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## **Diverse Response of Growth Stages of *Brassica* Varieties to *Lipaphis erysimi* Kalténbach (Homoptera: Aphididae)**

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### **ABSTRACT**

The study was conducted to know the diverse response on growth stages of mustard varieties to mustard aphids. Among ten mustard varieties, the maximum aphid population was recorded on Tori-7 at flowering stage but the population reached to the peak in BS-5 variety. Pod formation stage was more vulnerable for aphid infestation and increased population. Aphid infestation received higher at pod formation stage than flowering stage and consequently produced lower yield. Moreover, experiment indicated that aphid infestation were severe in 2007 as compared to 2006 in respect of percent infestation and number of aphids per plant under study.

**Key words:** Mustard aphid, mustard variety, growth stage, infestation, *Lipaphis erysimi*

### **INTRODUCTION**

Mustard (*Brassica* sp.) is the major source of edible oil among the oilseeds belonging to the family Cruciferae grown mainly in winter season in Bangladesh. Bangladesh occupies the 5th position in respect of total oilseed production around the world (Alam *et al.*, 1988). Mustard covers the land area of 216800 hectares in Bangladesh and produces about 183500 metric tons of oilseeds (BBS, 2007). Oilseed Brassicas contribute substantially to the oil economy of the world including Bangladesh in the form of oil yield and their by-products for industrial use (Bhartin *et al.*, 2002). Aphid has become a worldwide agricultural pest in the World for various crops mainly bean and mustard and this cosmopolitan pest cause's damage by directly sucking the plant sap and by excreting honeydews that produce sooty mould.

Although its performance in total oilseed production is approximately 70% in Bangladesh but the average yield of mustard is very low and yield production of mustard is not sufficient in Bangladesh at all therefore, every year imports 2085864 metric tons of edible oil to meet up the annual requirement of the country, which costs Tk. 64430 million (BBS, 2007). In our country, mainly three species are cultivated namely, *Brassica campestris*, *Brassica juncea* and *Brassica napus*. There are many insect pests on mustard in the world. These include some important aphid species such as cabbage aphid (*Brevicoryne brassicae* L.), turnip aphid (*Lipaphis erysimi* Kalt.), green peach aphid (*Myzus persicae* Sulzer) (Boyd and Lentz, 1994; Buntin and Raymer, 1994). The insect pests are one of the important reasons for yield loss in mustard crops (Khattak and Ahmad, 1993). The mustard aphid has a worldwide distribution (Blackman and Eastop, 1984). Among them *Lipaphis erysimi* Kalténbach (Aphididae, Homoptera) is the most serious pest (Morzia and Husain, 1994; Morzia *et al.*, 1996; Rouf and Kabir, 1997) of mustard in Bangladesh

and is distributed in many other countries in the World (Hamid and Ahmed, 1980; Setokuchi, 1983). Yield loss caused by aphid infestation in mustard ranged from 84.76 to 97.13% (BBS, 2007). The adults and nymphs both are very devastating pest to mustard plant and can seriously damage directly and indirectly at vegetative, flowering and pod formation stages by sucking sap from the plant. In case of severe infestation leaves become curled, plant hampers 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; Shahjahan, 1994). Better growth of plants and yield depends on different climatic factors, which in turn has indirect effect on aphids. Fogs, temperature and dews are the important agents, which affects the infestation severity of aphids as well as yield of the crop. Aphid feeds by sucking sap from their hosts' plants may become deformed and the leaves curled, shriveled and yellowed (Metcalf and Flint, 1993). Mustard aphids prefer young leaves and flowering parts of cruciferous plants (Boyd and Lentz, 1994). Aphids are vector of many plant diseases that cause greater losses than caused by direct feeding injury. This is often the greatest impact of an aphid infestation. Keeping these facts in mind the present investigation were undertaken to find out the effect of aphid infestation on different varieties of mustard.

## **MATERIALS AND METHODS**

The experiment was conducted at the village Rampur, near the Patuakhali Science and Technology University, on different plots during crop season of 2006 and 2007. The experiment was done at field observation under the natural condition. All plots receiving ten varieties of mustard viz. Nap-3, Shambol, Safal, Agrani, YS-52, Sampad, SS-75, Sangam, BS-5 and Tori-7 were exposed to aphids for infestation. Irrigation was done by the use of river water. Sowing was done in the first week of November, 2006. The plants were kept in an optimum number for well maintaining in each plot by reduction the excess plants.

Number of mustard aphid (*Lipaphis erysimi*) was recorded randomly selected plant in each plot from the start of infestation. Data were recorded weekly from early February till the end of March. The whole plant height in each plot was selected for experiment and number of aphids was recorded gently with the help of stick. Dislodged aphids were collected on a piece of white paper and then counted.

