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SCREENING OF DIFFERENT VARIETIES OF BITTER GOURD AGAINST THE INFESTATION OF *BACTROCERA CUCURBITAE* (COQ.) (DIPTERA: TEPHRITIDAE)

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ABSTRACT

A study on the screening of bitter gourd varieties viz., tia, heeradil, bulbuli, masrnagha, goghkorolla, poran, green queen and sonamukhi against the infestation of cucurbit fruit fly, *Bactrocera cucurbitae*(Coq.) was conducted during the period of February to July 2014. The percent fruit infestation and larval density were significantly varied among the bitter gourd varieties. The larval density was increased with the increased of percentage fruit infestation. Goghkorolla (19.39 %) categorized as tolerant whereas masrangha (41.91 %), tia (46.09 %) and sonamukhi (50.00 %) was moderately tolerant at early fruiting stage whereas heeradil (58.89%), green queen (59.05 %), poran (59.44 %) and bulbuli (69.06 %) categorized as susceptible varieties. Contrarily, at mid fruiting stage all varieties were susceptible to fruit fly except sonamukhi (46.69 %) which was moderately tolerant. At late fruiting stage, all the tested varieties showed susceptibility to cucurbit fruit fly infestation. The weight reduction in three different fruiting stages for all bitter gourd varieties was found to be differed and the highest weight reduction obtained from bulbuli and the lowest was the sonamukhi. Among the tested bitter gourd varieties the order of infestation intensity was found as green queen > bulbuli > poran > tia > goghkorolla > heeradil > masrangha > sonamukhi at all three fruiting stages.

Keywords: Screening, *Bactrocera cucurbitae* (Coq.), cucurbit varieties, percent fruit infestation, larval density.

INTRODUCTION

The cucurbits are most important group of vegetables which occupy 66 percent of the land under vegetable production in Bangladesh (IPM CRSP 2004). Among the

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cucurbit vegetables cultivated in Bangladesh, bitter gourd (*Momordica charantia*L.) is now drawing attention to greater extents with a total production of 52,000 tons/year (BBS 2013).It is found most bitter in taste among all the vegetables due to the presence of momordicin as the name literally suggests. The immature fruits and the tender leafy shoots or the ripe fruits have both nutritional as well as medicinal importance like potential health benefits to diabetes, arthritis, rheumatism, asthma, warts, abscesses and ulcers (Khan and Anderson 2003). A compound 'Charantin' present in the bitter gourd is useful to reduce blood sugar in diabetic patients (Shetty *et al.* 2005, Oishi *et al.* 2007).

Bitter gourds growing areas are attacked by a number of pests. Among the field pests, the cucurbit fruit fly, *Bactrocera cucurbitae* is a notorious pest of bitter gourd that cause enormous economic losses to fruits, vegetables and flowers (Bharathi *et al*. 2004, Singh *et al.* 2006, Diamantidis *et al.* 2008).This pest has a major limiting factor which causes intense qualitative and quantitative losses in bitter gourd (Chaudhary and Patel 2007, Biswas *et al*. 2007). The maggots feed inside the fruit (Nasiruddin *et al*. 2004, Dhillon *et al.* 2005) and infested fruits and flowers do not develop properly and fall down or rot on the plant and result in a dramatic reduction of yield. The extent of losses varies between 30 to 100% depending on the cucurbit species, season and prevailing climatic conditions (Dhillon *et al.* 2005, Sapkota *et al.* 2010).

The management of the cucurbit fruit fly mostly involves on various synthetic insecticides in Bangladesh. But chemical protection measures result so many serious drawbacks (Damalas and Eleftherohorinos 2011) its indiscriminate use causes ecological imbalance, pest resistance, outbreak of secondary pests, weak phytotoxicis, residues in food and feeds (Rahaman and Prodhan 2007). Furthermore, it is difficult to practice surface application of the contact insecticide as the fruit fly larvae pupate either in the soil or inside the fruits. Therefore, it is imperative to explore alternative methods to control of this pest. Hence, the selection of tolerant varieties against cucurbit fruit fly might be an important component for preparing an integrated pest management approach(s) against this pest.

