Pakistan J. Zool., vol. 44(4), pp. 991-995, 2012.

Effect of Plant Spacing on Aphid Population, Yield Components and Oil Contents of Late Sown Canola, *Brassica napus* L. (Brassicaceae)

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Abstract.- Cabbage aphid, *Brevicoryne brassicae* L. and mustard aphid, *Lipaphis erysimi* (Kalt.) are the common insect pests associated with oilseed rapes in the Pakistan. An experiment was conducted to determine the effect of plant spacing on populations of *B. brassicae* and *L. erysimi*, yield components and oil contents of late sown canola, *Brassica napus* L. The crop was sown at 10, 20 and 30 cm plant spacing in Randomized Complete Block Design in three replicates at experimental farm of the Bahauddin Zakariya University, Multan on December 26, 2009. The aphid densities were recorded weekly from the top 10 cm of the inflorescence by gently beating it six times on a white plastic sheet from start of aphid appearance untill the time of harvest. Populations of both aphid species were non-significantly different on plants in all three spacings of *B. napus*. Yield, plant height, numbers of pods per plant, pod length, number of racemes and oil contents were also non-significantly different among all the treatments.

Keywords: Canola, cabbage aphid, mustard aphid, canola oil, *Brassica napus, Brevicoryne brassicae, Lipaphis erysimi*.

INTRODUCTION

The oilseed plants, belonging to family Brassicaceae, are economically important crops around the world. Importance of oilseed crops can be visualized from the fact that during the year 2008-09, the total production of edible oil met 27.2% requirements of Pakistan, whereas remaining amount was imported by expending 84 billion rupees (Anonymous, 2009). *B. napus* occupied a minor position among the oilseed crops in Pakistan. But it is more important from health point of view as its oil contains lower amount of saturated fats (5-8%) than any other vegetable oil (Raymer, 2002).

Oilseed rapes suffer heavy losses from attack of aphid species like *Brevicoryne brassicae* L. and *Lipahis eyrsimi* (Kalt.) throughout the world. *L. eyrsimi* causes 10-90% losses in India to these crops depending upon severity of damage and crop stage (Rana, 2005). Losses due to *B. brassicae* and *L. eyrsimi* reach to 70-80% in Pakistan on different oilseed rapes. In the years of sporadic attack and severe infestation there may be no grain formation at all (Rustamani *et al.*, 1988; Khattak *et al.*, 2002). Both aphids are the common insect pests of rapes in Southern Punjab, Pakistan. Late sown canola, *B. napus* suffered 75.06% losses during crop year 2008 at Multan in Southern Punjab. Such heavy losses are difficult to avoid without application of insecticide (Razaq *et al*., 2011a).

Pest management practices, like host plant resistance and biological control and other than chemical control are environmental friendly (Speight *et al*., 2008). Research on different varieties of *B. napus* has proved that available varieties do not possess sufficient amount of resistance to avoid the damage by the aphids (Amer, *et al*., 2009; Razaq *et al*., 2011b). Natural enemies like *Chrysoperla* spp. and lady bird beetle, *Coccinella septempunctata* (L.) appear at the later stage of crop when most of the damage has been caused by aphids to brassicas in Multan. Moreover, populations of these two natural enemies are too low to reduce numbers of aphids (Aslam and Razaq, 2007). In many parts of the world the use of insecticides is the only option to reduce the damage from aphids to these crops (Brown *et al*., 1999; Bhowmik, 2003, Hainan *et al.*, 2007).

The cultural pest management involves changes in crop production practices to make the crop less suitable for the pest or to make it more

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0030-9923/2012/0004-0991 $ 8.00/0

suitable for the natural enemies or to enhance the ability of the crop to withstand pest attack (Norris *et al*., 2002). Cultural control practices assumed to be prophylactic and are frequently the first line of defense against pest populations. Most of the practices involve a little or no additional cost of production because they are merely the changes in timing or performing operations that are normally necessary for production of crop (Dhaliwal and Arora, 1994).

