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HOST PREFERENCE OF RED PUMPKIN BEETLE, *Aulacophora foveicollis* LUCAS (CHRYSOMELIDAE: COLEOPTERA) AMONG DIFFERENT CUCURBITACEOUS VEGETABLES

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Abstract

Study on the host preference of red pumpkin beetle (RPB), *Aulacophora foveicollis* (Lucas) on eight cucurbits viz. pumpkin (*Cucurbita moschata*), wax gourd (*Benincasa hispida*), bottle gourd (*Lagenaria siceraria*), cucumber (*Cucumis sativus*), snake gourd (*Trichosanthes cucumerina*), ridge gourd (*Luffa acutangula*), sponge gourd (*Luffa cylindrica*) and bitter gourd (*Momordica charantia*) was carried out under open field condition at Sher-e-Bangla Agricultural University (SAU), Dhaka during the Kharif-1 season from March 2012 to June 2012. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Data collection was based on damage of infested cotyledon (%), number of infested plants pit^{-1}, number of infested leaves plant^{-1}, and damage of infested flowers (%). RPB as a host suitability among the studied cucurbitaceous vegetables affected significantly on the all determined parameters except number of infested plants pit^{-1} throughout the data recording period. Among the cucurbits, pumpkin recorded the maximum damage of infested cotyledon (31.67 and 45.00%) than that of all other cucurbits at 4 and 9 days after sowing (DAS), respectively, where all plants of pumpkin in each pit (2.0) was infested by RPB. Leaf infestation by RPB were sharply increased from initial stage to full-vegetative stage irrespective of cucurbit species, and pumpkin recorded the maximum infestation during the study. Similarly, damage percentage of infested flower plot^{-1} was highest (27.33%) in pumpkin. Among all parameters, bitter gourd showed the least preference due to its high deterrence to RPB. Above exploration, it could be wrapped up that pumpkin would be highly preferred and bitter gourd would be least preferred to RPB among the tested cucurbits. Such investigations may potentially contribute towards devising an IPM strategy for RPB on cucurbits.

Keywords: Host preference, *Aulacophora foveicollis*, cucurbit

Introduction

Cucurbits, the most widely cultivated and important crops, are grown in all tropical and subtropical countries of the world. The family Cucurbitaceae, a vine crop family, includes about 118 genera and 825 species (Khan et al. 2015). In Bangladesh, major vegetables grown in summer are cucurbits (Khan et al. 2012). Cucurbits, in general, attract a number of pests like chrysomelid beetles, aphids, fruit flies, caterpillars, stink bugs and non-insect pests like mites (Gowda et al. 1995). Of these, red pumpkin beetle (RPB), *Aulacophora foveicollis* (Lucas) is said as a common and major pest of a wide range of cucurbits, especially sweet gourd, bottle gourd, sponge gourd, white gourd, water melon and musk melon. It is one of the most important constraints to cucurbit production capable of 30-100% yield loss (Dhillon et al. 2005). It is polyphagous in nature and widely distributed in Asia, Australia, Southern Europe and Africa (Atwal and Dhaliwal, 2005). Both larval and adult stages are injurious to the crop and cause substantial damage to almost every stage of cucurbits especially the seedling stage is subjected to intense damage by this pest which occurs throughout the year (Rahaman and Prodhan, 2007; Rahaman et al., 2008, Rajak, 2001). It feeds underside the cotyledonous leaves by biting holes into them (Chandravadana and Pal, 1983). Percent damage rating of leaves are quite evident ranged from 70-15%, which gradually decreases to lower value as leaf canopy increases (Saljoqi and Khan, 2007; Yamaguchi, 1983). The adult beetles feed on the leaves insatiably making irregular holes and also attack the flowers and flower buds (Butani and Jotwani, 1984). But the larvae feed on root tissue and cause direct damage to the newly developed seedlings. The

larval stage of the pest also does considerable damage as it bores into the root tissues and cause direct damage to the newly developed seedlings (Atwal and Dhaliwal, 2005). The larvae even infest the fruits touching the soil and thus making such fruits unfit for human consumption.

Damage sometimes becomes very severe if it is not controlled timely. At the advent of spring the beetles defoliate the cucurbit seedlings to such an extent that sometimes the crop has to be resown for 3 to 4 times (Mahmood et al., 2005; Parsad and Kumar, 2002). It makes the growers late marketing of the vegetables as well as lessen their income.

