

INCIDENCE OF APHID ON DIFFERENT BRINJAL GERMPLASM RELATED TO ABIOTIC AND BIOTIC FACTORS

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Abstract

The study was conducted with BD-7320, BD-7328, BD-9952, BD-10154, BD-10158, BARI Begun-1, BARIBegun-4, BARIBegun-5, BARIBegun-6, BARIBegun-7, BARIBegun-8 and BARIBegun-9 germplasms of brinjal with a view to understanding the effect of temperature, relative humidity, rainfall and predators on the incidence of aphid during September 2018 to March 2019. Aphid incidence and infestation started from the last week of November and the highest incidence was recorded during 2nd week of January on BD-10154. At that week, aphid showed lower number of incidence on BARI Begun-5, BARI Begun-6, BARI Begun-8 and BARI Begun-9. The highest infestation of aphid was observed on BARI Begun-5 during 2nd week of March, when the lowest infestation was found on BD-9952. Maximum and minimum temperatures showed significant positive correlation, relative humidity (RH) and rainfall revealed non-significant correlation with aphid incidence. Aphid abundance showed highly significant positive correlation with the abundance of predators on all the tested germplasms.

Keywords: *Solanum melongena*, *Myzus persicae*, predator, meteorological parameters.

Introduction

Brinjal *Solanum melongena* L. is an annual vegetable which belongs to the family Solanaceae. In Bangladesh, over 50.4 thousand ha land is devoted to brinjal cultivation annually and production is 340.2 thousand metric tons (BBS, 2016). Aphid is one of the most harmful threats to brinjal and their infestation caused significant reduction of yield (Miller *et al.*, 2009). The nymphs and adults of aphid suck sap from the leaves and tender shoots, and the infested plants become weak, pale, stunted, and reduced fruit size and yield as high as 25-40% (Ghosh *et al.*, 2004).

Germplasms of plant species vary in their morphological traits like canopy area, number of branch, number of hairs and trichomes per unit area of leaf, color of stem, leaf, flower and fruit etc. These physical characteristics influence on the abundance, infestation and foraging behavior of herbivore insects as well as the population of natural enemies. Afroz *et al.* (2019) observed fluctuations of the population of epilachna beetle, red pumpkin beetle and fruit fly on different

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germplasms of sweet gourd. Growth stages of the host plant also affect pest population abundance and dynamics. Some plants show susceptibility to a specific herbivore insect at their seedling stage, some show susceptibility at their juvenile stage (flowering and fruiting), and some are susceptible from seedling to harvesting.

Meteorological parameters play pivotal roles in the various growth and development stages of crop, and influence on the reproduction, behavior, abundance and infestation of phytophagous insects. The daily mean temperature had significant negative, light intensity had insignificant negative and relative humidity had insignificant positive correlation with the abundance of aphid on mustard (Mandal *et al.*, 2018). Amin *et al.* (2017) reported insignificant effect of temperature, relative humidity and rainfall on the incidence of aphid on CB1, CB3, CB5, CB8 and CB12 varieties of cotton at Gazipur in Bangladesh.

Predator insects are one of the important group of biotic components affecting pest population dynamics in the agricultural crop field. Among the predators, lady bird beetle and spider are reported as the highly effective natural enemies of aphid (Ali and Rizvi, 2009; Mathirajan and Regupathy, 2003; Ghawami, 2008).

Resistant and tolerant germplasms are the basic component of Integrated Pest Management (IPM). For selecting a germplasm against any insect pest, it is utmost necessary to know the seasonal incidence of the pest on that germplasm. It is also important to find out relationship between pest population with meteorological parameters and abundant predators. With this point in view, the present study was carried out to know the incidence and infestation of aphid on twelve germplasms of brinjal, and to find out correlation between the abundance of aphid with meteorological parameters and predators like lady bird beetle and spider.

Materials and Methods

Study site and condition

The study was conducted during September 2018 to March 2019 in the field and laboratory of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh. The area is located in the middle of Bangladesh at 25°25' N and 89°5' E with 34 m altitude above sea level. The area is characterized by a well-defined dry season (February to May), rainy season (June to September) and short winter (October to January) (Amin *et al.*, 2015).