Under these circumstances, an investigation was undertaken to find out tolerant varieties available in Bangladesh as a component of integrated pest management approach (IPM) against cucurbit fruit fly.

MATERIALS AND METHODS

To evaluate the susceptibility of different bitter gourd varieties against cucurbit fruit fly, seven hybrid varieties namely, tia, heeradil, bulbuli, masrangha, goghkorolla, poran, green queen and one local variety sonamukhi were used. The seeds of the cultivars were purchased from the local market of Dinajpur sadar. The experiment was carried out in the research field of the Department of Entomology, Hajee Mohammad Danesh Science and Technology University (HSTU) during the period from February to July 2014.

Land preparation and experimental design: The experimental field was prepared by deep ploughing and harrowing followed by laddering. The soil was labeled properly. All weeds and stubbles were removed from the field during land preparation. The field was arranged following randomized complete block design (RCBD) with three replications. The size of the experimental field was 22 m x 13 m. The whole experimental field was divided into 24 equal plots maintained 1 m distance from pit to pit. The size of each plot was 2.5 m × 2 m with an inter plot distance of 1 m to facilitate various intercultural operations. Two pits (30 cm × 20 cm sizes) in each plot were made along with the addition of basal doses of manures and fertilizers. Two pits in each plot were considered as one replication. Cowdung, N, P, K and S were applied at the rate of 5 t, 120 Kg, 40 Kg, 80 Kg and 30 Kg per hectare, respectively (Nasreen *et al*. 2013).

Seed sowing and transplanting: The seeds of each variety were soaked in water for 24 hours in separate petri dishes to soften the seed coat for germination. Water soaked seeds were placed individually in each polybag with tag. After germination, healthy seedling at 3 to 4 leaf stage was transplanted in the main pit. Pits were then covered properly with loose soil and water applied as required.

Cultural practices: Irrigation was applied frequently in the main field to maintain good soil moisture. Weeding and mulching were done as recommended by Rashid (1993). Proper drainage was done to avoid stagnation. Weeding was done before fertilizer application. Damaged seedlings were replaced by healthy ones from the stock.

Data collection: The experimental area was free from any management practices in order to evaluate the varietal tolerance. Harvesting of fruits were divided into three stages viz., early, mid and late fruiting stages. Twelve pickings were done at

the interval of 4 days i.e., four picking of fruits was considered in one stage. After each picking, the healthy and infested fruits were weighed with a top loading balance separately in the field. The data were recorded carefully on the number of healthy fruit, number of infested fruit, weight of healthy fruit, weight of infested fruit and larvae per infested fruit at different fruiting stages.

Fruit infestation and weight reduction were calculated by the following formulae:

$$\text{Fruit infestation (\%)} = \frac{\text{Number of IF}}{\text{No. of HF + No. of IF}} \times 100$$

Where, IF= Infested fruits, HF= Healthy fruits

$$\text{Weight reduction (\%)} = \frac{\text{Wt. of single HF - Wt. of single IF}}{\text{Wt. of single IF}} \times 100$$

The numbers of larvae per infested fruit were counted. The varieties were categorized by following the rating system described by Nath (1966) for the fruit damage as immune (no damage), highly tolerant (1–10%), tolerant (11–20%), moderately tolerant (21–50%), susceptible (51– 75%) and highly susceptible (76–100%).

Statistical analysis: The experiment was arranged in randomized complete block design (RCBD) and the data were analyzed by one way ANOVA based on the SPSS 20. The means of parameters were studied among the varieties compared by using Tukey's Honestly Significant Difference (HSD) tests, after an analysis of variance (ANOVA) at a probability level of 5%.