**Statistical analysis:** The experiment was laid out in a Randomized Complete Block Design (RCBD) having four replications with ten varieties of mustard. The data were analyzed by RCBD using ANOVA (Gomez and Gomez, 1984) by treating varieties in each plot and mean separation was done by DMRT at 0.05 probability level.

## **RESULTS AND DISCUSSION**

**Percent plant infestation at flowering stage:** Percent plant infestation varied significantly at 5% level of DMRT due to different variety of mustard at flowering stage (Table 1). Variety Tori-7 was the highly infested by aphid (30.05) at 2006 which was statistically similar to all the varieties under study. Aphid also infested the same variety at 2007 but the effect of this variety was statistically at par to BS-5. Variety Sangam was followed by variety Tori-7 and ranked in second position. The lowest plant infestation was recorded in Nap-3 both at 2006 and 2007. Prasad and Lal (2001) and Prasad (2009) revealed that the level of aphid infestation varies depending on various Mustard cultivars. This might be due to Nap-3 received comparatively resistant genetically

Table 1: Effect of aphid infestation on different varieties of mustard at productive stage (2006 and 2007)

Variety of mustard	% infestation at flowering stage		% infestation at pod formation stage	
	2006	2007	2006	2007
Nap-3	13.30h	16.33g	31.60g	38.97f
Shambol	14.90g	17.58f	47.10d	47.65e
Safal	16.85f	18.64e	40.30f	60.24d
Agrani	17.98e	18.59e	44.61e	77.27c
YS-52	20.11d	19.86d	46.12de	78.47c
Sanipad	19.98d	21.37c	40.05f	77.46c
SS-75	20.37d	21.44c	55.25c	83.45bc
Sangam	22.49c	23.44b	61.50b	87.01b
BS-5	25.50b	29.89a	54.85c	95.03a
Tori-7	30.05a	29.60a	63.50a	95.63a
CV (%)	5.06	5.45	6.91	5.56

Means in a column followed by same letter (s) are not significantly different at 5% level of DMRT

potential which led to formation of higher resistant materials in plant resulting lowest plant infestation of mustard. Islam *et al.* (1991) reported that the twig infestation was gradually increased with delayed sowing under the study. The higher percentage of twig infestation was observed in February during 2006-2007.

**Percent plant infestation at pod formation stage:** The varieties significantly varied in plant infestation at pod formation stage are presented in Table 1. The maximum plant infestation was noted in variety Tori-7 that was statistically superior to the rest of the variety in 2006 at 5% level of significance in DMRT. Plant infestation was increasing with increase the lifetime of plant in case of Sangam variety of mustard. In 2007, Tori-7 and BS-5 varieties were found maximum infestation at pod formation stage. Jatoi *et al.* (2002) reported that aphid infestation was higher in pod formation stage as compared to flowering stage of Mustard. The lowest plant infestation was noted on Nap-3 variety both in 2006 and 2007 of the crop under study. Similar results were recorded at pod formation stage. Significantly lower percentage of infestation on the variety Nap-3 (31.60 and 38.97%) and higher percentage on Tori-7 (63.50 and 95.63%) with BS-5 (95.03%) in same ranking were observed in two cropping seasons.

**Number of aphids per plant at flowering stage:** Number of aphids per plant varied significantly at flowering stage of mustard. The maximum aphids were noted in variety Tori-7. The effect of this treatment was statistically identical to variety BS-5. But the highest number of aphids was found in BS-5 at 2007 and the variety Tori-7 ranked in second position. The lowest number of aphids was recorded in Nap-3 at conjugative years. Jogender (2006) reported that the mustard aphid is a predominant pest of rapeseed and mustard crops frequently varying in its numbers. In this experiment, number of aphid per plant increased from 26 to 310 in 2006 and 29.33 to 331.3 in 2007 at flowering stage as per variety. Same findings were reported by Jatoi *et al.* (2002). He recorded that 21.70 to 38.86 aphids per plant were present at flowering stage as per variety but 21.80 to 43.30 aphids per plant were in pod formation stage of mustard. This result indicates that aphid infestations were higher in pod formation stage of mustard.

