

INFESTATION OF FOUR MUSTARD VARIETIES BY *Lipaphis erysimi* (Kalt) IN RELATION TO DIFFERENT LEVELS OF IRRIGATION

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Abstract

An experiment was conducted to find out the influence of three irrigation levels (no irrigation, one irrigation and two irrigation) on four mustard varieties (Tori-7, BARI Sharisha-6, BARI Sharisha-9 and BARI Sharisha-8). The non-irrigated plots had highest aphid population (34.96/plant) and lowest (11.16 aphids/plant) in two irrigation. The variety BARI Sharisha-8 showed lowest (5.34 aphids/plant) aphid infestation and its yield was highest (2.05 ton/ha). Interaction effects indicated that the crop escaped from the aphid incidence in the variety BARI Sharisha-8 irrigated 2 times and produced highest yield (2.37 ton/ha). The differences in the aphid population at three irrigation levels affected the yield contributing characters and it was negatively correlated (correlation coefficient value 'r' ranged from -0.91 to 1.0).

Keywords: Infestation, *Lipaphis erysimi* (Kalt), irrigation

Introduction

Oilseeds occupy an important place in agriculture and industrial economy (Singh *et al.*, 1994). Among the oil seed crops grown in Bangladesh, mustard is the most important in terms of both acreage and production. During 2003-2004 crop season, it covered about 436 thousand hectares of land and the production was about 349 thousand metric tons (BBS, 2006). The mustard aphid, *Lipaphis erysimi* (Kalt) is the most important limiting factors in lowering the grain yield of mustard. The rate of reproduction varies from 5 to 9 youngs in a single day by a single female and the total number of youngs produced by the female varies from 76 to 188 (Nair, 1986). The nymphs and adults of aphids suck saps from leaves, stems, inflorescence and pods as the plant shows stunted growth, withered flower and deformed pod (Begum, 1995; Atwal and Dhaliwal, 1997). It has been found to cause up to 87.7 per cent loss in yield in different varieties of mustard (Brar *et al.* 1987 and Suri *et al.*, 1988). In a recent study in Bangladesh it was observed that the yield loss due to infestation in mustard ranged from 87.16 to 98.16 % (Anon., 1995). Effective irrigation scheduling programs offer significant benefits to growers by reducing aphids in which lower aphid population was recorded from the crop irrigated two and three times (Singh *et al.*, 1994). Various research reports suggested that irrigation is economically feasible in mustard (Singh and Saran, 1993 and Sen *et al.*, 2001). To understand the potential benefits of irrigation in reducing aphids in mustard should be studied. The present study was

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therefore, conducted to find out the effect of irrigation on the incidence of mustard aphid.

Materials and Method

The experiment was conducted in the field of Regional Agricultural Research Station (RARS), Jamalpur, Bangladesh during the period from November 2006 to March 2007. It was laid out in split-plot design with three replications. The treatment three irrigation levels (no irrigation, one irrigation and two irrigation) were assigned in the main plot while the four mustard varieties (Tori-7, BARI Sharisha-6, BARI Sharisha- 9 and BARI Sharisha-8) were in the subplot. The unit plot size was 3.0m × 3.0m and plant spacing were 30 cm between rows and 5 cm between plants. Two flood irrigations were applied for maximum water use efficiency, one at early vegetative stage (30 days after sowing) and another one at the initial pod formation stage (55 days after sowing). All intercultural operations and other management were done as and when necessary. The number of aphids was counted from 10 randomly selected sampling units. Each sampling unit was 10 cm long tip of an inflorescence. The marketable seed yield (t/ha) from each treatment was recorded. The yield and yield contributing characters were also recorded at harvest in all the treatments. All data were analyzed using an analysis of variance (ANOVA) procedure and significantly different means were separated by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Effect of irrigation

