Relative Abundance of the Greenhouse Leafhopper, *Empoasca decipiens* Paoli (Homoptera: Cicadellidae) in Alfalfa Fields in Riyadh, Saudi Arabia

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Abstract. Studies were carried out to investigate the population dynamics of greenhouse leafhopper (GLH), *Empoasca decipiens* Paoli, during 1990-1992 in alfalfa fields at Riyadh, Saudi Arabia. A survey using a sweep net was conducted. In first year, September had significantly higher number of GLH compared to other months. However, in the second year the months of November and December had significantly higher numbers of GLH than the rest of the year. When data of both years were pooled, two distinct peaks were recorded, one in September and the other in November and December where the highest population peak was observed in November. Correlation calculated for greenhouse leafhopper relative abundance with temperature and relative humidity showed no considerable significant relationship. Cutting of alfalfa fields more frequent in fall is a suggested tactic for the management of this pest.

Key Words: *Empoasca decipiens*, greenhouse leafhopper, alfalfa, Homoptera, Cicadellidae, Riyadh.

Introduction

Greenhouse leafhopper (GLH), *Empoasca decipiens* Paoli, is a destructive sucking insect pest in alfalfa fields. Not much information is documented about GLH in Saudi Arabia. However, information about potato leafhopper (PLH); *Empoasca fabae* (Harris), that resembles GLH in many aspects, is comparable with GLH. Entomologists throughout the mid-western and eastern states of USA agree that PLH is probably the most damaging insect pest of alfalfa (Steffey, *et al.* 1994).

Feeding by PLH disrupts upward movement of photosynthate in alfalfa causing an over-accumulation of carbohydrates at the exposed site resulting in a physiological injury termed hopperburn (Nielsen *et al.* 1990). Leafhoppers, in general, remove sap from plant tissues that result in quality deterioration, stunting of plants, and loss in plant vigor, low yield and stand longevity (Hower and Byers 1977). Three theories of injury by feeding of PLH have been advanced: (1) a salivary toxin is injected and then translocated to leaves; (2) mechanical blockage of phloem is caused by cell damage or sheath salvia; (3) injury is initiated by specific compounds in the saliva that causes plant cell hypertrophy, resulting in blockage (Backus and Hunter 1989).

Potato leafhopper was found throughout the year in central valley of California, but population peaks were only in July, August and September (Summers *et al.* 1995). Potato leafhopper population reached economic threshold level in each of the three alfalfa cuttings during a growing season but the maximum population was recorded in second cutting, about 3-weeks after first cutting (DeGooyer *et al.* 1998a). In the same study, adults were collected from each of the three

Table 1. Monthly density of GLH for two consecutive years 1990-91 and 1991-92.

	Monthly density of GLH / 25 sweeps				
Months	First Year Mean[a]	Second Year Mean[a]	Both Years Mean[a]	Temp	Rh
Oct.	193.±7.1b	32.5±12.5b*	25.9±7.1bc	23.9	40.6
Nov.	35.3±12.8b	264.8±94.5a*	150.0±61.9a	19.3	45.3
Dec.	22.0±5.2b	216.0±71.2a	119.0±49.3a	16.6	54.9
Jan.	8.0±4.5b	19.5±10.7b*	13.8±5.8c	12.4	58.9
Feb.	9.5±6.0b*	15.0±5.8b*	12.3±4.0c	15.0	48.8
Mar.	16.3±5.9b*	4.3±2.5b*	10.3±3.7*c	19.1	35.4
Apr.	27.0±11.8b*	17.3±6.1b*	22.1±6.4bc	25.8	32.5
May	6.3±2.5b*	52.3±5.5b	29.3±9.1bc	30.1	20.0
Jun.	41.3±18.0b*	15.0±8.5b*	28.1±10.5bc	33.6	10.3
Jul.	44.3±31.6b*	25.8±11.2b*	35.0±15.9bc	34.1	9.6
Aug.	17.3±8.1b	53.5±11.5b	35.4±9.5bc	33.8	10.4
Sept.	155.8±29.5a	17.0±6.6b*	86.4±29.7ab	29.1	12.2
LSD	43.3	100.5	71.9		

[a]Data in column followed by different letter are significantly different at 0.05 α level, ± SE.
* Identify months where alfalfa have been cut.

cuttings whereas the nymphs were only found in 2nd and 3rd crops when a sweep net was used.