RESULTS AND DISCUSSION

Healthy and infested fruits at different fruiting stages: The number of healthy and infested fruits varied significantly ($p<0.001$) in different bitter gourd varieties at early, mid and late fruiting stages (Table 1). At early fruiting stage the highest number of healthy and infested fruits were found in green queen (10.67±0.67) and heeradil (14.33±0.88) varieties while the lowest was found in sonamukhi (3.33±0.33) and goghkorolla (2.00±0.00) (Table 1). But at mid fruiting stage, the highest number of healthy (13.00±0.58) and infested fruit (17.33±0.33) were found in the variety of bulbuli. On the other hand, the lowest number of healthy (6.67±0.33) and infested (7.67±0.33) fruits were found in green queen and

masrangha, respectively at mid fruiting stage. Significantly the highest (8.33±0.33 and 48.00±0.58) and lowest (2.00±0.00 and 19.33±0.67) number of healthy and infested fruits were recorded in sonamukhi and poran, respectively at late fruiting stage (Table 1).

Table 1. Healthy and infested fruits recorded in different bitter gourd varieties at early, mid and late fruiting stages

Varieties	Early fruiting stage		Mid fruiting stage		Late fruiting stage	
	No. of healthy fruits	No. of infested fruits	No. of healthy fruits	No. of infested fruits	No. of healthy fruits	No. of infested fruits
Tia	7.00±0.58bc	6.00±0.58cd	8.33±0.33de	14.00±0.58b	4.67±0.33b	39.33±1.45b
Heeradil	10.00±0.58a	14.33±0.88a	9.33±0.33cd	15.00±0.58b	5.00±0.58b	34.00±0.58b
Bulbuli	4.33±0.33d	9.67±0.67b	13.00±0.58a	17.33±0.33a	3.67±0.33bc	37.67±2.33b
Green queen	10.67±0.67a	12.00±0.58ab	6.67±0.33e	7.67±0.33c	2.33±0.33cd	25.67±0.88c
Masrangha	4.67±0.67cd	3.67±0.33de	6.67±0.33e	7.67±0.33c	4.00±0.00b	25.00±0.58c
Goghkorolla	8.33±0.33ab	2.00±0.00e	12.67±0.67ab	15.00±0.58b	4.67±0.33b	35.00±0.58b
Poran	4.33±0.33d	6.67±0.33c	10.33±0.33cd	17.33±0.33a	2.00±0.00d	19.33±0.67d
Sonamukhi	3.33±0.33d	3.33±0.33e	10.67±0.33bc	9.33±0.33c	8.33±0.33a	48.00±0.58a

All values are means ± SE. Values in the same column followed by different letters are significantly different at $P< 0.05$ (Tukey HSD test)

Percent fruit infestation: Percent fruit infestation of different varieties at early, mid and late fruiting stages and their tolerant status are shown in Table 2. At early fruiting stage the variety goghkorolla showed significantly the lowest fruit infestation (19.39%) and designated as tolerant variety whereas masrangha (41.91%), tia (46.09%) and sonamukhi (50.00%) found as moderately tolerant varieties. The highest fruit infestation was recorded in variety bulbuli (69.06%) which placed in susceptible category at early fruiting stage. However, on the basis of infestation intensity among the tested bitter gourd varieties the degree of susceptibility was found as bulbuli > heeradil > poran > green queen > sonamukhi > tia > masrangha > goghkorolla at early fruiting stage. Similarly at mid fruiting stage, the highest fruit infestation was found in the poran (63.40%) followed by

tia (62.68%) and heeradil (61.63%). On the contrary, significantly the lowest infestation was observed in sonamukhi (46.69%) which was categorized as moderately tolerant variety. The result also revealed that all the varieties showed susceptible reaction to cucurbit fruit fly except sonamukhi. All the tested varieties observed highly susceptible to cucurbit fruit fly at late fruiting stage. Though sonamukhi showed the lowest fruit infestation (85.09%) followed by masrangha (86.19%) and heeradil (87.09%). The degree of susceptibility at this stage was found to be green queen > bulbuli > poran > tia > goghkorolla > heeradil > masrangha > sonamukhi.