Cultivation of brinjal

Twelve germplasms of brinjal were used as experimental material. Among them BARI Begun- 1, BARI Begun- 4, BARI Begun- 5, BARI Begun- 6, BARI Begun- 7, BARI Begun- 8 and BARI Begun- 9 were Bangladesh Agricultural

Research Institute (BARI), Gazipur released variety and rest five genotypes namely BD- 7320, BD- 7328, BD- 9952, BD- 10154 and BD-10158 were collected from Plant Genetic Resource Centre, BARI. Each germplasm was cultivated in 3.0 m × 3.0 m plot following randomized complete block design with three replications. The spacing between block to block and plot to plot was 1.0 m and 1.0 m, respectively. Seeds were sown on 5th October 2018 in seedbed and 30 days old seedlings were transplanted to the field on 4th November, 2018. Fertilizers were applied according to the fertilizer recommendation guide (FRG, 2012). All the intercultural operations except insect control were adopted whenever necessary.

Data collection and analysis

To observe the incidence and infestation of aphid, field inspection was done weekly. For collecting data, five plants were randomly selected for each germplasm. Number of aphids prevailed on the top, middle and bottom leaves of the selected plants were recorded using hand lens. Number of healthy leaves and number of infested leaves of the selected plants were also counted and infestation level was calculated in percentage. Numbers of lady bird beetle and spider existed on the selected plants were counted through visual observation. Weather data was collected from the weather station of BSMRAU, Gazipur. Simple correlation using IBM SPSS 20.0 was worked out between the incidence of aphid on different germplasms with meteorological parameters, and abundance of predators.

Results and Discussion

Incidence of aphid on the brinjal germplasms showed fluctuations throughout the study (Figure 1). Aphid showed their incidence from the last week of November but data were collected from the 1st week of December to 4th week of March. Aphid incidence sharply increased and reached its peak on 2nd week of January (10.6 adults/3 leaves) on BD-10154 followed by BD-10158, BARI Begun-1 and BD-7320. At that week, aphid showed lower number of incidence on BARI Begun-5, BARI Begun-6, BARI Begun-8 and BARI Begun-9.

With the advent of time and plant growth, the population again started increasing and reached its peak on 2nd week of February (9.5 adults /3 leaves) on BARI Begun-9 followed by BARI Begun-5, BARI Begun-8, BD-10158 and BD-10154. At that week aphid showed lower incidence on BD-7320 followed by BD-9952, BARI Begun-4 and BARI Begun-6. Aphid population then declined on all the germplasms. Jafir *et al.* (2018) observed fluctuations of the abundance of aphid on different germplasms of brinjal in Faisalabad, Pakistan and reported the highest and the lowest abundance during 1st and 4th week of April, respectively.

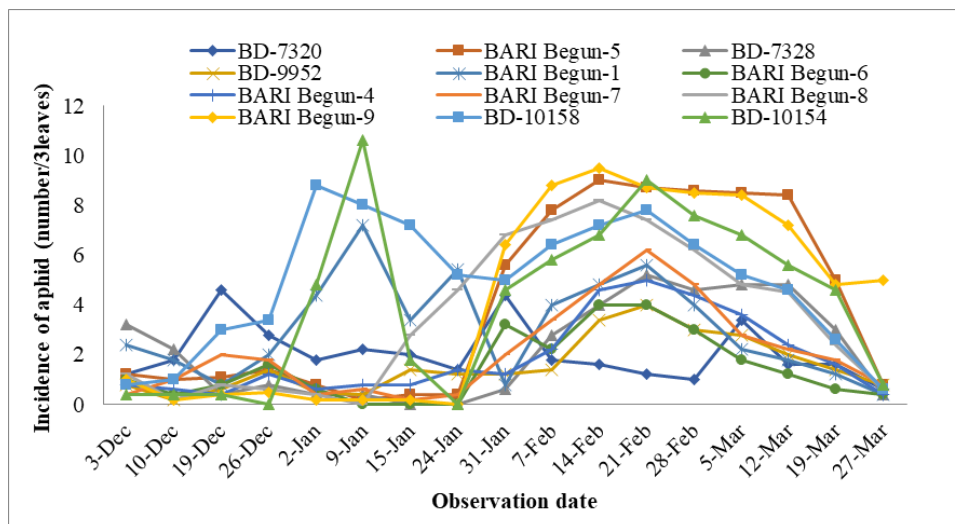


Fig. 1. Fluctuation of the incidence of aphid on brinjal germplasms during December 2018 to March 2019.