Diurnal studies revealed a significant difference in number of leafhopper captured at different times of the day but no consistent trend existed in the relative number of insect sampled at a particular time of day that could justify establishment of different economic thresholds (DeGooyer *et al.* 1998a). A model was developed to predict population dynamics of PLH on alfalfa based on filed date collected over a period of 3-years where simulations studies suggested that longer crop growth cycles might cause higher adults population at harvest (Flinn *et al.* 1986).

A sticky trap sampling technique for adult potato leafhoppers in alfalfa was conducted to compare trap color, orientation, and height showed that potato leafhoppers preferred yellow sticky traps, placed horizontally, with the same height of the top of the canopy (DeGooyer *et al.* 1998b).

Population dynamics study of beet leafhopper, *Circulifer tenellus* (Baker), and *Empoasca* spp in four different geographical regions in southern California, using yellow sticky cards, showed adult peak populations during late spring and summer (Meyerdirk and Hessein 1985).

Since not much information is present on this insect pest in Saudi Arabia, it is the aim of this study to investigate the population fluctuation levels of greenhouse leafhopper in alfalfa fields in Riyadh region.

Materials and Methods

This study was conducted to examine the population density and fluctuation of greenhouse leafhopper on alfalfa plant, (*Medicago sativa* L.) variety CUF-101, at Derab experimental research station, college of Agriculture, King Saud University, Riyadh, during two consecutive years. Data were collected from a sampling area of alfalfa of 250

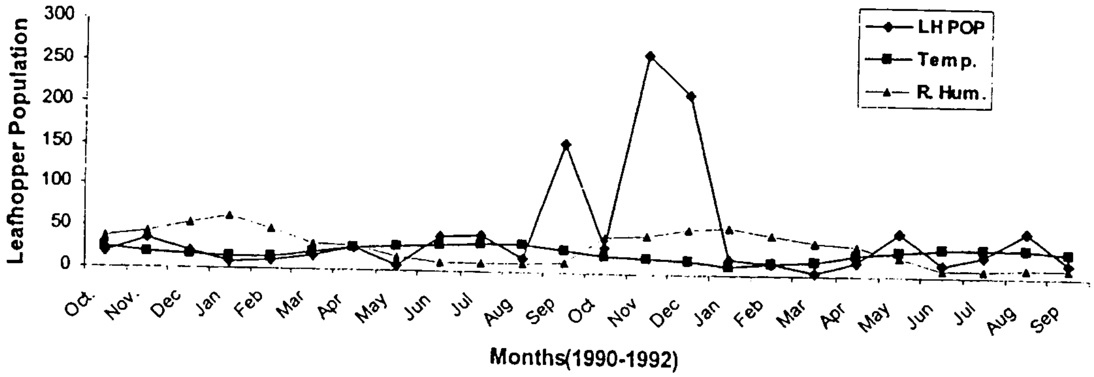

Fig 1. Population trend of Greenhouse leafhopper exhibited during two years in relation to temp. and relative

m^2. Sampling was started in Oct. 1990 on a cut alfalfa stand that has been in the ground for the last two years. Environmental information (Temp. and Rh) were obtained from the meteorological section of the experimental station of the faculty of agriculture, King Saud University, Derab.

Insect samples were collected with 25-double sweeps using a standard 15-inch diameter sweep nets, on weekly basis. The samples were taken to laboratory for identification and count. The counts were statistically analyzed for analysis of variance (ANOVA) means were separated using LSD test (SAS Institute 1996). Correlation was also done by the same program.