Table 2. Percent fruit infestation at early, mid and late fruiting stages of eight different bitter gourd varieties and their tolerance category

Varieties	% fruit infestation and their tolerance categories						Average % fruit infestation	TC
	Early	TC	Mid	TC	Late	TC		
Tia	46.09±0.35d	MT	62.68±0.51a	S	89.41±0.46abc	HS	66.06	S
Heeradil	58.89±0.28b	S	61.63±0.48a	S	87.03±0.32cde	HS	69.18	S
Bulbuli	69.06±0.17a	S	57.18±0.73b	S	91.14±0.48a	HS	72.46	S
Green queen	59.05±0.95b	S	54.02±1.84b	S	91.72±0.87a	HS	68.26	S
Masrangha	41.91±0.95e	MT	53.50±0.17b	S	86.19±0.27de	HS	60.53	S
Goghkorolla	19.39±0.61f	T	54.25±0.68b	S	88.26±0.61bcd	HS	53.96	S
Poran	59.44±0.56b	S	63.40±0.44a	S	90.60±0.30ab	HS	71.14	S
Sonamukhi	50.00±0.00c	MT	46.69±0.85c	MT	85.09±0.61e	HS	60.59	S

TC= Tolerant categories, T = Tolerant, MT = Moderately Tolerant, HS= Highly Susceptible, S = Susceptible, All values are means ± SE. Values in the same column followed by different letters are significantly different at $P< 0.05$ (Tukey HSD test)

The result of fruit infestation varies in three different fruiting stages ranging from 19.39 to 69.06%, 46.69 to 63.40% and 85.09 to 91.72% at early, mid and late stages, respectively in different bitter gourd varieties. The finding of the present study were comparable to those obtained by Gupta and Verma (1978) who reported that fruit infestation by melon fruit fly in bitter gourd was varied from 41.0 to 89.0%. The melon fruit fly reported to infest pumpkin fruits 60.0% to 87.0% in Solomon Islands (Hollingworth *et al.* 1997).

Weight reduction: The weight reduction per fruit in tested bitter gourd varieties at early, mid and late fruiting stages was found to be varied (Fig. 1). The highest weight reduction obtained from bulbuli at early (76.75%) and mid (68.38%) fruiting stages while at late fruiting stage the highest reduction was found in heeradil (67.83%). The lowest weight reduction was obtained from sonamukhi (47.06%) at early, mid and late fruiting stages. From the above finding it is clear that the highest weight reduction was recorded from bulbuli and heeradil which were hybrid variety. Similarly lowest weight reduction obtained from the variety sonamukhi.

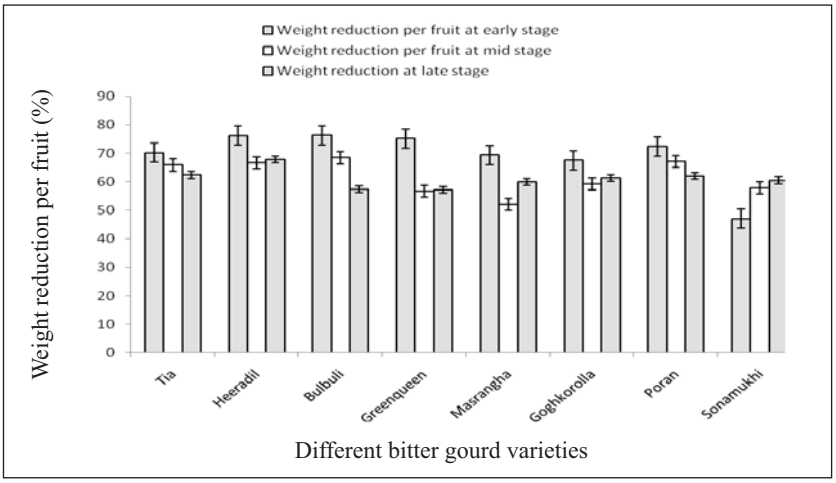

Fig. 1. Percent weight reduction of eight bitter gourd varieties at early, mid and late fruiting stages

Larval density: The range of larval density was 5.00 to 11.00, 11.68 to 17.55 and 16.80 to 24.53 at early, mid and late fruiting stage, respectively (Fig. 2, 3 & 4). The highest number of larvae (11.00) and percent fruit infestation (69.06%) was found in bulbuli whereas lowest number of larvae (5.00) and percent fruit infestation (19.39%) was found in goghkorolla at early fruiting stage (Fig. 2). Similarly at mid and late fruiting stages tia (17.54) and bulbuli (24.53) showed the highest number of larvae. The lowest number of larvae (11.68, 16.80) and the fruit infestation (46.69%, 85.09%) was found in sonamukhi at mid and late fruiting stage, respectively.

