

## LOCAL VARIATION IN CEREAL APHID FLIGHT ACTIVITY IN CANTERBURY

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### ABSTRACT

Autumn-winter flight activity of aphids, vectors of barley and cereal YDV, measured in 7.5 m high suction traps, was compared from four sites in Canterbury between 1997–2003. For weekly trap catches, the relationship between traps was usually poor ( $R^2 < 0.64$ ) except for Rokeby and Courtenay ( $R^2 = 0.89$ ). These relationships improved ( $R^2 > 0.75$ ) when combining weekly into monthly, seasonal (April-July), and winter (June-July only) values, except for the monthly comparisons with Hilton ( $R^2 < 0.54$ ). In general, suction trap catches at Hilton were most dissimilar from other traps. Courtenay and Rokeby were the most similar. Internet usage in 2003 indicated that users were least interested in the Courtenay trap data. This analysis suggests that not all suction traps are needed to provide useful information to cereal farmers. However, the utility of a particular trap is also influenced by its use for other aphid pest/crop combinations.

**Keywords:** suction traps, yellow dwarf virus, cereal aphids, aphid flight patterns, *Rhopalosiphum padi*.

### INTRODUCTION

In Canterbury, 7.5 m high suction traps are used to monitor aphid species that transmit yellow dwarf viruses (barley and cereal yellow dwarf) to autumn and winter sown cereal crops to provide information for aphid/virus management ([www.AphidWatch.com](http://www.AphidWatch.com)). The aphid species monitored include *Rhopalosiphum padi*, *R. maidis*, *R. insertum*, *Metopolophium dirhodum*, and at least one species of *Sitobion* (*S. miscanthi* and *S.n.r. fragariae*) (Farrell & Stufkens 1992; Teulon et al. 1999a). In particular, the number of flying aphids (which will contribute to primary infestation) caught in suction traps in the winter months of June and July has been a useful predictor of virus infection for crops sown after mid-May (Farrell & Stufkens 1992). For earlier sown crops, or years with unusually warm winters, aphid reproduction and movement within cereal crops (secondary infestation) is likely to contribute to virus infection (Teulon et al. 1999b; Teulon et al. 2001), so that reliance on aphid flight data alone may be insufficient for management decisions.

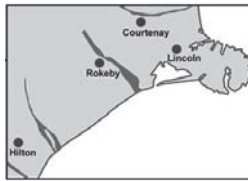
Aphid flight activity has been recorded in a suction trap at Lincoln since 1981 and it is from this trap's data that the relationship between aphid flight activity and virus infection was determined (Farrell & Stufkens 1992). Since 1997 three new suction traps (Hilton, Rokeby and Courtenay) have been erected in Canterbury in response to farmer demand for localised aphid flight data. However, there has been little analysis of the flight data from these traps, including analyses of differences in flight patterns between them. The objectives of the present study were therefore to describe aphid flight activity during autumn and winter, 1997–2003, in all four Canterbury suction traps, to examine differences in aphid flight activity between these traps and to provide a recommendation on the optimum number of traps required to provide useful information for aphid/virus management in cereals.

## METHODS

### Aphid flight activity

The flight activity of cereal aphid species was monitored with four 7.5 m high suction traps from April to July (autumn and winter) in 1997 to 2003. Suction traps were of the enclosed-cone type, containing an aerofoil fan, 305 mm in diameter, drawing about 60 m<sup>3</sup> of air per minute (Johnson & Taylor 1955; Stufkens et al. 2000). Traps were located at Lincoln (10 m above sea level (a.s.l.)), Hilton (70 m a.s.l.), Rokeby (150 m a.s.l.) and Courtenay (160 m a.s.l.) on the Canterbury plains (Fig. 1). Only the Lincoln and Hilton traps were running throughout the study period. Data were available from Rokeby from 1998 to 2003 and Courtenay from 1999 to 2003. Traps were emptied weekly and aphids sorted, counted and identified.

Numbers of aphids (all cereal aphid species combined) were graphed for each suction trap and each year with weekly and monthly values. The relationship between catches from different suction traps for weekly, monthly, seasonal (April to July) and winter (June and July) values combined, were examined by regression analysis. Suction trap pairs were analysed separately for the period of time both traps were running concurrently for all years combined.



