FIELD SCREENING OF BRINJAL GERMPLASM FOR RESISTANCE AGAINST SHOOT AND FRUIT BORER

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ABSTRACT

Investigations on the screening of twelve brinjal germplasms namely, BD 7320, BD 7328, BD 9952, BD 10154, BD 10158, BARI Begun 1, BARI Begun 4, BARI Begun 5, BARI Begun 6, BARI Begun 7, BARI Begun 8 and BARI Begun 9 were conducted against shoot and fruit borer at the experimental plots of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh. The abundance and infestation of the shoot and fruit borer as well as its effect on the reproductive performance of the germplasms were studied. Infestation levels of the shoot and fruit borer on the germplasms differed significantly with different date of the season. The abundance of shoot and fruit borer larvae in the fruits of the germplasms varied significantly and the germplasms BD 9952, BARI Begun 6 and BARI Begun 4 showed statistically similar and the lowest result. BARI Begun 6 depicted the lowest level of infestation compared to other germplasms. Considering the infestation level, the germplasms BD 9952 and BARI Begun 6 were categorized as resistant. The studied germplasms showed variations in the duration of the reproductive growth stages, yield contributing characters of the fruits, yield and seed weight. The germplasm BD 7320 showed the shortest durations for maturity of fruits for marketing and seed production. The largest fruit, the highest yield and seed weight were found from the germplasms BARI Begun 6, BD 9952 and BARI Begun 4, respectively.

Keywords: Abundance, infestation, Solanum melongena, Leucinodes orbonalis, yield

Introduction

Brinjal Solanum melongena L., one of the important vegetables is widely cultivated in tropical and subtropical regions of the world (Thapa 2010, Harish et al. 2011). In Bangladesh, brinjal is cultivated year round but the yield is very low because of the infestation of shoot and fruit borer Leucinodes orbonalis (Patil 2010). The larvae of the shoot and fruit borer attack brinjal plants from seedling to harvesting stage and cause yield loss up to 70% (Jat and Pareek 2003, Jayaraj and Manisegaran 2010). The pest may cause 100% damage if no control measures are taken (Rahman et al. 2011).

Patnaik (2000) reported the incidence of L. orbonalis in July planted brinjals and found the peak infestation (59.2-75.5%) during September and October. Krishnaiah and Vijay (1975) found 1.8-23 % fruit damage that started at 1st week of January and gradually increased till the last week of March. During vegetative stage the larvae bore into tender shoots causing wilting and die back of the branch terminals. This reduces the fruit bearing capacity of plant. During the reproductive stage, tiny larva bores into the flower buds and fruits, the bored holes are invariably plugged with excreta and feed inside until they pupate (Mehto et al. 2015).

For successful brinjal production in Bangladesh, farmers look for the varieties that are not susceptible to shoot and fruit borer. However, development of a resistant variety through cross-breeding and genetic modification requires information on host-plant morphology and interactions between the host-plants and herbivore insect behavior and ecology. To implement the Integrated Pest Management (IPM) programs, germplasm screening should be the main focus. Therefore, The present study was conducted to screen brinjal germplasms for resistance against shoot and fruit borer, and to evaluate the yield performance of the germplasms.
Materials and Methods

Cultivation of brinjal germplasm: The study was conducted in the field and laboratory of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh from September 2018 to March 2019 with the brinjal germplasms namely, BARI Begun 1, BARI Begun 4, BARI Begun 5, BARI Begun 6, BARI Begun 7, BARI Begun 8, BARI Begun 9, BD 7320, BD 7328, BD 9952, BD 10154 and BD 10158. The seeds of the germplasms were collected from the Plant Genetic Resource Centre (PGRC), Bangladesh Agricultural Research Institute (BARI). The seeds of germplasms were sown on 15 October 2018 in polythene bags for raising of seedlings. The seedlings were transplanted in the experimental plots on 14th November, 2018. Each plot measured an area of 3.0 m × 3.0 m. The study was conducted in randomized complete block with three replications. The spacing between block to block and plot to plot was 1.0 m and 1.0 m, respectively. Each plot had 3 rows and each row contained 5 plants. All the intercultural operations, except insect control measures, were undertaken based on necessity. Fertilizers were applied according to Fertilizer Recommendation Guide of Bangladesh Agricultural Research Council (FRG, 2018) (N = 40, P = 12.5, K = 30 and S = 5 kg ha⁻¹, and cow dung 5 ton ha⁻¹).

Observation of the durations of the developmental stages of the germplasm: After transplanting the seedlings of the germplasms, weekly observations were done to collect data. Every observation day, five plants were randomly selected and the data of the durations for fruit initiation, fruit elongation, marketable maturity of fruit and seed production were recorded.