Results of the effect of irrigation on the incidence of mustard aphids are shown in Table 1 which indicated significantly the highest infestation (34.96 aphids/plant) was found in the unirrigated plots and the lowest (11.16 aphids/plant) in plots irrigated two times. The moderate level of infestation (18.97 aphids/plant) was observed in one irrigated plot. Singh *et al.* (1994) reported that the population of mustard aphid was low in plots irrigated two and three times and the highest on unirrigated crop followed by the crop irrigated once. Liang-HongBin *et al.* (1998) reported that aphid infestation was negatively correlated ($r = -0.92$) with the amount of rainfall. Drought-stressed plants were infested with more aphids than drought-free plants. Parsana *et al.* (2000) showed that the mustard crop escaped from the aphid incidence in early sown crop when irrigated for 4 times at 20 days interval. Miles *et al.* (1982) reported that water stress in rape plant increased the reproduction of *Brevicoryne brassicae* and he also showed that aphids become adult faster on the plants undergoing stress than on the watered plants. It appears that stress hastened the entire development of the aphid but only to the point it was rejected as the plant became severely wilted. During drought, the chemical changes induced in plants may well assist some sucking

insects to develop to maturity before the plants become unusable. Bakheta and Brar (1988) reported that rainfed crop of *B. carinata* suffered heavily and succumbed to aphid injury in almost all varieties. Sidhu and Kaur (1976) reported that water stress increase the rate of development of aphids born on the plant.

Different levels of irrigation had also significant effect on the grain yield of mustard. The highest yield (1.97 t/ha) was recorded from two irrigated plots although it was statistically similar to irrigated once. Singh *et al.* (1994) showed that the highest yield was obtained with two irrigations and it was significantly higher than zero and four irrigations. Two irrigated plots increased 32.21% yield while one irrigation increased 22.15%. Prihar *et al.* (1981) showed that one irrigation three weeks after sowing increased 30-40% higher grain yield compared with no irrigation. Hoque *et al.* (1987) reported that the yield increase was highly significant for two irrigations. The results of the present findings are in perfect agreement with the findings of above authors.

Table 1. Individual effect of irrigation and variety on the population of mustard aphids

Treatment	Number of aphids/ plant	Yield (tonnes/hectare)
Irrigation Level:		
No irrigation (I ₀)	34.96 a	1.49 b (-)
One Irrigation (I ₁)	18.97 b	1.82 a (+ 22.15)
Two Irrigation (I ₂)	11.16 c	1.97 a (+ 32.21)
Level of significance	**	**
CV(%)	10.95	4.75
Variety:		
Tori-7	30.15 a	1.45 c
BARI Sharisha-6	28.16 a	1.71 b
BARI Sharisha-9	23.13 b	1.83 b
BARI Sharisha-8	5.34 c	2.05 a
Level of significance	**	**
CV (%)	10.95	5.67

- Data in a column followed by same letter(s) do not differ significantly based on Duncan's Multiple Range Test
- Data within the parenthesis with '+' sign represents the percentage of increase of mustard yield relative to the control
- ** Significantly different from zero at the 0.01 probability level
- '-' sign indicates desh

Effect of variety

The four mustard varieties showed significant variation on the population of aphids (Table 1). The highest population (30.15 aphids/plant) was recorded in the variety Tori-7 and it was identical to BARI Sharisha-6. The second highest (23.13 aphids/plant) was recorded from the variety BARI Sharisha-9. BARI Sharisha-8 had significantly lowest aphid population (5.34 aphids/plant) as this variety offered highest yield (2.05 t/ha). The variety BARI Sharisha-6 and 9 produced identical yield.

Table 2. Interaction effect between the levels of irrigation and variety on the infestation of aphids and yield of mustard

Treatments	Number of aphids/plant	Yield (tonnes/hectare)
No irrigation x Tori-7	59.94 a	1.13 f
x BARI Sharisha-6	40.13 b	1.54 e
x BARI Sharisha-9	35.73 bc	1.60 de
x BARI Sharisha-8	28.39 c	1.70 cde
One irrigation x Tori-7	30.95 c	1.67 cde
x BARI Sharisha-6	18.52 d	1.68 cde
x BARI Sharisha-9	17.09 de	1.84 bcd
x BARI Sharisha-8	11.64 def	2.07 b
Two irrigation x Tori-7	13.39 de	1.55 e
x BARI Sharisha-6	11.98 def	1.92 bc
x BARI Sharisha-9	16.58 de	2.03 b
x BARI Sharisha-8	2.68 g	2.37 a
Level of significance	**	**
CV (%)	10.95	5.67

- Data in a column followed by same letter(s) do not differ significantly based on Duncan's Multiple Range Test
- ** Significantly different from zero at the 0.01 probability level

Interaction effect

The interaction effect between the levels of irrigation and variety on the population of aphids and yield of mustard varied significantly (Table 2). The highest number of aphids (59.94/plant) was recorded from the variety Tori-7 with unirrigated plots. The variety BARI Sharisha-8 with irrigated two times had the lowest number of aphids (2.68/plant). Statistically similar results were obtained from the variety BARI Sharisha-6, 9 and 8 with one irrigation and BARI Sharisha-6 and 9 along with Tori-7 irrigated two times. The variety BARI

