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Research Article

HOST PREFERENCE OF EPILACHNA BEETLE, EPILACHNA DODECASTIGMA (WIED.) AMONG CUCURBITACEOUS VEGETABLES

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Abstract

A series of experiments were carried out at the field and laboratory of the Department of Entomology, Bangladesh Agricultural University to determine the host preference of Epilachna beetle, *Epilachna dodecastigma* (Wied.) among four cucurbitaceous crops viz. cucumber, bottle Gourd, sweet Gourd and bitter Gourd. Three varieties of each crop were tested. Data on insect incidence, infestation, food consumption and fecundity of *E. dodecastigma* were collected. The highest number of Epilachna beetle was recorded on cucumber and the lowest was on bottle Gourd both in open field and in net cage condition. Among the varieties, the highest insect incidence was recorded on Sitol Sosa and the lowest was on BARI Lau-4 both in open field and in net cage. The highest leaf and twig infestation was found on cucumber crop and its' Sitol Sosa variety, while the lowest was on bottle Gourd crop and its' BARI Lau-4 variety in both open field and in net cage. The Epilachna beetle showed the similar host preference in case of daily food consumption and oviposition rate both in net cage and laboratory condition. Thus, considering the insect incidence, infestation, food consumption and fecundity, the crop cucumber and the tested Sitol Sosa variety appeared to be the most preferred host for Epilachna beetle.

Keywords: Host; Preference; *Epilachna dodecastigma*; Cucurbit; Vegetable.

Introduction

Cucurbits include all Gourds are one of the most important vegetables in Bangladesh mainly cultivated in summer season. The agro-ecological condition of Bangladesh is highly favourable for the cultivation of cucurbitaceous vegetables. The constraints to sustainable increased productivity of cucurbitaceous vegetables are many. Among the constraints, incidence of insect pests is the major one. Cucurbits are severely affected by Epilachna beetle, Red Pumpkin beetle, Cucurbit Fruit fly etc. Among them, Epilachna beetle is the most devastating pest causing significant damage may up to 80% of the host plants depending on location and season (Rajagopal and Trivedi, 1989).

Two species of Epilachna beetle viz., *E. dodecastigma* (Wied.) and *E. vigintioctopunctata* (Fab.) are the serious pests of cucurbits in Bangladesh. Among them, *E. dodecastigma* is fairly common and causes damage to the solanaceous and cucurbitaceous crops (Khan *et al.*, 2000). It is widely distributed in South and East Asia, Australia, America and the East Indies (Hossain *et al.*, 2009).

Both grubs and adult beetles cause damage to the plants. Infestation primarily begins just after hatching of egg mass (Murata *et al.*, 1994). The grubs start their feeding gregariously and later dispersed to the next plants. The grubs feed on the lower epidermal layer of leaves whereas the adults feed irregularly upon the upper surface of leaves by scraping resulting net like appearance. Sometimes it is called a leaf scrapping coccinellid beetle (Imura and Ninomiya, 1978). The third and fourth instars of grubs are most destructive. An infested leaf becomes brown in colour, dries up and finally defoliated (Pradhan *et al.*, 1990). Consequently, vegetative growth and development of the plants are harmed causing significant reduction of their yields (Alam, 1969; Rajagopal and Trivedi, 1989).

For the effective management, a fair knowledge on host plant preference based on its feeding and oviposition behaviour is urgently needed. Therefore, the present study was carried out to find out the suitable host of Epilachna beetle in Bangladesh context based on the insect incidence, food consumption, fecundity and oviposition behaviour.

Materials and Methods

Experimental layout and field experiment

The field experiments were laid out in a Randomized Complete Block Design (RCBD) with 3 replications. The field was divided into 36 plots of each 2.35m × 2.35m size. Distance of 1m between blocks and 07m between the plots was kept to facilitate different intercultural operations.