Observation of fruit infestation and abundance of larvae: During fruiting stage, the plants of each germplasm were checked weekly interval to collect the data of the total number of fruits and the number of infested fruits per plant. Then the fruit infestation levels of the plants were calculated in to percentage. Ten infested fruits for each germplasm were exposed to count the abundance of larvae per fruit.

Categorization of the germplasms based on infestation level: The tested germplasms were graded into different categories of resistance. The resistance categories include tolerant, moderately tolerant, susceptible and highly susceptible corresponding fruit infestation of < 15%, 16-25%, 26-40% and >40%, respectively (Subbaratnam and Butani 1981).

Yield and yield contributing characteristics: The mature fruits of each plot were harvested and weighed using a digital balance (CANRY, China) and the plot wise yield was converted in to t/ha. Some yield contributing characteristics such as number of fruits per plant, fruit weight, length and diameter, and thousand seed weight were measured. Fruit length was measured using meter scale and slide calipers was used to measure the diameter of the fruits. The measurements were replicated ten times for each parameter. Sun dried thousand seed weight of each germplasm was taken using the digital balance.

Statistical analysis: Multivariate analysis of variance (MANOVA) was used to analyze the seasonal infestation of the fruits. A one-way analysis of variance (ANOVA) was applied for determining the abundance of pest, variation of plant developmental phenomena, infestation percentage and yield of the tested germplasm. The mean values were separated according to Tukey HSD posthoc test. All the analyses were performed using IBM SPSS 21.0 (IBM SPSS Statistics, Armonk, NY, USA).

Results and Discussion

The occurrence of shoot and fruit borer was observed from 09 January to 27 March 2019 on the tested brinjal germplasms (Table 1). All the germplasms revealed the lowest infestation level on 9 January and the infestation increased thereafter. The findings showed conformity with Krishnaiah and Vijay (2013), who reported increasing trend of infestation from the first week of January to last week of March. The rate of fruit infestation by shoot and fruit borer tended to increase with the increase of fruit age. Javed et al. (2011) reported 4.8% to 58.6% infestation among different cultivars.

The abundance of larvae in the tested germplasms ranged from 1.1±0.1 to 2.6±0.2 per fruit and the results differed significantly (Table 2). BD 9952, BARI Begun 6 and BARI Begun 4 showed statistically similar and the lowest abundance compared to other germplasms. Considering the fruit infestation, the germplasms BD 9952 (14.6%) and BARI Begun 6 (14.0%) were categorized as resistant, because their infestation rate was within the range of 0% to 15% (Table 2). Rest of the germplasms was categorized as moderately resistant as their infestation were within the range of 16–25%.
The studied brinjal germplasm showed significant variations in the durations of the reproductive growth stages (Table 3). In case of fruit initiation and fruit elongation, BARI Begun 1 showed the lowest results (52.8±0.4 and 58.0±0.3 days, respectively). BD 7320 showed the shortest durations for marketable maturity and seed production maturity of fruits (86.8±0.4 and 107.2±0.4 days, respectively). The studied germplasms were cultivated in a homogenous environmental and soil conditions but they differed in their durations of vegetative and reproductive growth stages, which are their inherent characteristics and may be the effect of shoot infestation.

The yield contributing characteristics of the fruits of the germplasms differed significantly (Table 4). BARI Begun 6 and BD 7320 showed significantly the lowest and highest result in case of fruit per plant. The germplasm BARI Begun 7 revealed the longest fruit and highest diameter and weight was found on BARI Begun 6.
The yield of the tested germplasms ranged from 6.6±2.8 to 15.1±2.3 t/ha and the results differed significantly (Figure 1). The germplasm BD 9952 showed the lowest level of infestation and the highest yield. The thousand seed weight of germplasms showed significant differences and the highest seed weight was recorded from BARI Begun 4 (19.3 ± 1.1g/1000 seeds) (Figure 2). The lowest seed weight was recorded from BD 9952 (14.0 ± 10 g/1000 seeds).

Variations of small and tight calyxes, hairiness on the corolla, shoot thickness, pith and compact vascular system of the germplasms affect the abundance and infestation of the phytophagous insects (Chelliah and Srinivasan 1983, Malik et al. 1986, Mishra et al. 1988).

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Figure 1. Yield of the brinjal germplasms when exposed to shoot and fruit borer infestation. Data expressed as mean ± SE. Bars with common letter(s) are not significantly different by Tukey posthoc statistic at p < 0.05.

Figure 2. Thousand-seed weight of the brinjal germplasms when exposed to shoot and fruit borer infestation. Data expressed as mean ± SE. Bars with common letter(s) are not significantly different by Tukey posthoc statistic at p < 0.05.
fruit/plant, fruit size, yield and seed weight. The germplasm BARI Begun 6 and BD 9952 exerted the lowest level of infestation and the highest yield, respectively. These germplasms could be cultivated in the areas where shoot and fruit borer is the major pests of brinjal, and BD 9952 could be a resource for development of resistant variety.

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