**FIGURE 1:** Location of the suction traps in Canterbury (scale 1 cm = 50 km).

### Suction trap data usage

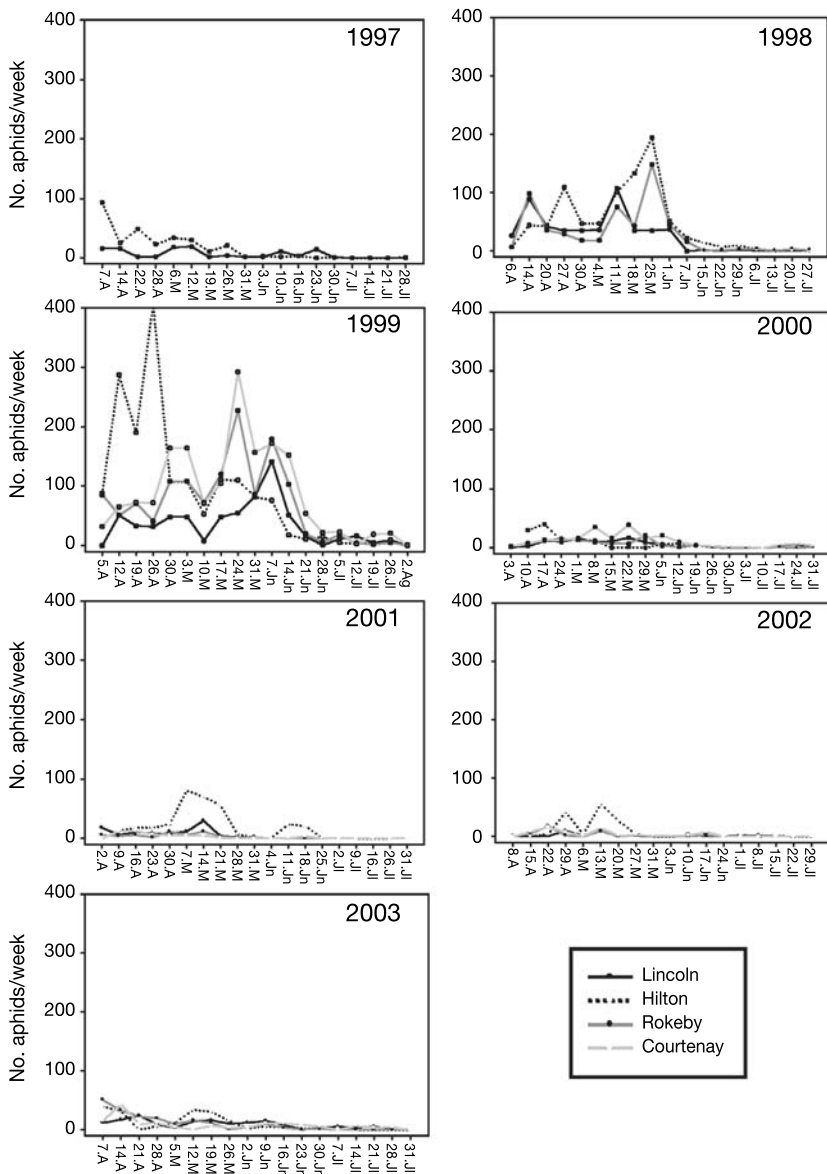
The number of visits to [www.AphidWatch.com](http://www.AphidWatch.com) was examined with Webtrends software. For April to August 2003, the number of visits to the internet pages providing aphid flight information for each suction trap was established. As we were only interested in usage by New Zealand farmers, farm consultants, etc., overseas and Crop & Food Research internal visits were ignored.