Currently the use of insecticides is the sole mean of controlling red pumpkin beetle. Use of broad spectrum insecticides has not only aggravated the management, but has also created several adverse effects such as outbreak of secondary pests, pest resistance, and health hazards (Bhaduri et al. 1989). There has always been a search for alternative and environment- friendly methods of pest control viz., biological control programs, physical and genetic control techniques. Successful incorporation of these control components into a pest management strategy requires an adequate knowledge on population dynamics and host plant preference of pest under varied agro-climatic conditions.

There are varying degrees of physical and chemical factors of resistance among different cucurbits which affect directly or indirectly to the red pumpkin beetle population and infestation (Mehta and Sandhu, 1992). Some of them are very much preferred than the others. If we utilize most preferred one as a trap or a barrier crop then the target crop may escape infestation and avoid destruction by this menacing insect pests. The act of attraction for a particular plant is called host preference i.e., an acceptance of a host plant by an insect pest relative to other acceptable hosts. Therefore, it needs to identify the least and the most preferred cucurbits to red pumpkin beetle.

A number of researchers has carried out different experiments on the numerous factors relating to host preference of red pumpkin beetle among various cucurbits (Khan, 2011; Khan et al. 2012; Mandal, et al. 2012; Rathod and Borad, 2010; Sheikh et al. 2013). But unfortunately, information on abundance and host preference of this pest is not sufficient. Taking into account the above facts, the present study was conducted to evaluate the comparative damage caused by red pumpkin beetle on different cucurbitaceous vegetables and to ascertain the order of preferred host of the red pumpkin beetle among different cucurbits.

Materials and Methods

The study on host preference of red pumpkin beetle *Aulacophora foveicollis* (Lucas) was carried out on eight different cucurbits i.e., pumpkin (*Cucurbita moschata*), wax gourd (*Benincasa hispida*), bottle gourd (*Lagenaria siceraria*), cucumber (*Cucumis sativus*), snake gourd (*Trichosanthes cucumerina*), ridge gourd (*Luffa acutangula*), sponge gourd (*Luffa cylindrica*), and bitter gourd (*Momordica charantia*) in the research field of Sher-e-Bangla Agricultural University (SAU), Dhaka from March to June 2012. Seeds of all cucurbits were collected from Bangladesh Agricultural Development Corporation (BADC), Jessore.

The open field experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications. The whole experimental plot was divided into 3 equal blocks where eight plots were in each block. Thus, there were 24 (8×3) unit plots altogether in the experiment. The eight treatments were randomly distributed within the block. The size of the unit plot was 3.0 m × 2.5 m with an inter-block distance of 1.5 m and inter-plot distance 1.0 m to facilitate different intercultural operations. Three circular raised pits were dug in each plot at a distance of 1 m between pits. Seeds were sown on 06 March 2012 in two holes of each pit by hand.

Data were recorded on % infested cotyledons, number of infested plants pit^{-1}, number of infested leaves plant^{-1} and % infested flowers for each treatment. Data on aforementioned parameters were recorded at 5 days interval which was started from 4 days after sowing (DAS) and continuing up to 64 DAS. In case of parameters of number of infested leaves plant^{-1} and % infested flowers, one plant per pit of each replication was selected and tagged for ease of data-recording.

The data collected on different parameters were analyzed by using a statistical package program MSTAT-C. The mean values were ranked by Duncan's Multiple Range Test (DMRT) at 5 % level of significance (Gomez and Gomez, 1984).

Results and Discussion

Percent damage of infested cotyledon

Red pumpkin beetle attacking cucurbit seedlings were counted and computed regarding percent damage of infested cotyledon at 4 and 9 days after sowing (DAS) where mean values were significantly influenced by RPB. Data on 4 DAS were ranged from 6.67 to 31.67% (Fig. 1). It was found that the maximum damage of red pumpkin beetle infested cotyledon (31.67%) was observed in pumpkin which was statistically close to the damage in that of bottle gourd (26.67%). Among other cucurbits, wax gourd, cucumber, snake gourd, ridge gourd, and sponge gourd showed moderate level of percent damage infestation ranged from 10.00 to 21.67% which were statistically similar with each other. The lowest percent damage infestation was recorded from bitter gourd (6.67%).