Sharisha-8 and 9 with no irrigation and Tori-7 irrigated once did not show significant variation of aphid infestation. The highest yield (2.37 t/ha) was recorded from the variety BARI Sharisha-8 with irrigated two times while lowest yield (1.13 t/ha) was obtained from the variety Tori-7 with no irrigation. Tori-7 did not show significant variation in yield between one and two irrigation as was found BARI Sharisha-8 and 9 with one irrigation and BARI Sharisha-6 and 9 with two irrigation.

Effect of aphid intensity on plant characters at different irrigation levels

The impact of varying aphid population was quite distinct on all the plant characters viz., Plant height, branches/plant, siliqua/plant, grains/siliqua and 1000 grain weight (Table 3) as these characters had significant negative relationship with the aphid population (Table 4). Plant height varied from 121.0 to 138.2 cm in different irrigation level being maximum with the lowest aphid intensity (11.16 aphids/plant). Total number of branches/plant ranged from 3.54 to 6.05 which ultimately affected the number of siliqua/plant. Maximum aphid intensity (34.96 aphids/plant) reduced the siliqua/plant up to 97.83 against maximum 134.9 siliqua recorded on plants with lower aphid pressure. Aphid intensity affected to the number of grains/siliqua as maximum 23.17 grains/siliqua were counted with the lower aphid population where as the plants harboured higher aphid intensity (34.96 aphids/plant) could produce only 20.70 grains/siliqua which was statistically similar treated with irrigated once. 1000 grain weight were also affected as was found in others.

Table 3. Effect of aphid intensity on plant characters of mustard at different irrigation levels

Treatment	Aphids/ plant	Plant height (cm)	Branches/ plant	Siliqua/ plant	Grains/ siliqua	1000 grain weight
Irrigation level						
No Irrigation	34.96 a	121.0 c	3.54 c	97.83 c	20.70 b	2.84 c
One Irrigation	18.97 b	134.2 b	5.00 b	119.60 b	21.41 b	3.01 b
Two Irrigation	11.16 c	138.2 a	6.05 a	134.9 a	23.17 a	3.34 a
Level of Significance	**	**	**	**	**	**
CV (%)	10.95	1.17	4.57	1.25	3.07	3.75

• Data in a column followed by same letter (s) do not differ significantly based on Duncan's Multiple Range Test (DMRT)

• ** Significantly different from zero at the 0.01 probability level

Malik and Deen (1998) showed that the differences in aphid population had significant effect on plant characters. Husain and Shahjahan (1997) reported that

the mustard varieties having higher plant height had less aphid infestation than those of shorter plant height. The findings of the above authors supported the results of the present investigation.

Table 4. Correlation matrix of aphid intensity and yield contributing characters in mustard

Characters	Plant height	Branches/plant	Siliqua/plant	Grains/siliqua	1000 grain wt.
Aphid intensity	-0.99	-0.99	-1.00	-0.91	-0.93
Plant height		0.98	0.98	0.86	0.89
Branches/plant			1.00	0.94	0.96
Siliqua/plant				0.94	0.96
Grains/siliqua					1.00
Regression equation with aphid intensity					
Plant height	$y = -0.7379x + 147.14$				
Branches/plant	$y = -0.1034x + 7.106$				
Siliqua/plant	$y = -1.5285x + 150.61$				
Grains/siliqua	$y = -0.095x + 23.82$				
1000 grain wt.	$y = -0.0195x + 3.486$				

Relationship between aphid infestation and yield attributing characters

Aphid intensity had significantly negative correlation with the plant characters as the correlation coefficient value 'r' ranged between -0.91 to 1.00 (Table 4). Plant height was positively associated with the branches/plant, siliqua/plant, grain/siliqua and 1000 grain weight. A strong negative correlation ($r = -0.74$) was observed between plant height and aphid infestation (Kabir 1987; Husain and Shahjahan 1997). The views of Atwal and Singh (1989), Singh and Singh (1989) and Malik and Deen (1998) corroborate with the present findings.

It can be concluded that the variety BARI sharisha-8 with two irrigations had minimum aphid infestation and gave the maximum yield. However, it needs further investigation for more confirmation.

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