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The Population Abundance of *Aphis gossypii* Glover (Hemiptera: Aphididae) in Different Chilli (*Capsicum annum*) Planting Densities

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Abstract: The population abundance of aphid, *Aphis gossypii* Glover in different chilli, *Capsicum annuum*, planting densities (plant spacing) was assessed. Results indicated that aphid population (alate and apterous) was significantly higher ($P < 0.05$) in the dense planting than in the sparse chilli planting density. The mean total number of aphids per plant was significantly higher ($P < 0.05$) in the lower portion of plant canopy than in the middle and upper portion of plant canopies of the 40 x 40 cm^2 plant spacing only. Plant spacing of 60 x 60cm^2 seemed to be the optimum plant density that could reduce aphid population.

Key words: *Aphis gossypii*, chilli, population abundance

Introduction

The *Aphis gossypii* Glover (Hemiptera: Aphididae) is an important insect pest of chilli (*Capsicum annuum*) in Malaysia. This aphid can cause serious damage and a main vector of virus diseases of chilli plants, and a significant yield loss will incur if left unchecked (Hussein and Abdul Samad, 1993). The plant density, which is a function of plant spacing per unit area, can exert an effect on insect pest abundance (Root, 1973). For example a reduction in plant density can reduce pest numbers (A' Brook, 1964, 1968; Farrell, 1976; Mayse, 1978; Tukahirwa and Coaker, 1982; Troxclair and Boethel, 1984). On the other hand, an increase in plant density will result in abundance of the pest numbers. Higher insect numbers in dense plantings can be connected with less natural enemies and high quantity of natural resources (food plants). However, the number of diamondback moth (DBM), *Plutella xylostella* (L.) (Lepidoptera: Plutellidae), larvae and parasitism rate *Diadegma insulare* (Hymenoptera: Ichneumonidae) on DBM larvae were not significantly influenced by the density of cabbage plants (Idris and Grafius, 2001). This study was aimed to investigate the effects of various chilli densities on the population abundance of *A. gossypii*. Result of the study could help us in selecting the appropriate chilli plant density per unit area that do not favor development and infestation of *A. gossypii* on crops such as chilli.

Materials and Methods

This study was conducted at MARDI Research Station Jalan Kebun, Klang, Selangor, Malaysia from April to June 2001. Five treatments (plant densities; spacing between plant were 0.4 x 0.4, 0.5 x 0.5, 0.6 x 0.6, 0.7 x 0.7 and 0.8 x 0.8 cm^2 for high, medium and low densities respectively) were tested in a 1.0 ha field. Each experimental unit (plot) was 5.0 x 6.0 cm^2 and treatments were arranged in a randomized complete block design. One-moth old chilli (*Capsicum annuum*) plant of variety MC 11 was transplanted manually from the greenhouse to the field on 13 April 2001. The fertilizer (15:15:15, N:P:K) was manually applied immediately after transplanting. Plots were kept free of weeds by applying herbicide (glyphosate, a.i. = 1.8 kg/ha) before transplanting and manually after transplanting. A circular yellow water-pan trap filled with water and detergent was placed in middle of each plot to trap alate aphids. The traps were supported with a wooden stakes and adjusted to just above of chilli canopy level from time to time. The data collected were numbers of apterous aphid per plant per season and number of alate aphid per season. A one-way analysis of variance was used to analysis the data. Means of the data were separated by Tukey's test at $\alpha = 0.05$ (Abacus Concept, 1991).

Results and Discussion

There was a significant difference ($F = 3.9$; $df = 4,1019$; $P = 0.004$) in the mean total number of alate aphids trapped per plot in among the treatments (Fig. 1). The number of alate aphid trapped was significantly lower ($P > 0.05$) in plots where chilli was planted in a treatment of 70 x 70 cm^2 plant spacing compared to 40 x 40 and 50 x 50 cm^2 plant spacing. The highest number of alate aphid trapped was in the plot of 50 x 50 cm^2 plant spacing but it was not different with that of 40 x 40 cm^2 plant spacing. This suggests that alate aphid had selectively alighted on plot of higher resource (chilli plants) concentration than on plot with low resource concentration (Root, 1973). The alighting of alate aphid may be influenced by the contrast between plant and soil background (A'Brook, 1968). In this study, the contrast between chilli plant and soil background for the high plant densities (close spacing) still exist even up to the beginning of harvesting time (2 months after transplanting). As such this had influenced the total number of alate aphid collected per season.

