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# ASSESSMENT OF SEVERAL MUSTARD VARIETIES RESISTANCE TO MUSTARD APHID, *LIPAPHIS ERYSIMI* (KALT.)

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**ABSTRACT**

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Four varieties namely, MM014-02wf, MM012-02ys, MM2-16-98, MM01l-02rb and Binasarisha-4 one check variety of mustard were tested against the mustard aphid, *Lipaphis erysimi* (Kalt.) under natural and artificial conditions. The result showed that the resistant or less susceptible variety had lower aphid infestation. Generally, aphid infestation showed trend from flowering stage, reached the peck at pod formation stage, and then trended to decline in all the mutants/variety. The highest yield was observed in the variety MM014-02wf, which had lowest aphid infestation. Considering the results of all parameters responsible for aphid resistance or susceptibility at the field and net house studies, the tested variety.

***Key words**: varieties, mustard, aphid and resistance*

## INTRODUCTION

Mustard is the main cultivable edible oilseed crop of Bangladesh and its performance in total oilseed production is approximately 70 percent. Bangladesh occupies the 5$^{th}$ place in respect of total oilseed production in the world (Alam *et al.* 1988). Mustard is the most important and popular crop which is mainly grown in winter season in Bangladesh and occupies an area of 27,000 hectares land and produces about 74,000 metric tons of oilseeds (BBS 2006). In our country, mainly three species are cultivated namely, *Brassica campestris, Brassica juncea* and *Brassica napus.*

Mustard aphid, *Lipaphis erysimi* (Kalt.) is one of the most destructive pests (Morzia and Huq, 1991; Rouf and Kabir, 1997) in Bangladesh and is distributed in many other countries (Hamid and Ahmed, 1980; Setokuchi 1983). Both the adults and nymphs cause damage to mustard plant at vegetative, flowering and pod formation stages by sucking sap from the plant. In case of severe infestation leaves become curled, plant fails to develop pods, the young pods when developed do not mature and cannot produce healthy seeds. As a result, plant loses their vigour and their growth is stopped (Husain and Begum, 2009 and Shahjahan 1994).

Generally, the farmers of Bangladesh control this pest by the application of chemical insecticides. The insecticides are hazardous and have many undesirable side effects. Moreover, the insecticides are very costly and many farmers of Bangladesh can not afford to buy insecticides. The insecticides are lipophilic in nature and they may have hazardous residues in oils. Satisfactory alternative to insecticides, such as use of pheromones, biological and cultural control measures have not been yet developed. To minimize the use of insecticides, development of tolerant variety against insect pests specially mustard aphid, *L. erysimi* (Kalt.) is urgent.

Among the various control methods, varietal resistance has received priority in Integrated Pest Management Programme (Hobner 1972). Plants that are resistant to insect pests have the unique advantages of providing inherent insect control to the crop. Plant resistance, in most cases biochemical nature and a number of factors are responsible for resistance i.e. non-preference, antibiosis and tolerance to insects (Kher and Rataul, 1991). The response of different mustard varieties and one control variety Binasharisha-4 to mustard aphid which will explore the possible sources and mechanisms of resistance of mustard varieties and to develop suitable techniques for screening and evaluating mustard varieties resistant to mustard aphid, *L. erysimi* (Kalt.). From this view, the present experiment was conducted with the following objectives i. To observe the reaction of several mustard varieties to mustard aphid, *L. erysimi* (Kalt.) in the field as well as in the net house, ii. To study the effect of damage done by mustard aphid population on the yield and yield contributing characters of four mustard varieties and one check variety.

## MATERIALS AND METHODS

The field experiment, was conducted at the experimental farm of Bangladesh Institute of Nuclear Agriculture (BINA) sub-station, Ishuardi and is situated approximately between the latitudes of $24^0$ $75^{//}$ N and between the longitudes of $89^0$ $07^{//}$ to $90^0$ $30^{//}$ E at a height of 18.0 meter above the mean sea level. The net house and laboratory experiments with artificial infestation were conducted at the Entomology Division, BINA, Mymensingh. The climate of the region is sub-tropical characterized by heavy rainfall along with moderately high temperature and humidity. The soil of the experimental field area was under the Calcareous Brown and high Ganges River Floodplain sandy loam soil with fine texture having a pH value of 80. The plots were fertilized with Urea, TSP, MOP and Zypsum at the rate of 260 Kg, 20 Kg, 66 Kg and 40 Kg per hectare respectively. Only one flood irrigation was given at the vegetative stage in the field. Four varieties and one check variety namely MMO14-02wf, MM012-02ys, MM011-02rb, MM2-16-98 and Binasarisha-4 were used for the experiments. The susceptibility of these varieties to aphid infestations were assessed on the basis of field, laboratory and net house experiments. On the basis of nymphal and oviposition periods, fecundity and rate of aphid multiplication, they selected some genotypes for use in future breeding programme for evolving insect resistant varieties.