The identification of GLH was carried out at the insect museum of the college of Agriculture, King Saud University, Riyadh, and was confirmed by the Insect Identification and Classification Research Section, plant protection research institute, agriculture research center, Dokki, Egypt.

Results and Discussion

The mean relative abundance of the greenhouse leafhopper recorded during two consecutive years has been presented in Table 1. The overall perusal of the mean values for leafhopper population during different months of first year of investigation revealed a significant variation between September and the rest of months of the year.

Leafhopper population of other months remained statistically non-significant with each other at $\alpha = 0.05$ and LSD = 43.3. There was no significant correlation between the relative abundance of GLH with temperature ($r = -0.41$) and relative humidity ($r = 0.28$).

Data provided in Table 1, about the population dynamics of leafhopper recorded during different months of second year of investigation depicted a significant difference at $\alpha = 0.05$ and LSD = 100.5 between November and December and the rest of the months, where the leafhopper populations number were 264.8 and 216.0, respectively. Leafhopper population of other months remained statistically non-significant.

The peak density of GLH of both years was recorded in Nov., Dec., and Sept (Fig. 1). The population density of GLH showed no significant correlation neither with temperature ($r = -0.13$) nor with relative humidity ($r = 0.17$).

It is concluded from this study that greenhouse leafhopper has the highest activity during the months of fall season of the year, where the most activity of the alfalfa plant growth coupled with favorable temperature and humidity favors the activity of the leafhoppers. In a previous study, it was found that predator numbers were highest in spring season and lowest in fall season, especially coccinellid beetles (Al-Suhaibani *et al.*, 2000). Also, Meyerdirk and Hessein (1985) found that egg parasitoids had a major impact on leafhopper population density on sugar beets in southern California. These predators and parasitoids could have a negative effect on GLM numbers. Furthermore, it is possible to relate the increase in GLH population in fall season to the harvest and removal of summer crops, at nearby locations which may cause migration of GLH individuals into alfalfa fields. The delay of harvesting of alfalfa fields in fall season due to the decrease of temperature might be a playing factor that gives more time for GLH numbers to multiply (Simonet and Pienkowski 1979). This also explain the decrease of GLH population numbers in spring and summer season were frequent cutting does not allow enough time for population build up (Flinn, *et al.*, 1986). From the results of this study and previous research, it is suggested, as a tactic for the management of this pest, to cut alfalfa fields more frequently in fall season.

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التذبذب العددي والوفرة الموسمية لحشرة قافزة البيت المحمي في حقول البرسيم في الرياض ، المملكة العربية السعودية

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ملخص البحث : تمت دراسة التذبذب العددي والوفرة الموسمية لقافزة البيت المحمي (***Empoasca decipiens*** **Paoli (Homoptera: Cicadellidae)**) في حقول البرسيم لفترة استمرت لمدة عامين (١٩٩٠-١٩٩٢ في الرياض ، المملكة العربية السعودية. تم عمل الحصر باستخدام شبكة صيد كانسة قياسية . في السنة الأولى، كانت أعداد الحشرة أعلى معنويا في شهر سبتمبر (أيلول) . أما وفي السنة الثانية ، فكانت أعداد هذه الحشرة أعلى معنويا في شهري نوفمبر وديسمبر (تشرين الثاني وكانون الأول) . عند دمج البيانات للسنتين لوحظ وصول قمة الوفرة العددية لقافزة البيت المحمي في فترتين خلال مدة الدراسة، الأولى في شهر سبتمبر (أيلول) والثاني في شهري نوفمبر وديسمبر (تشرين الثاني وكانون الأول)، وكانت قمة التعداد الثانية هي الأعلى . تبين الدراسة ضعف معامل الإرتباط لإعداد القافز مع درجة الحرارة والرطوبة. يوصى بحش حقول البرسيم على فترات متقاربة خاصة في فصل الخريف لأن ذلك من شأنه أن يقلل من الوفرة العددية (الفوران العددي) لقافزة البيت المحمي .