Quality seeds of bottle gourd (BARI Lau-4, BARI Lau-3, Local Bottle gourd), bitter Gourd (Taj Korola-88, BARI Karola 1, Local Bitter Gourd), sweet gourd (BARI Misti Kumra-1, BARI Misti Kumra-2, Local Sweet Gourd) and cucumber (Local Cucumber, Sitol Sosa, Boro Sosa) were collected from Bangladesh Agriculture Research Institute, Gazipur and from Mymensingh town, Bangladesh. The seedlings were developed in poly bags. Fifteen days old seedlings were transplanted to the main field. All recommended standard horticultural practices were performed. Bamboo creeping was made allowing easy creeping and preventing the plant from lodging.

Mass culture of the Epilachna beetle

The adult beetles were collected from the field, brought to laboratory and paired in separate petridish (15cm diameter). Fresh and healthy leaves of different vegetables were provided everyday as food. After egg laying, adult beetles were removed for uninterrupted hatching. After hatching, the grubswere transferred in several petridishes. Ten larvae per petridish were reared up to adult emergence. Adult obtained from the mass culture was used for net and laboratory experiments.

Incidence of the Epilachna beetles in the field and net cage condition

The incidence of Epilachna beetles was determined on the basis of the number of the beetles and larvae per plant. The number of beetles and larvae were counted at 30, 60 and 90 days after transplanting. Pooled mean for the four crops viz. sweet Gourd, bottle Gourd, bitter Gourd and cucumber as well as the mean value of three varieties of each crop was calculated. Twelve varieties of four cucurbits with three replication of each were grown in the earthen pots were enclosed with mosquito net. Sixty beetles were released in each cage and the number of insects per plant at 6, 12 and 18 day after release in net cage was recorded. Mean population for each crop and varieties were calculated by the procedures followed for field condition mentioned above.

Percentage of leaf and twig infestation in the field and net condition

Total number of leaf and twig and number of infested leaf and twig was recorded at ten days interval. Thereafter, mean percentage of infested leaf and twig at seedling stage, mature stage and fruiting stage were calculated for the each crop and respective varieties. In net cage, same kinds of data were recorded at two days interval and mean percentage infestation per day for the each crop and respective varieties were calculated.

Food consumption in net cage and laboratory condition

Food consumption of *E. dodecastigma*was estimated. The leaf area (mm^2) consumed on each variety was recorded at 2 days interval for twenty days in net cage by using square millimeter graph paper. Finally total consumed area and daily average consumed leaf area on each variety was calculated. Food consumption was also estimated in laboratory by placing adult beetles individually in each petridish to feed upon leaves of twelve varieties of four cucurbits. Fresh leaves were supplied daily. Wet cotton was used to keep adequate humidity inside the petridishes. The weight loss of consumed leaf was determined daily up to seven days by using electric balance and finally amount of consumed leaf per day was calculated in percentage.

Fecundity

Fecundity was calculated only in net cage condition by releasing thirty pairs of adult Epilachna beetles. The fecundity was determined by counting the total number of eggs found per host plant laid by the beetles for up to twenty days. Finally, mean no for each crop and varieties were then calculated.

Data analysis

Data from different experiments were analyzed using a statistical package program MSTAT-C. The mean values were ranked by Duncan's New Multiple Range Test (Duncan, 1955).

Results

Incidence of Epilachna beetle in field and net cage condition

The mean number of the Epilachna beetles recorded on each crop and variety is presented in Fig. 1A and 2. At 30 DAT, the maximum number of insects was found on cucumber (4.33) followed by sweet gourd (3.22), bitter gourd (2.0) and the minimum were recorded on bottle gourd (0.77). Thus, according to incidence, the ranked order of the host preferred by Epilachna beetle was as follows cucumber> sweet gourd> bitter gourd> bottle gourd. Same ranking on host preference was observed at 60 and 90 DAT (Fig. 1A).In all crops tested, maximum numbers of beetles were recorded at 60 DAT.

Incidence of the beetles on twelve varieties is presented in Fig. 2 and found that number varied significantly at 30 DAT, 60 DAT and 90 DAT. At 30 DAT, the highest number of insects was found on variety Sitol Sosa (4.66) and the lowest number of insect found on BARI Lau-4(0.33). Thus, the ranked order of the preferred variety by Epilachna beetle was as follows:Sitol Sosa>Local cucumber>Boro Sosa and the ranked order of less preferred variety was as follows BARI Lau-4>BARILau-3>Local Bottle Gourd. Same order on host preference was observed at 60 and 90 DAT (Fig. 2)

In the net cage, the highest insects per plant were found on cucumber and the lowest number was recorded on bottle gourd (Fig. 1B). Thus, in net cage condition, the Epilachna beetle showed same preferences as observed in field condition.