***Percent plant infested by aphid***

The total number of infested and uninfested plants at flowering stage were counted from two rows randomly selected from each plot. Thus the percentage of infested plant by aphid was calculated using the following formula:

$$\text{Percentage of plant infested} = \frac{B}{A} \times 100$$

Where,
A = Total number of plants
B = Number of infested plants

***Number of aphids at flowering stage***

The population of aphid in the field was counted on 10 randomly selected plants from each plot at flowering stage. The top 10 cm apical twigs of the selected plants were cut and brought to the laboratory in polythene bags separately for counting the number of aphid pre plant. The aphids were removed from the infested plant parts with the help of a soft camel hair brush on a piece of white paper. Then the numbers of aphids were counted with the help of a magnifying glass and hand tally counter. The infested twigs and inflorescence were checked carefully, so that single aphid could not escape at the time of counting (Plate I).

Plate I. Aphid infested mustard plant

***Seed yield (kg/ha)***

The mustard crops were harvested at full maturity. The crops were harvested by uprooting the plants. From each plot 10 plants were randomly selected to obtain various yield attributing parameter such as plant height, number of branch per plant, number of pods per plant, number of seeds per pod. Plant height of the above ground portion of the plant was measured by meter scale. Seed yield was recorded after harvest. Seeds were collected from each plot and were sum-dried. The results were expressed in kg/ha.

***Multiplication of aphid on different varieties of mustard***

The plants were at flowering stage, a single plant was selected and infested artificially with field collected aphid in each pot. Each plant was covered with nylon net and tied with a thread (Plate II). After 10 days of artificial infestation, the plants were uprooted carefully and each plant was kept separately and brought to the laboratory.

The data were adjusted by using Duncan's New Multiple Range Test (DMRT) and Least Significant Difference (LSD) test at 5% and 1% level.


Plate II. Multiplication of aphid on different varieties of mustard plants infestation covered with nylon bags

## RESULTS AND DISCUSSION

The nymphal and oviposition periods, fecundity and rate of aphid multiplication are considered fairly resistant to attack and recommended for use in breeding for resistance. Flowering and pod formation stage is the optimum time for aphid infestation. The aphid developed faster on the inflorescence then on other parts of the plant and consistently produced more offspring on the leaves and inflorescence on the pods.

***Percentage of aphid infested plant***

The overall infestation was low throughout the cropping season (Table 1). The lowest plant infestation was recorded in the variety MM014-02wf (1.79%) followed by the variety MM012-02ys (2.23%) and the variety Binasarisha-4. The highest infestation was recorded in the variety MM011-02rd (6.01%).

***Number of aphids per plant***

The number of aphids per plant among the mutants/variety (Table l). The lowest aphid population was found in the variety MM014-02wf (11.13) followed by Binasarisha-4 (17.93) and variety MM012-02ys (11.8), the highest number of

aphid population was recorded in the variety MM011-02rd which was at par with the variety MM2-16-98. On the basis of mean aphid population and multiplication index, susceptibility index was recorded and proved tolerant to the mustard aphid.

The multiplication rate of aphids on the plants after 10 days of initial infestation the multiplication of aphids were significantly high on mustard varieties with means ranged from 40.00-157.7 aphids/plant (Table 2). The highest number of aphids were observed in the variety MM01l-02rb (157.7 aphids/plant) and the lowest number of aphids were observed in the variety MM014-02wf (40 aphids/plant) followed by Binasarisha-4 (66.67 aphids/plant) with non significant difference (Table 2). Aphid population increase in the variety MM012-02ys (81.33 aphids/plant) was also significantly lower than the variety MM2-16-98 (140.7 aphids/plant) and MM011-02rb (157.7 aphids/plant). Prasad (2009) reported that 53 varieties, belonging to different species of oilseed *Brassica* were screened for resistance to the aphid, *L. erysimi* (Kalt.) under field conditions. At 85 days after sowing (DAS), the mean aphid infestation index (MAII) of each variety revealed that none was free from aphid infestation. At 100 days after sowing, the infestation further increased in all the varieties, which the MAII ranging from 2.1 in T27 to 5.0 in several *B. juncea*, *B. campestris* and *B. tournefortil* lines. Some of the lines died due to severe aphid infestation.

The data in (Table 3) revealed that comparatively highest plant height (117.7 cm) was observed in the variety MM014-02wf followed by the variety Binasarisha-4 (111.27 cm) and the lowest plant height was observed in the variety MM01l-02rb (91.57 cm) which was followed by the variety MM2-16-98 (99.30cm). The highest number of branches per plant was observed in the check variety Binasarisha-4 (7.23). The lowest number of branches per plant was recorded in the variety MM011-02rb (5.99). Highest number of pods per plant was recorded in the variety Binasarisha-4 (91.30) followed by the variety MM014-02wf (87.02) which had less infested by aphids (Table 3).

