OBSERVATIONS ON THE PHENOLOGY OF ROSE-GRAIN APHIDS IN MID-CANTERBURY

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SUMMARY

Rose-grain aphids (*Metopolophium dirhodum*) were found in a succession of cereals throughout the year in mid-Canterbury: post harvest regrowth and self-sown plants, forage, autumn-sown and spring-sown cereals. Prairie grass (*Bromus catharticus*) and phalaris (*Phalaris aquatica*) supported some aphids in spring and autumn. No aphids were found on ryegrass (*Lolium perenne*) or cocksfoot (*Dactylis glomerata*). Production of winged aphids on forage oats, and colonisation of autumn-sown cereals was apparently reduced by cool winter weather. The time of peak aphid numbers of spring barley was delayed at higher altitudes, where aphid numbers in spring were lower than at Lincoln.

INTRODUCTION

The rose-grain aphid was first found in New Zealand in 1982 when heavy infestations were recorded on cereals in Canterbury. Both holocyclic and anholocyclic populations occur in Europe (Dean 1974); the species overwinters as eggs on *Rosa* spp. or as parthenogenetic females on Graminae. Host plants recorded from Europe and North and South America include wheat, oats, barley, maize, rye, prairie grass, cocksfoot, Kentucky bluegrass (*Poa pratensis*) and *Phalaris* spp. (Greene 1966, Dean 1974, Botto *et al* 1979, Hand and Carillo 1982). Information on the annual cycle of host plants and the timing of aphid outbreaks is required as a basis for any pest management programme. This paper reports the results of surveys made in mid-Canterbury in 1983 and 1984.

METHODS

The survey was carried out in cereal and grass paddocks encountered on road transects through the area between the Waimakariri and Rakaia rivers at altitudes below 60 m above sea level (Lincoln area). Additional surveys were carried out between the Waimakariri and Ashburton rivers, 60-220 m a.s.l. (Kirwee area), and within 12 km of Methven, >220 m a.s.l. (Methven area). Inspections of 20-100 sites were made on 1-4 days/month in 1983 and 1984.

Areas of wheat, oats, barley, ryegrass, cocksfoot, prairie grass or phalaris were inspected. Foliage was searched for 10 observer-minutes at each site, and the presence of rose-grain aphid stages and morphs recorded. Ninety percent of sites examined were in cereals, the remainder in grasses.

Sweet brier (*Rosa rubignosa*) bushes were inspected at 20 sites near Dunsandel in April each year, and domestic roses were examined during the winter in Christchurch.

RESULTS

Rosa spp. No rose-grain aphids were found on roses, and no sexual forms were found elsewhere during the survey.

Grasses. Prairie grass and phalaris supported small groups of rose-grain aphids in April and November 1984, at Lincoln. None were found on ryegrass or cocksfoot.

Cereals - Lincoln area.

Rose-grain aphids infested wheat, oats and barley grain crops in both seasons, persisting on late-sown spring oats until early February. Self sown plants and regrowth from stubble supported small groups of aphids between February and May.

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Forage oats emerged in March, and supported rose-grain aphids from late March throughout the winter until October at some sites. 10-20 sites/month were inspected from April until June 1983: approximately 20% supported aphids. This proportion rose to >90% during the August-October period (Table 1). Aphid population density varied from <0.1/tiller to ca. 2/tiller in the sites examined between March and September. Occasional dense infestations of up to 50 aphids/tiller were found on forage oats in the spring.

TABLE 1: Forage oats: number of sites inspected (n), number of infested sites (inf.), and number of sites with winged 4th stage rose-grain aphid (+ 4a) in 1983 and 1984, Lincoln area.

Month	n	1983 inf.	+ 4a	n	1984 inf.	+ 4a
July	15	4	1	22	21	8
August	14	14	2	9	8	3
September	14	12	3	4	4	4
October	11	10	4	1	1	1
Total	54	40	10	36	34	13

Table 1 shows that the proportion of forage oat sites supporting winged 4th stage nymphs during the period July-August was greater in 1984 (11/31 sites) than in 1983 (3/29 sites) (chi sq = 4.4, d.f.:1, $p < 0.05$). No winged 4th stage nymphs were found on autumn-sown cereals during this period, but winged adults were present (total 40) on 69 such sites inspected in July-August 1984. In contrast, no winged adults were found on 88 sites inspected in the same months of 1983 (Table 2). It is likely that winged adults moulting from the winged 4th stage nymphs on forage oats migrated to the autumn-sown cereals. These adults were detected in 1984, but not in 1983, when the incidence of winged 4th stage nymphs on forage oats was, as shown above, relatively low.

TABLE 2: Autumn-sown cereals: numbers of infested sites/inspected sites, with total numbers of winged adult rose-grain aphids found in parentheses.