Infestation level of leaves of the tested germplasms was recorded from 1st week of December to 4th week of March and found fluctuations (Figure 2). Percent leaf infestation reached a peak during 1st week of December (19.8%) on BD-10158 followed by BD-10154, Begun-8, BARI Begun-9, BD-7320. Infestation level declined after 2nd week of December and showed similar result from 3rd week of December to 1st week of February on all the germplasms except BARI Begun-5 and BARI Begun-9. From 2nd week of February, aphid showed higher level of infestation on all the tested germplasms. The highest infestation was recorded during 2nd week of March (21.5%) on BARI Begun-5 followed by BD-10154, BD-10158, BARI Begun-1, BARI Begun-7 and BD-7320. At that week, the lowest infestation was found on BD-9952. The present findings showed that infestation of aphid on different germplasms had variations and fluctuated throughout the study which is supported by Mundi *et al.* (2011) who reported 10.0%-15.0% infestation of brinjal by sucking insects like aphid and jassid.

The meteorological parameters indicated that during 1st week of December when aphid population was first recorded, the maximum and minimum temperatures were 27.0°C and 14.0 °C, respectively. At that time relative humidity was 91%, and there was no rainfall (Table 1). At 1st week of January when aphid population started rising, the maximum and minimum temperatures were 27.5°C and 11.0°C, respectively, the relative humidity slightly declined 89%, and there was no rainfall. The highest aphid population was recorded in the 2nd week of February and at that time maximum and minimum temperatures, relative humidity were 28.5°C, 14.5°C and 81% respectively, and there was no rainfall.

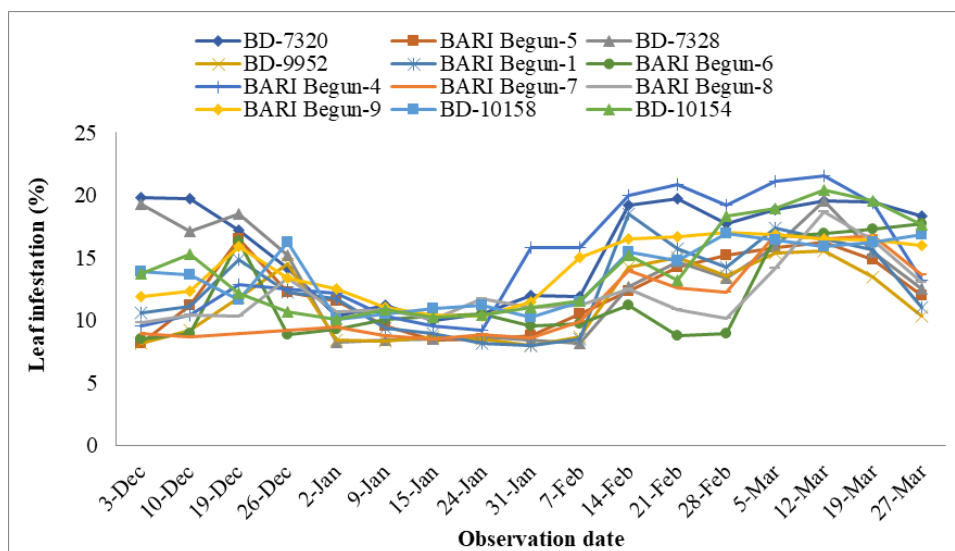


Fig. 2. Infestation level of aphid on brinjal germplasm during December 2018 to March 2019.

Table 1. Data regarding weekly observations on different meteorological parameters

Observation date	Temperature °C		Relative humidity (%)	Rainfall (mm)
	Maximum	Minimum		
03.12.18	27.0	14.0	91	0.0
10.12.18	26.0	12.5	90	0.0
19.12.18	17.0	16.0	90	2.6
26.12.18	26.0	11.0	79	0.0
02.01.19	27.5	11.0	89	0.0
09.01.19	26.0	11.0	90	0.0
15.01.19	26.0	12.0	80	0.0
24.01.19	28.5	12.0	90	0.0
31.01.19	24.0	10.0	90	0.0
07.02.19	27.0	11.5	90	0.0
14.02.19	28.5	14.5	81	0.0
21.02.19	30.0	16.0	83	0.0
28.02.19	27.0	19.0	90	23.38
05.03.19	25.5	19.0	90	10.39
12.03.19	31.0	22.0	92	0.0
19.03.19	30.0	19.0	76	0.0
27.03.19	34.0	21.0	75	0.81