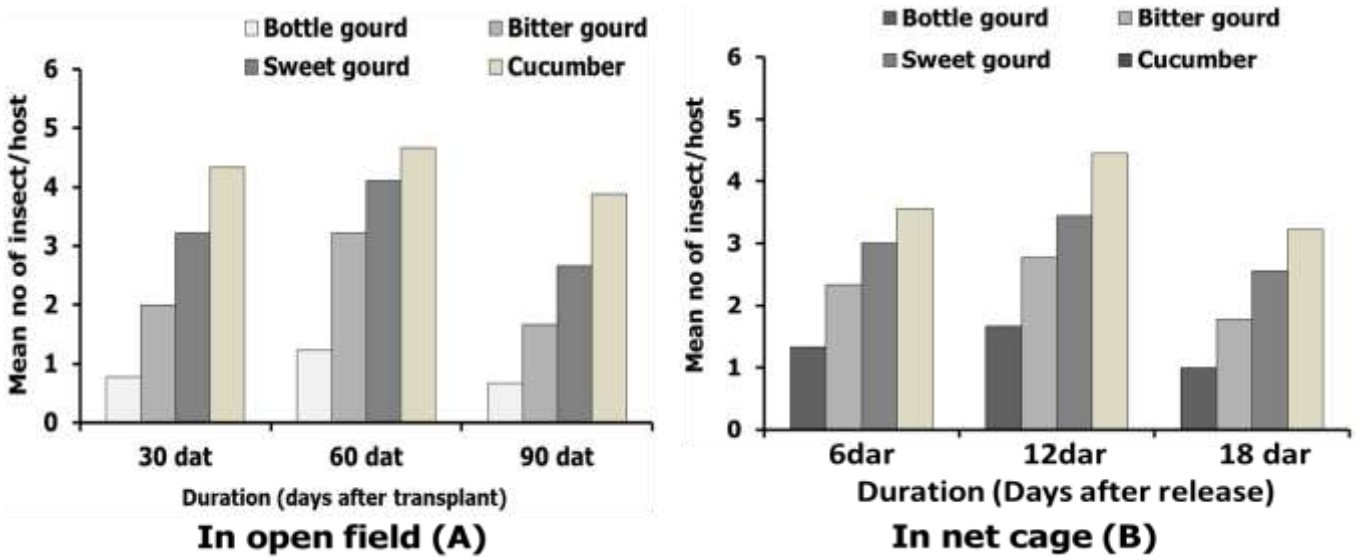

Fig 1: Incidence of Epilachna beetle (mean number) on four different cucurbitaceous crops at 30 DAT, 60 DAT and 90 DAT in open field (A) and at at6 DAR, 12 DAR and 18 DAR in net cage (B) condition.