	Oats	Wheat	Barley	Total
1983				
July	—	0/20 (0)	—	0/20 (0)
August	0/27 (0)	0/39 (0)	0/2 (0)	0/68 (0)
September	3/9 (5)	0/16 (0)	0/14 (0)	3/39 (5)
October	11/20 (20)	3/18 (1)	2/26 (1)	16/64 (22)
Total	14/56 (25)	3/93 (1)	2/42 (1)	19/191 (27)
1984				
July	1/3 (6)	5/24 (1)	1/2 (2)	7/29 (9)
August	6/7 (21)	5/27 (10)	0/6 (0)	11/40 (31)
September	6/6 (7)	15/34 (4)	3/4 (1)	24/44 (12)
October	4/5 (7)	8/12 (1)	2/2 (1)	14/19 (9)
Total	17/21 (41)	33/97 (16)	6/14 (4)	56/132 (61)

The proportion of infested sites in autumn-sown cereals rose to 25-70% in October (Table 2) when winged 4th stage nymphs were found in aphid samples. These infestations were the likely source of winged adults recorded on spring-sown cereals at Lincoln in early November in both years (Stufkens and Farrell, unpublished). Aphid numbers on autumn and spring-sown cereals increased during November to maxima of 10-240 aphids/tiller (Stufkens and Farrell 1984, 1985).

Cereals - Kirwee and Methven areas

Surveys of autumn-sown cereals in the Lincoln and Kirwee areas were carried out on 4th, 12th October 1983, and 12th, 20th September 1984. Table 3 shows that the

TABLE 3: Autumn-sown cereals in the Lincoln area (a) and Kirwee area (b): numbers of sites infested/sites inspected, with total numbers of winged adult rose-grain aphids found in parentheses.

		Oats	Wheat	Barley	Total
September 1984	a	6/6 (7)	15/34 (4)	3/4 (1)	24/44 (12)
	b	2/10 (0)	1/27 (0)	3/11 (0)	6/48 (0)
October 1983	a	5/6 (4)	6/12 (1)	3/8 (1)	14/26 (6)
	b	1/11 (1)	0/13 (0)	0/11 (0)	1/35 (1)

number of winged adults — which were immigrants — and the proportion of sites infested were significantly lower in the Kirwee area ($\chi^2 = 18$, $p < 0.001$). The development of aphid infestations in spring-sown barley crops was surveyed during November and December 1984 in the Kirwee and Methven areas. Table 4 compares mean aphid counts/tiller and plant growth stages (Zadoks *et al* 1974) recorded in these surveys with data from spring barley plots sampled on adjacent dates at Lincoln (Stufkens and Farrell 1985). These data show that peak aphid numbers were recorded at successively later dates at Lincoln, in the Kirwee area, and near Methven. Barley growth was relatively more advanced at Lincoln (sown 6th September) than at inland sites.

TABLE 4: Spring-sown barley in three areas. Numbers of rose-grain aphids/tiller ($\bar{x} \pm \text{SE}$), and mean growth stage (z) with numbers of sites inspected in parentheses.

Date	Lincoln	Kirwee	Methven
20 November	38.5 $\pm$ 1.7 (10) z45	3.7 $\pm$ 0.8 (31) z35	0.9 $\pm$ 0.5 (10) z36
4 December	15.6 $\pm$ 3.6 (10) z71	39.4 $\pm$ 5.3 (33) z44	10.1 $\pm$ 2.2 (30) z46
20 December	0.5 $\pm$ 0.2 (10) z81	7.7 $\pm$ 1.5 (41) z57	20.1 $\pm$ 3.1 (25) z57

DISCUSSION

The annual cycle of host plants of the rose-grain aphid in the Lincoln area appeared to be largely restricted to cereal crops. No sexual forms were found, and the aphid was rarely observed on grasses.

Self-sown and regrowth cereals acted as hosts for the aphid during the period in February and March between grain harvest and forage emergence. No other hosts were found at that time. Maize is recorded as a host in Britain (Hand and Carillo 1982), and forage maize sown in December is a potential host during the post-harvest period.

Forage cereals were the only hosts of rose-grain aphids found during the winter, and were probably the source of winged immigrants colonising the autumn-sown cereals (Tables 1, 2). Production of winged aphids in forage oats, and colonisation of autumn sown cereals during winter and spring was greater in 1984 than in 1983 (Tables 1, 2, 3). Dedryver and Gelle (1982) found a similar variation between years in movement of rose-grain aphid from wheat regrowth to winter wheat in western France. They related this variation to the severity of winter climate. Meteorological records for Lincoln (Crop Research Division, unpublished) show that June-August values for heat accumulation ($525\text{--}639\text{D}_{0.0}^{\circ}\text{C}$) and days with ground frost (42 and 25 in 1983 and 1984 respectively) indicate that in this area the winter was cooler in 1983 than in 1984. The results suggest that the degree of colonisation of autumn sown cereals in mid-Canterbury is affected by winter climate.

Aphid populations on spring barley peaked later in the year at high altitudes in mid Canterbury (Table 4). This delay may be related to the low spring populations on local autumn sown cereals (which were probably the source of immigrants) and to the late

emergence of spring barley at higher altitudes. The extent to which inland barley is colonised by migrants from early aphid peaks near the coast is unknown.

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