Correlation between incidence of aphid and meteorological parameters is shown in Table 2. Abundance of aphid showed significant positive correlation with

maximum temperature for all the tested germplasms except BD-7328, BD-10158 and BD-10154. Incidence of aphid showed significant positive correlation with minimum temperature for all the tested germplasms except BARI Begun-1, BD-10158 and BD 10154. The findings were similar to Rao *et al.*(2013)who reported that aphid population was regulated by warm temperature. Incidence of aphid on all the germplasms showed non-significant negative correlation with relative humidity. Rainfall had insignificant negative correlation with the incidence of aphid on BD-7320, BARI Begun-1, BARI Begun-4, BARI Begun-7, BARI Begun-8, BD-10158 and BD-10154. The present study showed that rainfall occurred in the 3rd week of December, 4th week February, 1st week of March and at the end of the study when aphid population declined on all the germplasms. The result is in accordance with the findings of Patel *et al.* (2015) who reported that rainfall had negative impact on aphid population.

Table 2. Correlation between the abundance of aphid on brinjal germplasms and meteorological parameters

Germplasm	Weather factors			
	Max Temp.(⁰ C)	Min Temp.(⁰ C)	RH (%)	Rainfall (mm)
BD-7320	0.687**	0.481*	-0.452 ^{NS}	-0.289 ^{NS}
BARI Begun-5	0.498*	0.814**	-0.279 ^{NS}	0.361 ^{NS}
BD-7328	0.369 ^{NS}	0.887**	-0.083 ^{NS}	0.377 ^{NS}
BD-9952	0.566*	0.823**	-0.303 ^{NS}	0.207 ^{NS}
BARI Begun-1	0.540*	0.092 ^{NS}	-0.094 ^{NS}	-0.277 ^{NS}
BARI Begun-6	0.509*	0.766**	-0.281 ^{NS}	0.120 ^{NS}
BARI Begun-4	0.703*	0.696**	-0.419 ^{NS}	-0.205 ^{NS}
BARI Begun-7	0.483*	0.688**	-0.347 ^{NS}	-0.157 ^{NS}
BARI Begun-8	0.561*	0.532*	-0.350 ^{NS}	-0.211 ^{NS}
BARI Begun-9	0.544*	0.575**	-0.263 ^{NS}	0.052 ^{NS}
BD-10158	0.344 ^{NS}	0.019 ^{NS}	-0.199 ^{NS}	-0.079 ^{NS}
BD-10154	0.452 ^{NS}	0.216 ^{NS}	-0.151 ^{NS}	-0.241 ^{NS}

NS = Non significant, * = Significant, ** = Highly significant

Correlation between abundance of aphid and predator is shown in Table 3. Abundance of aphid showed highly significant positive correlation with both lady bird beetle and spider population for all the tested germplasms. The present finding showed agreement with Soni *et al.* (2008) who found density dependent relationship between aphid and ladybird beetle *Coccinella septumpunctata*. Kamal *et al.* (1992) reported that spiderhad good predatory potentiality to control most of the sucking pests like aphid, jassid and whitefly.

Table 3. Correlation between the abundance of aphid and predator on brinjal germplasms

Germplasm	Predator	
	Lady bird beetle	Spider
BD-7320	0.832**	0.854**
BARI Begun-5	0.943**	0.778**
BD-7328	0.731**	0.939**
BD-9952	0.935**	0.941**
BARI Begun-1	0.931**	0.688**
BARI Begun-6	0.873**	0.948**
BARI Begun-4	0.955**	0.983**
BARI Begun-7	0.980**	0.963**
BARI Begun-8	0.991**	0.961**
BARI Begun-9	0.960**	0.979**
BD-10158	0.983**	0.967**
BD-10154	0.969**	0.956**

** = Highly significant

The present study showed that aphid had different levels of abundance and infestation on the tested germplasms, and depicted fluctuations throughout the study. The differences of the abundance and infestation of the pest may be due to the variations of the growth stages of the germplasms to weather conditions, and number of abundant predators. Other factors like variations of the number of leaf trichomes, leaf thickness and toughness, pH, cell sap, content of moisture, sugar, protein, minerals or tannin in the leaf of the germplasms may affect the abundance and infestation of the pest. During the peak season, aphid incidence and infestation was lower on BARI Begun-6, BARI Begun-8, BARI Begun-9 and BD-9952. These germplasms could be cultivated in the areas where aphid is a major pest of brinjal. Further studies are needed for finding out resistance characteristics which could be useful for development of new variety.

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