Table 1. Percentage of aphid infested plants and aphid population on different variety of mustard under field condition

| Variety | Percentage of aphid infested plants | Number of aphids per plant |
|---|---|---|
| MM014-02wf | 1.79c | 11.13b |
| Binasarisha-4 | 2.70c | 17.93b |
| MM012-02ys | 2.23c | 11.8b |
| MM2- 16-98 | 4.18b | 35.07a |
| MM011-02rb | 6.01a | 40.93a |
| Level of significance | ** | ** |
| LSD value (0.05) | 1.704 | 7.765 |
| Coefficient of variance (%) | 17.64 | 9.83 |

** significant at 1% level
Means followed by different letter(s) in a column are significantly different at 1% level

Table 2. Multiplication of mustard aphid on different variety after 10 days of release at net house

| Variety | Number of aphids/plant |
|---|---|
| MM014-02wf | 40.00c |
| Binasarisha-4 | 66.67bc |
| MM012-02ys | 81.33b |
| MM2- 16-98 | 140.7a |
| MM011-02rb | 157.7a |
| Level of significance | ** |
| LSD value (0.05) | 29.90 |
| Coefficient of variance (%) | 16.32 |

** significant at 1% level
Means followed by different letter(s) in a column are significantly different at 1% level

The lowest number of pods per plant was found in variety MM2-16-98 (57.07). The highest pod length (6.03cm) was found in the variety MM014-02wf followed by the variety Binasarisha-4 (5.78 cm) and MM012-02ys (5.33 cm) which were less infested by mustard aphid. The lowest pod length was observed in the variety MM011-02rb (4.04 cm). Highest number of seeds per pod (30.53) was observed in variety MM014-02wf followed by the variety Binasarisha-4 (28.71) which had comparatively lower aphid infestation (Table 3). The lowest number of seeds per pod was found in the variety MM011-20rb (24.29). The varieties showed significant differences among themselves with respect to seed yield (Table 3). The highest seed yield was observed in the variety MMO14-02 wf (1816 kg/ha). The lowest seed yield was observed in the variety MM01l-02rb. Similar results were also reported by Sing and Lal (1997) who observed that the percent reduction in yield was proportional to the level of population of mustard aphid and every increase of one mustard aphid beyond 29.5 and 34.6/10 cm terminal shoot/plant resulted in reduction of 1.4 kg/ha

during rabi 1989-90 and 1.0 kg/ha during 1990-91, respectively. The taller genotypes of mustard had comparatively less aphid infestation than those of dwarf genotypes.

Table 3. Yield contributing characters of mustard influenced by mustard aphid, *L. erysimi* (Kalt.)

| Variety | Plant Height (cm) | Number of Branches per plant | Number of Pods per plant | Pod length (cm) | Number of seeds per pod | Yield of seeds (kg/ha) |
|---|---|---|---|---|---|---|
| MM014-02wf | 117.7 | 7.03 | 87.02a | 6.03a | 30.53a | 1816a |
| Binasarisha-4 | 111.27 | 7.23 | 91.30a | 5.78ab | 28.71ab | 1607ab |
| MM012-02ys | 103.29 | 6.89 | 81.09b | 5.33ab | 26.23bc | 12.98cd |
| MM2-16-98 | 99.03 | 6.09 | 57.07c | 4.59bc | 25.11bc | 1360bc |
| MM011-02rb | 91.57 | 5.99 | 79.37bc | 4.04c | 24.29c | 1078d |
| Level of significance | NS | NS | ** | * | * | ** |
| LSD value (0.05) | - | - | 5.48 | 1.18 | 3.49 | 265.1 |
| Coefficient of variance (%) | 23.69 | 13.07 | 3.52 | 12.26 | 6.88 | 9.83 |

** significant at 5% level
** significant at 1% level
Means followed by different letter(s) in a column are significantly different at 1% level

## CORRELATION

A negative correlation was observed between plant height and aphid incidence indication that the shorter varieties had suffered more severe aphid attack than the taller varieties. Significant negative correlations were also observed between aphid attack and number of seeds per pod. A significant negative relationship was found between aphid infestation and yield.

## CONCLUSION

Results obtained from the field, net house and laboratory experiments reflected that the moderately resistant or less susceptible varieties had lower percentage of infested plants and aphid population. Taller plants, higher number of branches, more number of pods, greater number of seeds per pod and higher pod length were less infested by aphid attack. Significant difference were found among the variety in respect to number of branches per plant, multiplication of aphid and yield. The findings of this studies indicated that the use of aphid resistant varieties have number of advantages, as the resistance is inherent in the plant itself with no extra cost involved in the control measures. Therefore, the use of resistant varieties such as MM014-02wf, Binasarisha-4 are the most effective and important weapon for controlling aphids without insecticides application and thereby play an important role in Integrated Pest Management (IPM) Programme. Hence, the farmer will be suggested to grow aforesaid resistant or less susceptible and high yielding varieties. This will help them to ensure higher yield of mustard and at the same, the risk of health hazard and environment pollution may be avoided.

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