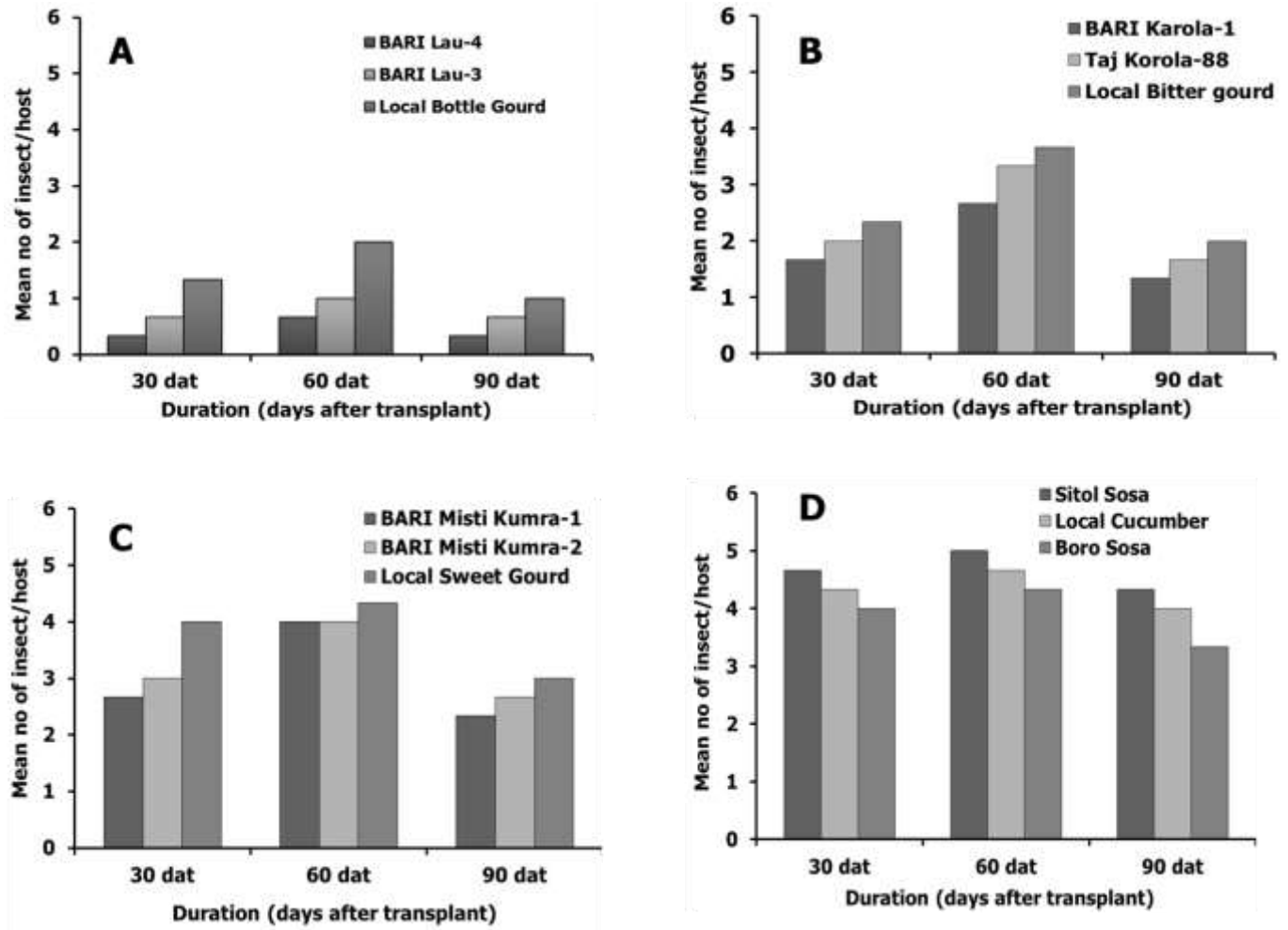

Fig. 2: Incidence of Epilachna beetle on each three varieties of bottle gourd (A), bitter gourd (B), sweet gourd (C) and cucumber (D) crop at 30 DAT, 60 DAT and 90 DAT in field.

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Percentage of leaf and twig infestation in the field condition

Among the crops

The leaf and twig infestation caused by Epilachna beetle on different cucurbit crops is presented in Table1.

It was found that there were significant variations in leaf and twig infestation on different cucurbits. Among the crops, at mature stage, leaf and twig infestation percentage was the highest on cucumber, followed by sweet gourd and lowest infestation was on bottle gourd. So, the host preference rank based on leaf infestation was cucumber> sweet gourd> bitter gourd>bottle gourd. Similar preferences were also observed for other stages of the crops (Table 1). The Epilachna beetle, thus, mostly preferred the mature stage followed by seedling stage and least preferred is the fruiting stage for infestation.

Among the varieties

Percentage leaf and twig infestation varied significantly among the different cucurbit varieties are presented in Table 2. The varieties of the Cucumber crops showed the highest while bottle gourd varieties showed the lowest infestation percentage in all the three stages of the crops. At mature stage, the highest leaf and twig infestation was found on Sitol Sosa followed by local cucumber and Boro Sosa and the lowest infestation was on BARI Lau-4 followed by BARI Lau-3. Similar results also observed at fruiting and seedling stage of the crops (Table 2). Therefore, the crop varieties of Bottle Gourd are least and varieties of Cucumber are most preferable by Epilachna beetles. Other varieties were found as moderately preferable by the Epilachna beetle.