Among the cultural practices, modifying the plant spacing also affects the incidence and population development of insect pests (Norris *et al*., 2002). Closer spacing of rice plants has been reported to increase the incidence of brown hopper *Nilparvata lugens* (Stal.), whitebacked plant hopper *Sogatella furcifera* (Horvath), gall midge *Orseolia oryzae* (Wood-Mason) and rice leaf folder *Cnaphalocrosis medinalis* Guen. (Saroja and Raju, 1982; Snotake and Naik, 1990). On the other hand, narrow spacing was reported to decrease the incidence of stem borer *Scripophaga nivella* (Walker), green leaf hopper *Nephotettix virescens* (Distant) and whorl maggot *Hydrellia* sp. (Dhaliwal and Arora, 1994). It has been reported that closer spacing increases the incidence of sucking insect pests and bollworms of cotton in India (Sidhu and Dhawan, 1985).

There is no information on the effect of density of plants on aphid incidence, grain yield and oil contents of *B. napus* in the Multan region. The aim of this study was to identify the appropriate plant spacing that may reduce incidence of aphids without adversely affecting yield of the canola.

MATERIALS AND METHODS

The research was carried out during growing season 2009-2010 at the Warble Farm, Bahuddin Zakariya University, Multan in Southern Punjab, Pakistan. Climate of Multan region is arid and receives mean annual rainfall of about 125mm. The winter season extends from November to February. There is short spring during March and temperature starts rising sharply after March (Amer *et al*., 2009).

B. napus variety, Shiralee, was sown in Randomized Complete Block Design (RCBD) in three replications by hand drill on December 26, 2009. There were five rows in each treatment with row to row distance of 0.5m. Distance between replications was 1.5 m. Thinning of the plants was done after three weeks of sowing to maintain the distance of 10cm (T_1), 20cm (T_2) and 30cm (T_3) in each plot. All cultural practices were performed throughout the growing season uniformly in all the plots. No insecticides were sprayed throughout the growing season.

The population of aphids were recorded at weekly intervals from the start of aphid colonization untill maturity of the crop from six randomly selected plants. For this purpose three plants were selected from 3rd and 4th row in each treatment, respectively. Top 10 cm of the every inflorescence of each selected plant was beaten gently six times with a 15cm long stick of pencil thickness. Dislodged aphis were collected on a piece of white sheet and then counted.

At the end of the season, plant height (cm), numbers of racemes, number of pods per plant, number of seeds per pod, length of pod (cm) and weight of 1000 seeds were recorded from six plants by randomly selecting three plants in each of the 3rd and 4th row of all the plots. Total yield was taken from each plot of experiment by harvesting one meter square and converted to per hectare (Kg). Oil contents were determined using Soxhlet extractor. For each sampling date, aphid numbers of six plants from each plot were averaged to a single aphid count. Mean numbers of aphids, total yield and all the yield components were analyzed by performing analysis of variance (ANOVA) using Statisticx computer software (Anonymous, 2005).

RESULTS AND DISCUSSION

Population data of both the species did not follow the assumption of normal distribution for analysis of variance, therefore data were square root transformed (Steel and Torrie, 1984). The population fluctuation of *B. brassicae* and *L. erysimi* starting from 8th March to 5th of the April, 2010 and the population densities were not significantly different ($P>0.0$, df = 2, 4) at three plant spacing. However, highest populations were recoded on 22nd March when compared with all other sampling dates (Table I). Highest populations of both species have

Table I.- **Mean population of *Brevicoryne brassicae* and *Lipaphis erysimi* on top per 10 cm inflorescence of *B. napus* sown at three plant spacing in unsprayed plots on different sampling dates during 2010 at Multan.**