There was a gradual increase in percent damage of infested cotyledon by RPB at 9 DAS in all cucurbits. Percent damage trend varied significantly among all cucurbits with the time interval (Fig. 1). Among the all cucurbits, the highest damage of cotyledon (45.00%) was observed in pumpkin while successively bottle gourd, wax gourd and cucumber recorded the statistically identical percent damage of cotyledon (40.00, 36.00 and 35.00%, respectively). On the other hand, snake gourd, ridge gourd, sponge gourd and bitter gourd were statistically same in respect of percent damage of cotyledon by RPB attack (25.00, 23.33, 19.00 and 15.00%, respectively).

These results revealed that the variation in cotyledon infestation among the cucurbits was found due to the degrees of preference of host by RPB. These results also showed that the pumpkin was the most preferred and bitter gourd was the least preferred host for red pumpkin beetle among the cucurbits under this field condition.

These results were in conformity with those reported by Khan (2012) who reported that bitter gourd showed the least preference of RPB among ten tested cucurbits and the order of preference of RPB was muskmelon> sweet gourd> cucumber > khira > ash gourd > bottle gourd > sponge gourd ≥ ribbed gourd ≥ snake gourd > bitter gourd. The result of the present study was in agreement with the findings of Hasan (2012), Kamal et al. (2014), and other researchers of home and abroad where they reported that the bitter gourd showed the least suitable host of RPB.

Number of infested plants pit^{-1}

Mean number of RPB-infested plants of cucurbit per pit per treatment were recorded 13 times at 5 days interval started from 4 to 64 DAS (Table 1). The number of infested plants pit^{-1} during all the determined periods of the study did not vary significantly among the tested cucurbits. These results revealed that all the plants of cucurbit were statistically similarly infested by RPB which indicated that all the cucurbits were similar host preference of red pumpkin beetle. However, the highest number of infestation was noticed on pumpkin among cucurbitaceous vegetables while bitter gourd showed the lowest number of infestation at every data recording stage during study.

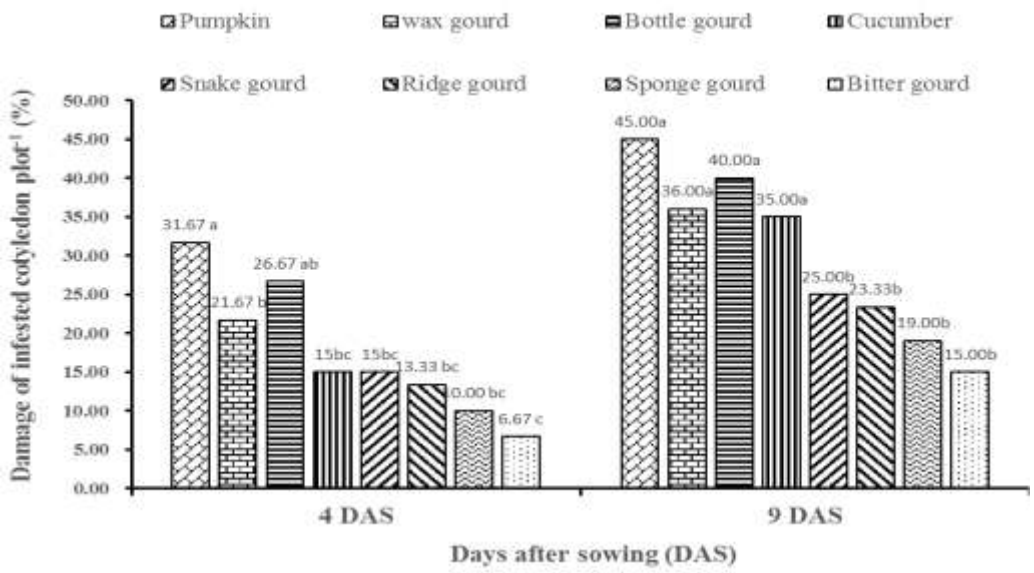

Figure 1. Effect of different cucurbits as host plant of red pumpkin beetle on percent damage of infested cotyledon plot^{-1} at 4 and 9 days after sowing (DAS)