Table 1. Infestation percentage of leaf and twig of four cucurbit crops at different stages in field condition

Crop	Infested plant parts (%)					
	Leaf			Twig		
	Seedling stage	Mature stage	Fruiting stage	Seedling stage	Mature stage	Fruiting stage
Bottle Gourd	6.28^{c*}	7.97^{c}	4.83^{c}	4.74^{c}	6.78^{c}	3.10^{c}
Bitter Gourd	9.38^{b}	10.92^{bc}	8.44^{b}	10.03^{b}	11.65^{b}	8.43^{b}
Sweet Gourd	10.17^{b}	11.75^{b}	8.85^{b}	12.42^{b}	13.79^{ab}	12.18^{a}
Cucumber	18.22^{a}	19.78^{a}	17.26^{a}	13.29^{a}	15.89^{a}	12.45^{a}
LSD	**2.977**	**3.137**	**2.662**	**2.746**	**2.441**	**2.334**

*Means followed by common letters are not significantly different; Level of significance, P=0.01

Table 2: Leaf and twig infestation (%) on 12 varieties of four crops at different stages in field condition

Variety	Infested part of plant (%)					
	Leaf			Twig		
	Seedling stage	Mature stage	Fruiting stage	Seedling stage	Mature stage	Fruiting stage
Crop: Bottle Gourd						
BARI Lau-4	4.40^{g}	6.02^{f}	3.80^{h}	3.03^{d}	5.49	2.02^{d}
BARI Lau-3	6.66^{fg}	8.35^{ef}	4.05^{gh}	4.26^{d}	6.93	3.03^{d}
Local Bottle Gourd	7.79^{fg}	9.55^{de}	6.63^{fgh}	6.93^{c}	7.91	4.26^{d}
Crop: Bitter Gourd						
BARI Karola-1	6.55^{fg}	10.00^{de}	6.49^{fgh}	7.91^{c}	10.47	6.93^{c}
Taj Korola-88	9.47^{def}	10.36^{de}	8.03^{ef}	10.47^{b}	11.69	7.91^{c}
Local Bitter Gourd	12.13^{cd}	12.39^{cd}	10.79^{cde}	11.69^{ab}	12.78	10.47^{b}
Crop: Sweet Gourd						
BARI Misti Kumra-1	8.38^{ef}	10.44^{de}	6.83^{fg}	12.03^{ab}	13.53	11.69^{ab}
BARI Misti Kumra-2	10.37^{de}	10.74^{de}	8.83^{def}	12.44^{ab}	13.57	12.42^{ab}
Local Sweet Gourd	11.75^{cd}	14.07^{c}	10.89^{cd}	12.78^{a}	14.28	12.42^{ab}
Crop: Cucumber						
Sitol Sosa	21.66^{a}	22.17^{a}	21.33^{a}	13.57^{a}	16.22	13.57^{a}
Local Cucumber	18.56^{b}	19.30^{ab}	17.85^{b}	13.53^{a}	16.07	12.42^{ab}
Boro Sosa	14.44^{c}	17.85^{b}	12.59^{c}	12.78^{a}	15.37	11.35^{ab}
Level of significance	**0.01**	**0.01**	**0.01**	**0.05**	**NS**	**0.01**
LSD	**2.977**	**3.137**	**2.662**	**2.021**	**-**	**2.334**

*Means followed by common letters are not significantly different; Level of significance, P=0.01

Percentages of leaf and twig infestation in net cage condition

A significant variation in leaf and twig infestation on different cucurbitaceous crops were also found in the net cage condition as presented in Table 3. And the data recorded for the twelve varieties of four crops presented in Table 4.

Daily average leaf infestation percentage in net cage was the highest on cucumber (15.56%) followed by sweet Gourd (14.52%) and bitter gourd (10.51%) where the lowest on bottle gourd (5.75%).Infestation percentage of twigs also showed similar trend (Table 3).