## RESULTS AND DISCUSSION

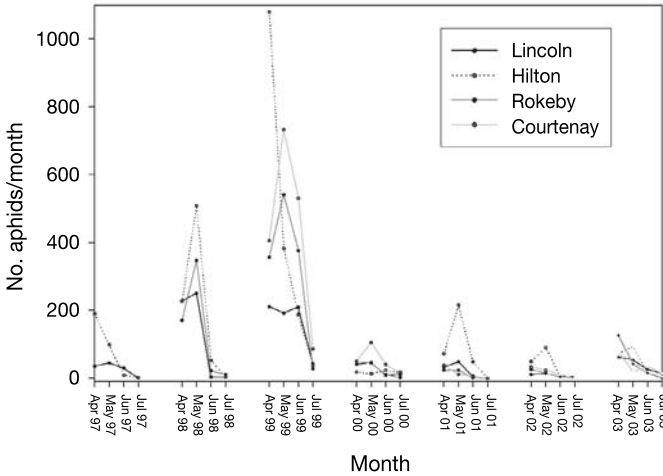
### Aphid flights

The number of cereal aphids (six species combined) caught in the four suction traps during April to July from 1997 to 2003 are detailed in Figure 2 (aphids per week) and Figure 3 (aphids per month). The observed flight activity patterns were broadly similar to those described previously (Lowe 1967; Farrell & Stufkens 1992) with a greater number caught in April and May compared with June and July. There were also large differences between years, with many more aphids caught in all traps in 1998 and 1999 compared with other years.

For the period studied, the most common cereal aphid species caught in all suction traps was *R. padi* (87.3%). A similar proportion of *R. padi* was found in the Lincoln suction trap for the same months from 1981 to 1987 by Farrell & Stufkens (1989). The proportion of *R. padi* was markedly less in the Hilton suction trap in 1997 (67.9%) and 2001 (71.2%) due to a relatively high proportion of *R. insertum* caught in this trap. The local abundance of *R. insertum* in South Canterbury was discussed by Teulon et al. (1999a). In Courtenay in 2002, the proportion of *R. padi* was also lower (71.6%) than in other samples, due to the high numbers of *M. dirhodum* caught in this trap. Other cereal aphids may be locally abundant in certain seasons, such as *R. maidis* which was reported in high numbers in the Lincoln suction trap in 1985 and 1986 (Farrell & Stufkens 1989).



**FIGURE 2:** Number of aphids captured per week at Lincoln, Hilton, Rokeby and Courtenay, April–July, 1997–2003. No samples were obtained on the following dates: 18 June 2001 at Lincoln, 08 July 2002 at Rokeby, 21 April 2003 at Hilton and 07 July 2003 at Courtenay.



**FIGURE 3: Number of aphids captured per month at Lincoln, Hilton, Rokeby and Courtenay, April-July, 1997–2003.**

**Differences in numbers of aphids between suction traps**

For most seasons, large weekly differences in aphid numbers between traps were apparent, especially in April and May when numbers tended to be higher (Fig. 2). In particular, numbers of aphids in the Hilton trap were different from other traps, even in years with relatively few aphids such as 2000, 2001 and 2002. These observations were reinforced by the low levels of correlation (most  $R^2 < 0.6$ ) for weekly catches between all paired comparisons of the four traps (Table 1).

With weekly catches combined into monthly values, differences between traps were less pronounced but still apparent (Fig. 3). In particular, the Hilton trap remained the most different with more aphids caught in April and May of most years compared with the other traps. Low levels of correlation ( $R^2 < 0.54$ ) remained between Hilton and all other traps. However, there was a very high correlation ( $R^2 > 0.98$ ) for monthly catches between Rokeby and Courtenay (Table 1). These two traps have similar timings and magnitudes of aphid flights. With weekly catches combined into seasonal values there was a high level of correlation (all  $R^2 > 0.90$ ) between all paired comparisons of the four traps (Table 1). For the critical winter period of June and July (combined data), correlations between all traps were very high (all  $R^2 > 0.97$ ) except for Hilton (all  $R^2 < 0.88$ ).

