4	12													
springtails	various	8	11	16													
ground beetles	Carabidae spp	22	8	7	5	1	38	17	14	10	2	1	8		5	2	3
rove beetles	Staphylinidae spp	9	1	3	59	49				5	1						
dung beetles	Scarabaeidae spp			2	1	4				6							
click beetles	Costelidae spp			5	6		2	1							1		
leaf beetles	<u>Chrysomelidae</u>			5													
ladybirds	Coccinellidae spp	29	12	109	117	206	38	68	77	1	5	34	12	1	2	4	1
fungus beetles	Lathrididae spp	38	27	88	151	22	4	9	6	11	9	4	9	3	1		
Argentine stem weevils	Hyperodes bonariensis	64	24	37							6	2					
gorse weevils	Cyrtoloniidae spp	1	1		1		2	18	8	2		1					
Sitona weevils	<u>Sitona humeralis</u>				2	8	38										
Victoria weevils	<u>Desiantha diversipes</u>																
crane flies	<u>Tipulidae</u> spp				13	27	56	77	71								1
flies	various	258	765	617	675	337	157	133	299	71	28	65	27	14	16	10	14
leaf hoppers	Cicadellidae spp				1	18	6	14	10								
aphids	Aphididae spp	30	182	285	18	4	3	10	15	24	74	40	2		1	1	1
potato mirids	<u>Calocoris norwegicus</u>				3							3	7				
wheat bugs	<u>Nysius huttoni</u>	32	67	62	481	76		1	2	50	12	54	35	10	4		
green vegetable bugs	<u>Nezara viridula</u>																
caterpillars	various		2	8	2		2	4									
moths	"	3	2	2	1		1			2			1				2
centipedes	various		16	65	112	54	19	85	44								
Tasmanian lacewings	<u>Micromus tasmaniae</u>			44	7	23	5	2									
small field crickets	Gryllidae spp	1	1										5	5			

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destructive to 4-week-old plants by cutting off leaves. Similarly grass grub beetles were observed to cause some feeding damage to the leaves of 7-week-old plants, but by this time the plants were sufficiently robust to withstand this. During November beet leafminer (*Liriomyza chenopodii*) larvae became apparent in the outer beet leaves but it is doubtful that they had any detrimental effect on the plants.

Initially lucerne fleas were thought to be potentially damaging although no seedling mortality could be attributed to this insect. Table 1 shows that in January the wheat bug was present in very large numbers; under certain conditions this insect may be damaging or lead to fungal disease problems.

By far the most important insect-related pathogenic condition to occur in the crop was yellowing, probably caused by an aphid-borne virus. Yellowing of the leaves was first observed in early December and from that time onwards the symptoms became increasingly severe. Preliminary transmission experiments and electron microscopic examination of sap from yellowed plants suggest that the condition is not caused by beet yellows, beet western yellows (BWYV) or beet mild yellowing viruses (BMV) (J.W. Ashby, pers comm). In Tasmania a similar yellowing of sugar beet has been attributed to infection with subterranean clover red leaf virus (SCRLV) (G.R. Johnstone, pers comm). This virus belongs to the same group as beet western yellows and beet mild yellowing viruses and is prevalent in white clover (*Trifolium repens*), storksbill (*Erodium* spp) and several other weed hosts in Canterbury (Ashby *et al* 1979). SCRLV is transmitted mainly by the foxglove aphid (*Aulacorthum solani*) and when transmitted experimentally to sugar beet causes yellowing identical to that observed in the field. In Tasmania and in New Zealand it has not yet proved possible to isolate the virus from yellowed sugar beet from the field, but the prevalence of the virus and of the vector in Canterbury and the demonstrated ability of the virus to infect sugar beet makes it very likely that the observed yellowing of sugar beet in this district is caused by SCRLV. A similar yellowing virus, transmitted by the green peach aphid (*Myzus persicae*) is known to occur in New Zealand but in recent years has only rarely been encountered (Ashby pers comm). In light of the similarity of these viruses to BWYV and BMV, which have been found in a number of northern hemisphere studies to cause substantial reductions in root yield, seed production and sugar content, it is possible that similar damage may occur here from SCRLV. The incidence of these two aphid species is plotted in Fig. 1. Both species had almost disappeared by mid-January and crops sown after 23.11.79 showed far less yellowing (Martin, pers comm).

Fig 1. Aphid incidence ex pitfall and wind vane traps

Although demeton-S-methyl was applied to the protected plots from 6.11.79, as soon as aphids were first observed on the leaves, it was only partly effective in preventing the yellowing disease. Possibly the virus became established in the short time

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before the first application of insecticide when the total aphid density was less than 10 per plant. Alternatively, the insecticide toxicity may not have been acute enough to prevent viral uptake before killing the aphid. The shortest inoculation time of BWYV by green peach aphid is put at 10 minutes (Duffus 1973).

This preliminary examination demonstrates that insect damage or insect-borne disease can occur in fodder beet grown in Canterbury. Furthermore, the situation could be more severe in areas where large amounts of beet are grown on a rotational basis. Populations of disease-bearing aphids may build up very rapidly, particularly where winters are mild or where other potential host plants, including many common weed species, are growing nearby.

Since the beet is an industrial crop, economic considerations are important in any insect control system. It appears that the disease-bearing aphids exhibit a distinct seasonality; it may be possible to exploit this by discontinuing insecticide treatments when the population should have decreased naturally and the plants have become sufficiently robust to withstand other pests.

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