Table 1. Effect of different cucurbit as host plant of red pumpkin beetle on number of infested plants plot^{-1} at different days after sowing (DAS)

Name of cucurbit	Number of infested plants plot^{-1} at different days after sowing (DAS)												
	4	9	14	19	24	29	34	39	44	49	54	59	64
Pumpkin	1.33	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Wax gourd	0.67	1.00	1.33	1.00	1.33	1.33	1.33	1.33	1.33	1.33	1.67	1.67	1.67
Bottle gourd	0.67	1.33	1.67	1.33	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Cucumber	0.67	1.00	1.33	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Snake gourd	1.33	1.00	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
Ridge gourd	0.67	1.00	1.00	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Sponge gourd	0.33	1.00	1.00	1.00	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
Bitter gourd	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE(±)	0.11	0.10	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
$LSD_{(0.05)}$	0.82	0.60	0.76	0.58	0.73	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.72
Level of sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Note: NS=Not significant

Number of infested leaves plant^{-1}

Number of the infested/damaged leaves was counted manually present on the tagged plant of each pit of each plot throughout the growing season. It was recorded from 14 to 64 DAS at 5 days interval (Table 2). It is clearly evident that number of infested leaves plant^{-1} by RPB was increased with the increase of study period as the plant's canopy size proliferates subsequently from cotyledonary to true leaf to flowering stage. Results revealed that lowest number of infested leaves on mean basis was recorded in bitter gourd while the maximum preference went to pumpkin resulted in the highest number of leaf infestation at different days after sowing. Data presented in this table (Table 2) also revealed that the listing of the comparative host preferences on the basis of leaf infestation of RPB among the cucurbits was; pumpkin> bottle gourd> wax gourd>

cucumber> snake gourd> ridge gourd> sponge gourd> bitter gourd.

The result supported the previous similar works done by Khan et al. (2011). Khan (2012), in his another work in field also found sweet gourd in the most vulnerable group and bitter gourd in the non-preferred group by the red pumpkin beetle which agrees with the present study. Similar trend of results also obtained on host preference by Hassan et al. (2012). Three selected varieties from Cucurbitaceae family were cultivated in the field. Results showed that sweet gourd was most preferred as compare of bottle gourd by the RPB and bottle gourd was more preferred as compare with bitter gourd. Chandravadana and Pal (1983) documented that triterpinoid glucoside extracted from bitter gourd acts as feeding deterrent to RPB.

Percent damage of infested flower plot^{-1}

Percent damage of infested flower data was recorded and calculated after flowering at 54 DAS onward till 64 DAS where data were significantly influenced among the different host plants of cucurbit on the basis of host preferences of RPB (Fig. 2). The damage of RPB was counted by counting the damaged flower over total flowers of selected plant per pit. The results on mean percentage of infested flower damage ranged from 13.33 to 27.33% which might significantly reduced the fruit yield (Fig. 2). In this figure, the highest percentage of flower damage plot^{-1} (27.33%) was observed in pumpkin followed by wax gourd and bottle gourd (25.00%) and the values were statistically identical with each other. Among other cucurbitaceous plants, both bitter gourd and sponge gourd showed the least suitability to RPB (13.33%). Medium preference was observed in cucumber, ridge gourd and snake gourd and they were statistically similar. These results revealed that pumpkin is the most preferred host to RPB than that of other cucurbitaceous plant while the lowest preference was recorded in bitter gourd.

The host preferences of *A. foveicollis*, was also conducted by Singh et al. (2000) where data on density of red pumpkin beetles per leaf and percentage infestation on the vines, leaves and flowers of cucurbits were made every morning. They proved that host preferences of RPB ranked bitter gourd (*M. charantia*) as least preferred and long melon (*Cucumis utilissimus*) as highly preferred and watermelon as the favourite host. Karim (1992) also reported the similar observation where RPB found to be killed entirely with leaves, flower and fruits due to severe damage of underground roots by the grubs of the RPB.