Table 2: Effect of infestation on number of aphids at different varieties of mustard at productive stage (2006 and 2007)

Variety of mustard	No. of aphids plant <sup>-1</sup> at flowering stage		No. of aphids plant <sup>-1</sup> at pod formation stage	
	2006	2007	2006	2007
Nap-3	26.00g	29.33i	47.00i	57.50f
Shambol	58.00f	59.00h	78.00h	95.25e
Safal	91.00e	89.67g	160.00f	145.30d
Agrani	111.00e	105.00f	189.00e	168.00d
YS-52	198.00d	225.70d	220.00d	247.50c
Sampad	99.00e	133.00e	125.00g	166.00d
SS-75	252.00c	234.40d	300.00c	426.00a
Sangam	286.00b	296.70c	384.00b	373.50b
BS-5	295.00ab	331.30a	448.00a	399.50ab
Tori-7	310.00a	314.70b	435.00a	416.80a
CV (%)	8.25	4.53	5.50	9.27

Means in a column followed by same letter (s) are not significantly different at 5% level of DMRT

**Number of aphids per plant at pod formation stage:** Number of aphids among the different varieties of mustard ranged from 47 to 448. The effect of aphid on number of aphids per plant of mustard was significant at 5% level of DMRT (Table 2). The mean effect of variety on plant height of mustard was statistical significant. The maximum number of aphids (448 plant<sup>-1</sup>) was noted in BS-5, which was statistically at par to Tori-7. However, the effect of sangam was statistically superior to Nap-3, Shambol, Safal, Agrani, YS-52, Sampad and SS-75 and ranked in second position under study. The lowest number of aphids (47 plant<sup>-1</sup>) was recorded in Nap-3 variety of mustard. But in 2007, SS-75 was the most vulnerable to aphids in respect of the number of aphid infestation at pod formation stage of mustard. Therefore, number of aphid per plant increased from 47 to 448 in 2006 and 57.5 to 426 in 2007 at pod formation stage as per variety. Same findings were reported by Jatoi *et al.* (2002). This might be due to the lacking of the optimum different factors viz. temperature, moisture, humidity, fog and dews during the entire growing period resulting increased the number of aphids per plant of mustard. The minimum aphid infestation (57.50 plant<sup>-1</sup>) was observed in Nap-3 variety of mustard.

Figure 1 shows that the mustard aphid prefer to attack at pod formation stage than others as like flowering or seedling stages and also shows that Tori-7 is the most favorable mustard crop of aphids in both flowering and pod formation stages. Nap-3 is the more resistant to aphid in both stages. At flowering stage, in case of YS-52, SS-75 and Sampad showed the same response to aphid but response was quietly different at pod formation stage. There had shown that Sampad is restricted to aphid than others two.

The experiment (Fig. 2) had shown that aphids multiply more at pod formation stage than flowering stage, it means that number of aphids were available on the mustard plant more at pod formation stage. In case of Nap-3, there is a little amount (<50) of aphids at both stages where as Tori-7 and BS-5 contains the maximum number of aphids at the flowering stage (>300) and the pod formation stage (>400). The field experiment had shown that Nap-3 is the best and Shambol, Safal Agrani and Sampad were favorable to culture at natural condition for farmer.

**Plant grading caused by grain of aphid infestation:** Percentage of aphid infested plants was recorded at flowering and pod formation stages in two conjugative years (2006 and 2007). Radically lower percentages of infestations (13.30 and 31.60%) were observed in the first year (2006) but

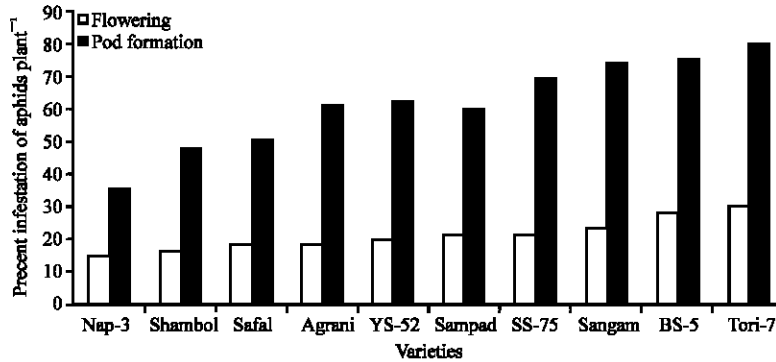


Fig. 1: The comparative study of percent infestation of aphids per plant at both flowering and pod formation stage of mustard