**TABLE 1:  $R^2$  values ( $P < 0.05$ ) for the regressions of the weekly, monthly and seasonal captures of traps during April-July and seasonal captures during June-July 1997–2003.**

	Week (April-July)			Month (April-July)			Season (April-July)			Winter (June-July)		
	L <sup>1</sup>	H	R	L	H	R	L	H	R	L	H	R
H	0.25	-	-	0.46	-	-	0.91	-	-	0.75	-	-
R	0.59	0.29	-	0.80	0.54	-	0.91	0.96	-	0.97	0.87	-
C	0.64	0.23	0.89	0.89	0.42	0.98	0.97	0.96	0.99	0.99	0.88	0.99

<sup>1</sup>L=Lincoln; H=Hilton; R=Rokeby; C=Courtenay.

### Suction trap data usage

The number of visits in 2003 for selected New Zealand users to the AphidWatch.com (cereal) pages illustrating aphid flight activity for each suction trap is listed in Table 2. These data were not available for other years for technical reasons. A total of 274 visits were recorded from these pages for all suction traps from April to August; the period of time when farmers are most likely to use this information for aphid/virus management in autumn and winter sown wheat. The lowest number of visits was made in April and the highest in June. The Rokeby and Lincoln trap pages were the most visited and Courtenay the least. While it is difficult to interpret the importance of the visits to the internet sites, a similar number of telephone calls would be considered to indicate a very high interest for this information. Furthermore, it is known that consultants visit the internet site and pass the information on to several farmers (N. Brookes, pers. comm.), so that the number of farmers using the aphid data is likely to be greater than these web figures suggest.

**TABLE 2: Numbers of visits by selected New Zealand visitors to AphidWatch.com cereal pages indicating aphid flights for each suction trap during April-August 2003.**

Month	Total number of visits	% of visits to each trap-page			
		Lincoln	Hilton	Rokeby	Courtenay
April	5	20	60	20	0
May	52	27	21.2	34.5	17.3
June	134	30.6	22.4	37.3	9.7
July	59	52.5	1.7	45.8	0
August	24	25	20.8	41.7	12.5
Total	274	33.9	18.2	38.8	9.1

Additional information on the use of specific suction trap aphid flight information was available from a direct dial telephone information service in use from 1998 to 2000 (Table 3). Total usage increased over this period but the service was discontinued because of the perception that more growers were using the internet site. The phone service showed a more even distribution of interest across all suction trap sites compared to the internet site.

**TABLE 3: Total number of calls made to a direct telephone information service for aphid numbers with percentage of calls for each suction trap for the period April-August in 1998, 1999 and 2000.**

Year	Total number of calls	% of calls to each trap			
		Lincoln	Hilton	Rokeby	Courtenay
1998	76	21.1	32.9	46.1	-
1999	105	6.7	29.5	43.8	20.0
2000	112	26.8	17.0	33.9	22.3

### Suction trap requirements for cereal farmers

Between-season differences in all suction traps were sometimes large, indicating the need for monitoring aphid flights every year. The relevance of within-season differences will be influenced by the use which farmers make of the aphid flight information for aphid/virus management. Farmers that use aphid flight information to time spray applications would require weekly updates. However, use of the suction trap data in this way has not been validated and is therefore not recommended at this time. Growers that

sow their crops after mid-May may only need to know the total number of aphids flying in June and July in accordance with the relationship between aphid flight and virus incidence developed by Farrell and Stufkens (1992).

The Lincoln trap will remain the cornerstone of the cereal (or any other crop) suction trap programme because of the depth of knowledge developed with its use over 23 years. The Hilton trap is the most distant from other traps (about 64 km from the closest trap at Rokeby) and sited on the edge of the Canterbury plains. The divergent aphid flight patterns at this site reflect these differences. On the other hand, Rokeby and Courtenay are relatively close to each other (about 40 km), at a similar elevation and with similar surrounding topography.

If weekly information is needed, all traps (and possibly traps in other areas) would be required. Based on a requirement for monthly differences, either Rokeby or Courtenay could be discontinued. Both these traps could be dropped if only seasonal or June and July values are required.

Recent web-site usage patterns suggest that Courtenay is the least important of the current suction traps for autumn and winter sown wheat farmers. However, other uses of suction trap data need to be considered. For example, data from the Courtenay trap is used to monitor potato and forest aphids so that the cost of running this trap is spread over a number of different user groups. Data from the Hilton trap is also used by the potato industry.

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