Among the varieties average daily leaf infestation percentage varied significantly. Interestingly, statistically identical highest infestation was occurred on Sitol Sosa (16.61%) followed by Local cucumber (15.65%) varieties and Local sweet gourd (16.q3%) variety. On the other hand, the lowest infestation percentage was on BARI Lau-4 (4.83%) followed by BARI Lau-3 (5.99%) and local bottle gourd (6.43%). Twig infestation also followed similar observations.

Food consumption in net cage

In net cage, the quantity of total consumed leaf area was recorded at seedling stage of the four host plants and presented in Table 5. Food consumption varied significantly on the four cucurbit crops. As expected, the highest consumption was on cucumber and the lowest was on bottle Gourd.

Table 3. Percentage of leaf and twig infestation per day on four cucurbit crops in net cagecondition

Crop	Infestation percentage of leaf and twig per day	
	Leaf	Twig
Bottle Gourd	5.75^{c*}	3.64^{d}
Bitter Gourd	10.51^{b}	8.18^{c}
Sweet Gourd	14.52^{a}	11.86^{b}
Cucumber	15.56^{a}	15.58^{a}
LSD	2.308	2.477

*Means followed by common letters are not significantly different; Level of significance, P=0.01

Table 4: Percentages of leaf and twig infestation per day by Epilachna beetle on twelve varieties of four cucurbitaceous host plants in net cage

Variety	Infestation percentage of leaf and twig per day	
	Leaf	Twig
Crop: Bottle Gourd		
BARI Lau-4	4.83^{e*}	1.50^{g}
BARI Lau-3	5.99^{e}	3.96^{fg}
Local Bottle Gourd	6.43^{e}	5.45^{f}
Crop: Bitter Gourd		
BARI Karola-1	9.29^{d}	5.78^{f}
Taj Korola-88	10.92^{cd}	8.52^{e}
Local Bitter Gourd	11.32^{cd}	10.26^{de}
Crop: Sweet Gourd		
BARI Misti Kumra-1	12.60^{bc}	11.08^{de}
BARI Misti Kumra-2	14.83^{ab}	12.15^{cd}
Local Sweet Gourd	16.13^{a}	12.34^{cd}
Crop: Cucumber		
Sitol Sosa	16.61^{a}	17.03^{a}
Local Cucumber	15.65^{a}	15.52^{ab}
Boro Sosa	14.42^{ab}	14.17^{bc}
LSD	2.308	2.477

*Means followed by common letters are not significantly different; Level of significance, P=0.01

Table 5: Total leaf area (mm^2) consumption and total number of eggs laid by Epilachna beetle on four different cucurbit crops

Crop	Total leaf area consumption (mm^2)	Total number of eggs laid /Plant/20 days
Bottle Gourd	112.2[d*]	39.44 c
Bitter Gourd	2111[c]	54.56 bc
Sweet Gourd	2540[b]	68.78 b
Cucumber	2935[a]	107.20 a
LSD	215.2	22.40

*Means followed by common letters are not significantly different; Level of significance, P=0.01

Conversely, the total leaf area consumption on twelve different varieties of four cucurbitaceous crops was measured and presented in Table 6. Significant variation was observed among the varieties. Epilachna beetle showed same reactions to the different varieties as observed for leaf and twig infestation.

Food consumption in laboratory

In addition to net cage experiments, food consumption per Epilachna adult beetle was also recorded in laboratory on the basis of weight loss of consumed leaf and presented in Fig. 3. Similar to other parameters, highest food consumption by Epilachna beetle was observed by feeding on cucumber varieties which did not change over the seven days of feeding. Same trend was observed for sweet Gourd and bitter Gourd crop. The lowest food consumption by Epilachna beetle was observed by feeding on Bottle Gourd which showed an increasing trend of feeding from 4th day to the seventh day of feeding possible due to adaption of force feeding.

Similarly, food consumption per adult Epilachna beetle on the twelve varieties was also recorded. Weight loss of leaf due to beetle feeding is presented in Table 6. The highest weight loss was on variety of Sitol Sosa (17.13%) followed by local cucumber (16.81%) and the lowest weight loss on BARI Lau-4 (1.73%) followed by BARI Lau-3 (1.85%) and local bottle gourd (2.01%). Food preference of Epilachna beetle on different varieties of cucurbits might be due to variation in their morphological and chemical composition.