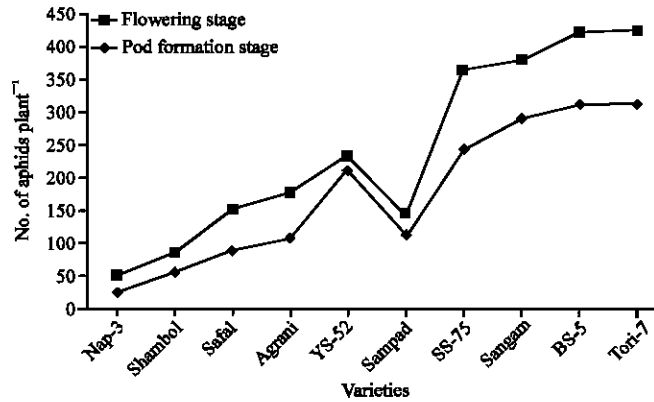


Fig. 2: Figure showing the comparative study of average number of aphids of two years per plant at both flowering and pod formation stage of mustard

higher percentage (16.33 and 38.97%) in the second year (2007) (Table 1) at both the stages. Aphid infestations were recorded at the village Rampur, near the Patuakhali Science and Technology University campus on the different plots. Interaction effect between two conjugative cropping seasons showed that the percentages of infestations were significantly lower (13.30, 31.60 and 16.33, 38.97%), respectively in first and second season. The infestations were lower at flowering stage than that of pod formation stage (Table 1).

The varieties under test showed diverse response to the attack of aphid. At flowering stage, the variety Nap-3 had significantly lowest percentage (13.30%) of infested plant. The infestation percentage was statistically close, ranging from 14.90 to 20.37% in Shambol, Safal, Agrani, Sampad, YS-52 and SS-75. The highest infestation was found in Tori-7 (30.05%) followed by BS-5 and Sangam which showed the significant differences were observed between them (Table 1).

The percentage of aphid infestation remarkably increased at pod formation stage in comparison to flowering stage. In 2006, further Nap-3 variety recorded the lowest damage by aphid (31.60%) and significant differences were shown among all the varieties. The highest percentage of aphid infested plant was also found in Tori-7 (63.50%) followed by Sangam (61.50%). Significance difference between these two varieties in respect to percentage of aphid infested plants (Table 1) was recorded.

Table 3: Response of Aphid to different growth of stages on diverse mustard varieties

Response of aphid to mustard	Name of varieties of mustard	
	At flowering stage	At pod formation stage
Extremely vulnerable	Tori-7	Tori-7 and BS-5
Vulnerable	BS-5, Sangam	Sangam, SS-75 and YS-52
Moderately vulnerable	SS-75, YS-52, Sampad, Agrami and Safal	Sampad, Agrami, Safal and Shambol
Fairly opposing (Quite resistance)	Sham bol and Nap-3	Nap-3

Interaction effect between varieties and cropping seasons demonstrated that significantly lower percentages of infestation were found in the variety Nap-3 (13.30 and 16.33%) at flowering stage in two cropping seasons and higher percentage of aphid infestations were observed in the variety Tori-7 (30.05 and 29.60%) than other varieties although BS-5 was recorded as extremely vulnerable variety (29.89%) in 2007. Similar results were recorded at pod formation stage. Significantly lower percentage of infestation in the variety Nap-3 (31.60 and 38.97%) and higher percentage in Tori-7 (63.50 and 95.63%) with BS-5 (95.03%) in same ranking were observed in two cropping seasons (Table 1).

Interaction of varieties and cropping seasons (2006 and 2007) showed that significantly higher infestations ranging from 38.97-95.63% were observed in the second season. The lowest infestation was observed in the variety Nap-3 followed by Shambol and the highest in Tori-7 followed by BS-5 and Sangam at the conjugative years. The results of the present studies showed that the vulnerable to aphid variety Tori-7 had the highest percentage of aphid infested plants both at flowering and pod formation stages, which was followed by BS-5. Both of these varieties can be termed as extremely vulnerable to aphid at pod formation stage.

Grading of ten mustard varieties considered for the present study on the basis of aphid infestation percentages could be grouped in extremely vulnerable, vulnerable, moderate vulnerable and quite resistance at two different stages of plant growth. Extremely vulnerable to Aphids were Tori-7 varieties at flowering stage and extremely vulnerable to Aphids were Tori-7 and BS-5 at pod formation stage of mustard. Aphid infestation were susceptible for BS-5 and Sangam varieties at flowering stage but at pod formation stage, Sangam, SS-75 and YS-52 these three varieties were susceptible to Aphids. Among all of the varieties only Shambol and Nap-3 were grow quite resistance to Aphids at flowering stage and at pod formation stage there were recorded that only Nap-3 variety was the most resistance to aphid infestation (Table 3).

## CONCLUSION

From the research findings, it can be concluded that southern belt of Bangladesh, specially Patuakhali, Barguna were apt cropping area for mustard cultivation by using some specific varieties of Mustard. Among ten varieties of mustard, Nap-3 and Shambol were the most tolerant varieties against the severe aphid infestation in that area whereas Tori-7 and BS-5 were not suitable for that area because of highly susceptibility to aphids.

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