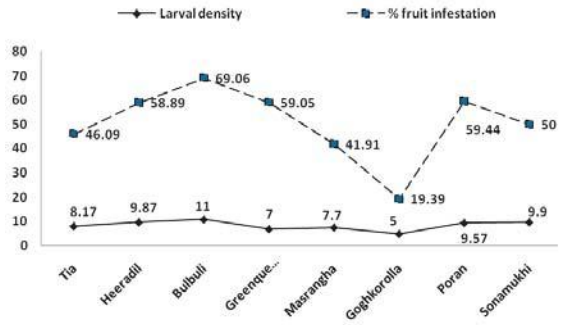

Fig. 2. Larval density and percent fruit infestation at early fruiting stage of eight bitter gourd varieties

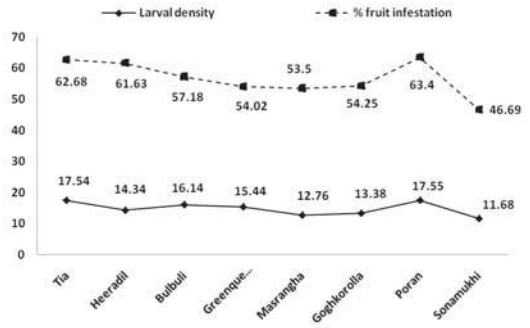

Fig. 3. Larval density and percent fruit infestation at mid fruiting stage of eight bitter gourd varieties

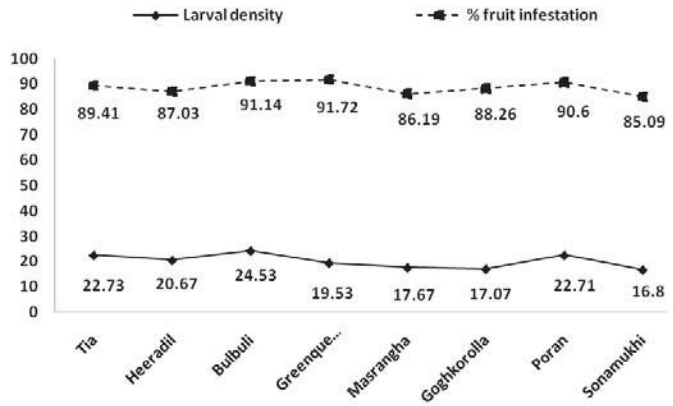

Fig. 4. Larval density and percent fruit infestation at late fruiting stage of eight bitter gourd varieties

From the above finding it is clear that different larval density were found at early, mid and late fruiting stages in tested bitter gourd varieties. The present results were comparable to those reported by Dhillon *et al*. (2005), Thakur *et al*. (1994 & 1996) and Tewatia *et al*. (1997) who reported significant differences in the genotypic susceptibility of fruit infestation and larval density of melon fruit fly in different bitter gourd genotypes. Little variations might be attributed due to environmental factors or genetically induced physiological and biochemical variations in plant traits (Misirli *et al*. 2000, Siemens *et al.* 2002, Goncalves-Alvim *et al*. 2004).

The present results also revealed that the percent fruit infestation proportionally increased with the increased of larval density. Percent fruit infestation and larval density were found significantly lower in totant varieties and higher in susceptible varieties of bitter gourd. These results are in agreement with those of Dhillon *et al*. (2005). They opined that a significantly lower percentage of fruit infestation and larval density per fruit were found in wild genotypes (tolerant) while higher in cultivated genotypes (susceptible) of bitter gourd. So far, no literature on the resistance or susceptibility of tested bitter gourd varieties against cucurbit fruit fly is available in the country; hence these results cannot be compared or correlated with any research report.

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