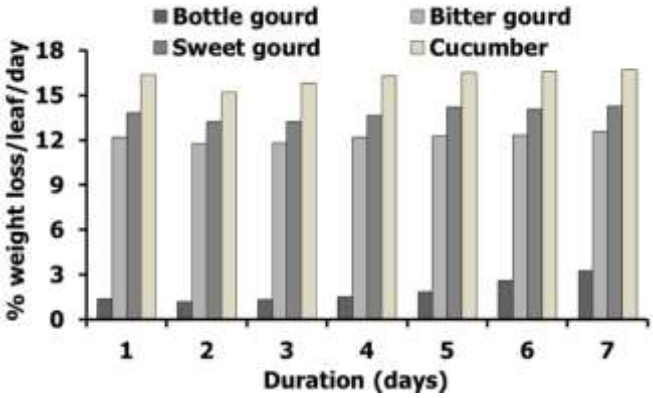

Fig. 3: Percentage of daily weight loss of leaf consumed by single adult Epilachna beetle on four different cucurbitaceous crops.

Oviposition preference of Epilachna beetle

The total number of eggs laid by the Epilachna beetle during the whole period on different host plant was counted and presented in Table 6. The highest number of eggs laid on cucumber and the lowest number of eggs laid on bottle gourd. The significant variation in egg laying on different host, might be due to variability in host choice and in food value of host plant leaves to the insects. Similar to the crops, the total number of eggs laid on different varieties was counted and presented in Table 6. The highest number of eggs laid on the variety Sitol Sosa (120) followed by local cucumber (113.33) and the lowest number of eggs found on BARI Lau-4 (35.33).

Table 6: Total leaf area (mm^2) consumption; daily percent weight loss of a leaf and total number of eggs laid by Epilachna beetle on twelve varieties of four cucurbit crops

Variety	Total leaf area consumption (mm^2)	Percent weight loss of a leaf /Day/adult beetle	Total number of eggs laid/Plant/20 days
Crop: Bottle Gourd			
BARI Lau-4	76.67[g*]	1.73[f]	35.33[e*]
BARI Lau-3	110.00[g]	1.85[f]	40.66[de]
Local Bottle Gourd	150.00[g]	2.01[f]	42.33[de]
Crop: BitterGourd			
BARI Karola-1	1896.66[f]	11.67[e]	51.00[de]
Taj Korola-88	2116.66[e]	12.20[de]	52.33[de]
Local Bitter Gourd	2320.00[de]	12.59[cd]	60.33[cd]
Crop:SweetGourd			
BARI Misti Kumra-1	2404.33[d]	12.67[cd]	62.66[cd]
BARI Misti Kumra-2	2531.00[cd]	13.37[c]	62.00[cd]
Local Sweet Gourd	2683.33[bc]	15.30[b]	81.66[bc]
Crop:Cucumber			
Sitol Sosa	3033.00[a]	17.13[a]	120.00[a]
Local Cucumber	2950.00[a]	16.81[a]	113.33[a]
Boro Sosa	2823.33[a]	14.67[b]	88.33[b]
LSD	**22.40**	**0.8266**	**22.40**

*Means followed by common letters are not significantly different; Level of significance, P=0.01

Discussions

The present study was undertaken to determine the suitable hosts of Epilachna beetle among four important cucurbitaceous vegetable. From our results it was clear that the cucumber was the most preferable crops and bottle Gourd was the least preferable crops to Epilachna beetle in both open field and net cages among selected crops in the experiment. Among twelve selected varieties, Sitol Sosa ranked highest and the BARI Lau-4 ranked lowest on all the parameters measured in both field and laboratory experiments. Thus, our data revealed that the crop cucumber and variety Sitol Sosa were the mostly preferable and crop bottle gourd and variety BARI Lau-4 were the least preferable to the Epilachna beetle.