Table 2. Effect of different cucurbits as host plant of red pumpkin beetle on number of infested leaves plant^{-1} at different days after sowing (DAS)

Name of cucurbit	Number of infested leaves plant^{-1} at different days after sowing (DAS)										
	14	19	24	29	34	39	44	49	54	59	64
Pumpkin	4.33 a	7.00 a	7.67 a	8.67 a	9.67 a	11.00 a	12.67 a	13.67 a	15.33 a	15.67 a	17.00 a
Wax gourd	3.33 ab	6.67 a	8.00 a	8.67 a	8.67 ab	8.00 bcd	11.00 abc	13.00 ab	15.00 ab	15.33 ab	16.33 ab
Bottle gourd	4.00 a	6.67 a	7.33 a	8.00 a	9.33 a	10.33 ab	11.33 ab	13.00 ab	15.00 ab	15.33 ab	16.67 ab
Cucumber	1.67 bc	4.33 b	4.00 b	6.33 ab	7.00 abc	9.67 abc	9.00 bcd	10.00 abc	12.67 abc	13.67 abc	13.67 bc
Snake gourd	1.67 bc	4.00 b	4.67 b	5.33 b	6.00 bc	7.33 cd	9.33 bcd	10.67 abc	11.33 bc	12.33 bc	12.67 c
Ridge gourd	1.67 bc	4.00 b	4.67 b	5.00 b	6.33 bc	7.00 cd	8.00 cd	9.67 bcd	11.33 b	12.67 abc	12.33 c
Sponge gourd	1.00 c	4.00 b	4.33 b	5.00 b	5.67 c	7.00 cd	8.33 bcd	9.33 cd	11.00 c	12.00 c	12.33 c
Bitter gourd	1.00 c	3.67 b	4.00 b	4.33 b	5.67 c	6.67 d	7.67 d	8.67 d	11.00 c	12.00 c	12.33 c
SE(±)	0.27	0.30	0.34	0.37	0.35	0.36	0.38	0.44	0.48	0.40	0.47
LSD $_{(0.05)}$	0.84	1.16	1.14	1.31	1.45	1.54	1.65	2.30	2.91	2.46	2.50

Note: In a column, means followed by same letter(s) are statistically identical by DMRT at 5% level of significance.

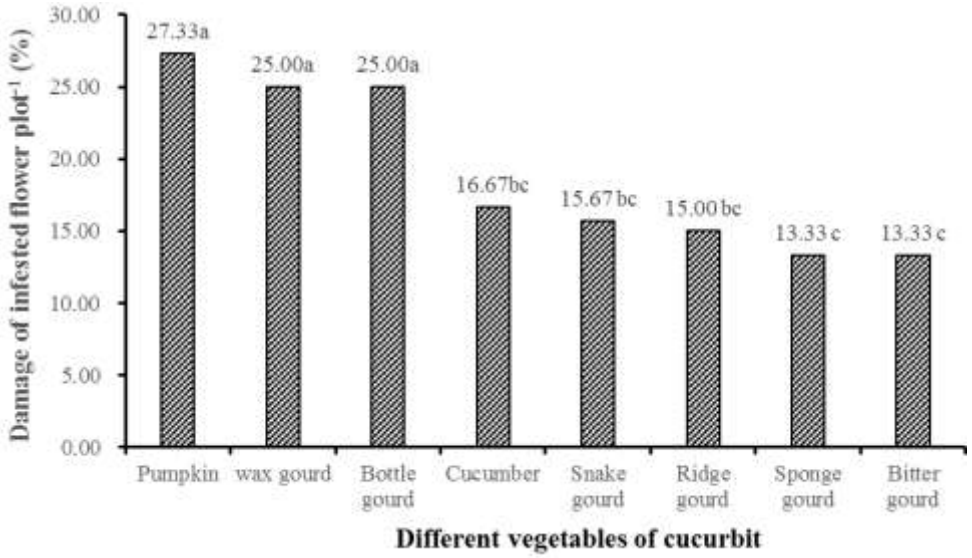

Figure 2. Effect of different cucurbits as host plant of red pumpkin beetle on percent damage of infested flower plot^{-1}

Conclusion

From the above research it could be summarized that there is a significant variation for host preference of red pumpkin beetle among different cucurbits. The most preferred host of red pumpkin beetle was pumpkin and was graded as the most susceptible host. Bitter gourd was least or non-preferred hosts of red pumpkin beetle and these may be graded as resistant hosts. This finding provides an insight towards damage-extent of red pumpkin beetle on cucurbits which will be useful in conducting future research on the ecofriendly and sustainable management of the pest.

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