Plant spacing	Sampling dates/Aphids per 10 cm inflorescence *									
	8th Mar.		15th Mar.		22nd Mar.		29thMar.		5th April	
	Original	Transformed	Original	Transformed	Original	Transformed	Original	Transformed	Original	Transformed
B. brassicae										
10cm	10.56	02.96	83.22	07.97	513.72	22.06	156.39	9.52	22.06	04.12
20cm	31.83	05.29	30.94	05.53	375.50	19.15	95.11	7.50	68.56	05.61
30cm	05.00	01.88	42.22	06.07	150.06	11.93	10.28	2.17	22.56	03.30
L. erysimi										
10cm	1.76	1.20	10.89	3.20	6.06	2.36	24.90	3.97	6.82	2.59
20cm	5.31	2.15	8.07	2.79	19.89	4.12	1.50	0.87	0.82	0.63
30cm	0.83	0.76	7.43	2.66	3.72	1.91	1.22	0.79	4.49	1.81

*Means were non-significantly different among the plant spacings at LSD>0.05

been found during the first or second week of March on timely sown crops at Multan and Bahawalpur. However, negligible numbers of aphids were recorded in 4th week of the March. Average numbers of aphids of both species *i.e.*, *B. brassicae* and *L. erysimi* were low in our research when compared to that of already published (Amer *et al.*, 2009). Higher aphid infestations on late sown crops have been reported in *Brassica* crops from India. A delayed sowing provides better coincidence of the growth stage of plants having tender shoots and consequently mustard aphids colonize the crop at an earlier growth stage. The availability of such favourable conditions affects the length of the period of aphid injury to *Brassica* that consequently causes reduction in the yield (Singh *et al.*, 1984; Chattopadhyay *et al.*, 2005; Razaq *et al.*, 2011a). Result of this study do not agree with those of Sarwar (2008) who reported differences in *L. erysimi* populations on canola sown at 20, 30 and 40cm in Sindh Province of Pakistan. The difference might be due to time of sowing and environmental conditions (Chattopadhyay *et al.*, 2005).

The results indicated that plant spacing did not significantly affect the yield components except the seeds per pod which was significantly different. Highest numbers of seeds per pod (26.04) were observed in the plots where *B. napus* was planted 30 cm apart (Table II).

Table II.- **Plant height, pods per plant, pod length, thousand seed weight, numbers of racemes, oil content, yield/ha. of *B. napus* at different plant spacing of canola at Multan during 2010.**

	Plant spacing		
	10cm	20cm	30cm
Plant height (cm)	120.3	122.6	148.6
Pods per plant	82.34	66.13	67.88
Seeds per pod	23.46A	21.75A	26.04B
Pod length(cm)	5.98	5.98	6.16
Thousand seed weight (gm)	3.33	2.79	2.97
No. of racemes	7.04	8.37	5.96
Oil content (%)	37.17	24.50	25.50
Yield/ha (kg)	674.0	714.8	760.8

Numbers in rows followed by the same letter or without letters are not significantly different (p>0.05) LSD test.

Results of the present study are in agreement with those of Ohlsson (1974), May *et al.* (1993) and

Angadi *et al*. (2003), who reported similar yield and yield components from canola grown at different row spacing or plant density in Sweden and Canada, respectively. On the other hand increase in seed yield and yield components have been observed in Alberta (Kondra, 1975), New Zealand (Simths, 1976), Alaska (Lrws and Anoknrcnr, 1987) and Southern Manitoba (Morrison *et al.*, 1990).

In present research, all the three plant spacing had similar populations of both aphid species. This study also suggests that application of insecticides is inevitable as populations of both the species of aphids were too high. However, caution is needed in timing of application of insecticides as peak populations of aphids were observed a week later than the timely planted *B. napus*. At Multan, conventional (bifenthrin, carbosulfan and methamidophos) and neonicotinoid insecticides (thiamethoxam and imidacloprid) have been proved to be equally toxic to *B. brassicae* and *L. erysimi* on canola after seven days of application during 2005 (Amer *et al*., 2010). Therefore, each of these insecticides can be applied to manage aphids. There was a limitation in present research that it has been conducted for single cropping season, therefore, further research is needed with sowing of *B. napus* with plant spacing on different planting dates.

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(Received 23 January 2012, revised 13 March 2012)

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