The mean total number of apterous aphid per plant was also found to be significantly different among the treatments ($F = 3.7$; $df = 4, 659$; $P = 0.005$) (Fig. 1). The number of aphid was significantly higher ($P < 0.05$) in lower plant densities (40 x 40 cm^2 and 50 x 50 cm^2) than in the higher plant densities (60 x 60 cm^2 and 70x70 cm^2). This tends to agree with that the resource concentration hypothesis proposed by Root (1973). Although plant quality may be lower in dense planting than in the sparse planting (Fox *et al.*, 1990), result showed that apterous aphid is more abundance in the dense planting than in the sparse planting (Fig. 1). Higher apterous aphids in the dense planting may also have resulted in producing the higher number of apterous aphid per plant in dense plant spacing than in sparse planting of chilli.

The number of apterous aphid per plant canopy was also found to be not significantly different ($F = 2.2$; $df = 2, 659$; $P = 0.104$) among canopies per plant in all the treatments except for treatments 40 x 40 cm^2 (Fig. 2). The number of aphid was significantly higher ($P < 0.05$) in lower part of plant canopy than in the middle and upper part of plat canopies. Although statistically there was no significant different, the number of apterous aphids was relatively higher at the bottom than at the middle or the top of the plant canopy in 50 x 50, 60 x 60 and 70 x 70 cm^2 treatments. In the 80 x 80 cm^2 plant spacing, however, there was a relatively more aphid observed in upper part of plant canopy than other part of plant canopies. There was no significant

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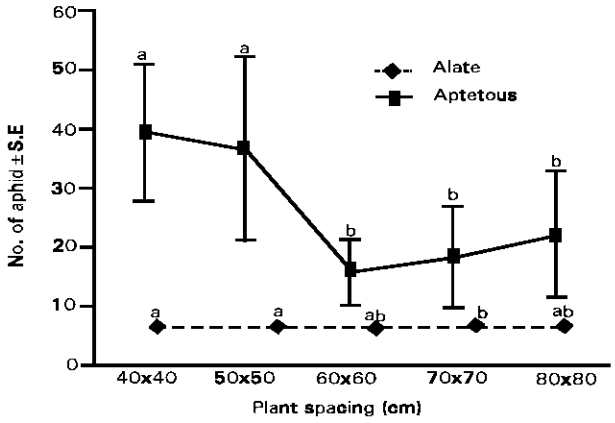

Fig. 1: Mean number of alate and apterous *Aphis gossypii* per plant in five different plant densities from April to June 2001. Means in the same curve with similar letters per line were not significantly different

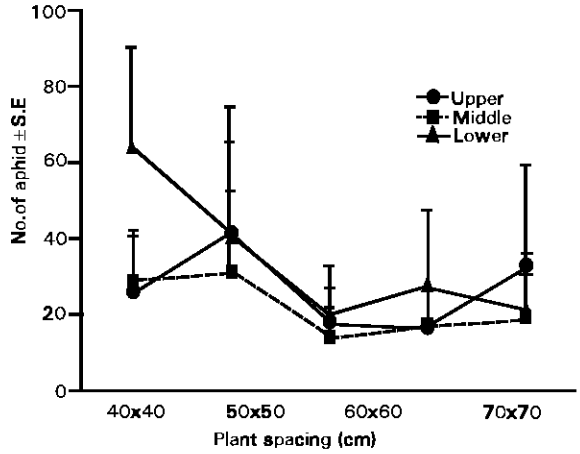

Fig. 2: Mean number of alate *Aphis gossypii* per plant canopy in five different chilli plant densities from April to June, 2001

interaction (F=3.37; df=8, 659; P=0.404) between plant canopy height and treatments in influencing the number of apterous aphid per canopy. The reason for more aphids in the lower part of plant canopy is probably due to the favorable microclimates for an aphids and not for its natural enemies (Delobel, 1981; Coaker, 1987). Results of this study also tend to agree with the results of previous studies conducted by Idris *et al.* (2001), Idris and Mohamad Roff (1999, 2002).

Although there was no significant different in the mean total number of alate and apterous aphid both in 60x60 and 70 x70 cm^2 plant spacing (low plant density), the plant spacing of 60 x60 cm^2 seemed to be the optimum plant spacing of chilli plants that expected could reduce the population of alate and apterous aphids. However, further study on the effects of plant density on the alate and apterous aphids abundance should be conducted under different field setting, location, and regions before specific or general recommendation could be made.

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