The exact reason behind the high preference by Epilachna beetle on cucumber and less preference on bottle gourd was unidentified. In general, the preference of an insect to use plants as host and food is a very complex process. It is rarely depends on a single factor rather influenced by many factors such as odor, taste, vision, age of the plant, thickness of the leaves, proportion of crude fibre, parenchymatous tissue, water content, etc. (Katakura *et al.*,1989).

Chemical factors were found to be also responsible for such influence on feeding preference. Plants differing in their cyanogenic capacity affect the oviposition choices by *Epilachna varivestis* (Ballhorn and Lieberei, 2006). Methyl linoleate plays an important role in host selection of *E. vigintioctopunctata* (Endo *et al.*, 2004). In case of cucurbit crops which specifically contain cucurbitacins was reported to be acted as feeding stimulants for *E. admirabilis*, *E. boisduvali*, *E. vigintioctopunctata* and *E. vigintioctomaculata* (Abe and Matsuda, 2000). Besides, genetic variation among the individuals of *Epilachna pustulosa*infesting on host plants was also reported (Ueno *et al.*, 1997).

Based on our present results, further study is needed to analyze the chemical contents, especially cucurbitacins of the tested cucurbitaceous crops and its role on feeding behaviour of *Epilachna* species.

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References

Abe M and Matsuda K (2000) Feeding of four phytophagous lady beetle species (Coleoptera: Coccinellidae) to cucurbitacins and alkaloids. *Appl. Ent. Zool*. **35**: 257-264.DOI: 10.1303/aez.2000.257

Alam MZ (1969) Insect Pests of Vegetables and Their Control in East Pakistan. Agril. Inf. Serv., Dept. Agric., 3, R. K. Mission Road, Dhaka. 149p.

Ballhorn DJ and Lieberei R (2006) Oviposition Choice of Mexican Bean Beetle (*Epilachna varivestis*) Depends on Host Plants Cyanogenic Capacity. *J. Chem. Eco.* **32**: 1861-1865. DOI: 10.1007/s10886-006-9114-z

Endo N, Abe M, Sekine T and Matsuda K (2004) Feeding stimulus of solanaceae-feeding lady beetle, *Epilachna vigintioctopunctata* (Coleoptera: Coccinellidae) from potato leaves. *Appl. Ent. Zool*. **39**: 411-416. DOI: 10.1303/aez.2004.411

Hossain MS, Khan AB, HaqueMA, Mannan MA and DashCK(2009) Effect of different host plants on growth and development of Epilachna beetle. *Bangladesh J. Agril. Res*. **34(3)**: 403-410. DOI: 10.3329/bjar.v34i3.3965

Imura O and Ninomiya S (1978) Quantitative measurement of leaf area consumption by *Epilachna vigintioctopunctata* (Fabricius) (Coleoptera: Coccinellidae) using image processing. *Appl. Ent. Zool*. **33**: 491-495.

Katakura H, Shioi M and Kira Y (1989) Reproductive isolation by host specificity in a pair of polyphagous ladybird beetles. *Evolution*, **43**: 1045-1053. DOI: 10.2307/2409584

Khan MH, Islam BN, Rahman AKMM and Rahman ML (2000) Life table and the rate of food consumption of Epilaclina beetle, *Epilachna dodecastigma* (Wied.) on different host plant species in laboratory condition. *Bangladesh J. Ent*. **10(1-2)**: 63-70.

Murata M, Iwabuchi K and Mitsuhashi J (1994) Partial rearing of phytophagous lady beetle, *Epiachna vigintioctopunctata* (Coleoptera: Coccinellidae). *Appl. Entomol. Zool*., **29(1)**: 116-119.

Pradhan S, Jotwani MG and Prakash S (1990) Comparative toxicity of insecticides to the grub and adult of *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae). *Indian J. Ent*. **24(4)**: 223.

Rajagopal D and Trivedi TP (1989) Bioecology and management of Epilachna beetle, *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae) on potato in India. *Tropical Pest Managem. Entomol. Univ. Agril. Sci. Bangalore, India*. **35(4)**: 410-413.

Ueno H, FujiyamaN and Katakura H (1997) Genetic basis for different host use in *Epilachna pustulosa*, a herbivorous ladybird Beetle.*Heredity*.**78**:277-283. DOI: 10.1038/hdy.1997.42