Research in
ISSN : P-2409-0603, E-2409-9325
AGRICULTURE, LIVESTOCK and FISHERIES
An Open Access Peer Reviewed Journal

Open Access **Res. Agric. Livest. Fish.**
Research Article **Vol. 3, No. 3, December 2016: 411-416**

COMPARATIVE STUDY ON HOST PREFERENCE AND DAMAGE POTENTIALITY OF RED PUMPKIN BEETLE, *Aulacophora foveicollis* AND EPILACHNA BEETLES, *Epilachna dodecastigma*

Md. Mahbubur Rahman[1*] and Mohammad Mahir Uddin[2]

Department of Entomology, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

***Corresponding author:** Md. Mahbubur Rahman; E-mail: rahmanmm_ent@bau.edu.bd

ARTICLE INFO

Received
30.11.2016

Accepted
14.12.2016

Online
18 December 2016

Key words
Ridge gourd,
Bitter gourd,
Snake gourd,
Leaf infestation

ABSTRACT

Experiments were carried out in the field and in the laboratory of the Department of Entomology, Bangladesh Agricultural University during the period from February to August, 2013. Three cucurbitaceous vegetables viz. bitter gourd, ridge gourd and snake gourd were used as test crops. Considering to percent leaf infestation and leaf area consumptions, red pumpkin beetle was found mostly harmful to snake gourd (22.62% and 8.84%, respectively) but least harmful to bitter gourd (3.00% and 1.25%, respectively). On the other hand, Epilachna beetle was found mostly damaging to bitter gourd (46.00% and 21.67% respectively) and least damaging to ridge gourd (11.20% and 5.00%, respectively). Similar to the field experiments, red pumpkin beetle consumed more leaf areas of snake gourd (up to 43.36%) and Epilachna beetle (both adult and grubs) consumed more leaf areas of bitter gourd (up to 91.46%) in the laboratory experiments. Bitter gourd (1.42%) and ridge gourd (0.78% to 41.27%) were least preferable to the red pumpkin beetle and Epilachna beetle, respectively.

To cite this article: Rahman MM and MM Uddin, 2016. Comparative study on host preference and damage potentiality of Red pumpkin beetle, *Aulacophora foveicollis* and Epilachna beetles, *Epilachna dodecastigma*. Res. Agric. Livest., Fish., 3 (3): 411-416.

INTRODUCTION

Bangladesh is a country with sub-tropical climate, where cucurbits are most important vegetables principally grown in summer season. High incidence of insect pests is considered as the major and common constraint in the successful production of cucurbitaceous vegetables in Bangladesh. Cucurbits are severely attacked by a number of insect pests such as red pumpkin beetle, Epilachna beetle, cucurbit fruit fly, aphids, cucumber moth etc. Among them, Red pumpkin beetle and Epilachna beetle are two major pest infesting during the whole cultivating periods and may cause damage up to 80% of the host plants (Rajagopal and Trivedi, 1989).

Red pumpkin beetle is a polyphagous pest in nature feed voraciously on leaves, flower buds and flowers that may cause 30-100% losses in the field (Rashid et al., 2014). Both larval and adult stages of Red pumpkin beetle are injurious to the crop and cause severe damage to almost all cucurbits from the seedling stage (Rahaman and Prodhan, 2007). The adult beetles feed on the leaves making irregular holes and also attack the flowers and flower buds and larvae feed on root tissues (Guruswamy et al., 1995), stems and fruits touching to the ground. On the other hand, both grubs and adults of Epilachna beetle are damaging to the host plants. The grubs feed on the lower epidermal layer of leaves making concentric markings whereas the adults feed irregularly upon the upper surface of leaves by scraping resulting net-like appearance. Later on, the infested leaves become brown in colour, entirely dry up and defoliated (Pradhan et al., 1990). Consequently, vegetative growth and development of the plants are greatly harmed by Epilachna beetle causing significant reduction of their yields (Imura et al., 1978; Srivastava et al., 1998; Ghosh et al., 2001).

The most commonly used control method of Red pumpkin beetle and Epilachna beetle in Bangladesh is the application of chemical insecticides (Anonymous, 1994). But indiscriminate use of broad spectrum insecticides has not only complicated the management strategies, but has also created several adverse effects such as pest resistance, secondary pest outbreak (Hagen and Franz, 1973), health hazards (Bhaduri et al.,1989) and environmental pollution (Kavadia et al.,1984; Desmarchelier, 1985; Fishwick, 1988) etc. On the other hand, adequate knowledge on the feeding choice, damage potentiality of insects as well as host susceptibility can be effective tools in the development of sustainable management strategy of these insects. Moreover, the host preference and food consumptions of Red pumpkin beetle and Epilachna beetle can be useful for interpreting between them. However, comparative research findings of host preference and damage potentiality of Red pumpkin beetle and Epilachna beetle are not adequately available. Considering the above points, the present research was planned to ascertain comparative host preference, food consumption and damage potentially Red pumpkin beetle and Epilachna beetle.

MATERIALS AND METHODS

Experiments were conducted in field laboratory and in the laboratory, of the Department of Entomology, Bangladesh Agricultural University, Mymensingh during February to August 2013. In the field experiment, the land was ploughed with a power tiller and kept open to sunlight for few days. The land was then gradually ploughed and cross-ploughed for several times with a power tiller to obtain desirable tilth. All ploughing operations were followed by laddering for breaking up the clods and leveling the surface of the soil. All weeds and stubbles were removed from the field and finally, the unit plots were prepared as 10cm raised beds along with the addition of the manures and basal doses of fertilizers. The whole experimental field was divided into 9 equal plots (2m×2m) and one pit was prepared in the middle of each plot. Three cucurbitaceous vegetables such as bitter gourd, snake gourd and ridge gourd were used in the experiments with three replications of each. Before sowing, seeds were soaked overnight for proper germination. Three seeds were sown in each pit and one healthy seedling per pit was maintained through thinning at 7 days after germination. Each plant was supported by bamboo platform (bamboo *matchan*) for easy creeping and preventing from lodging. The seedlings were maintained following all recommended horticultural practices. Percent leaf infestation and leaf area consumption by both beetles and Epilachna grubs were used as a parameter for incidence and damage potentiality. Data were recorded at 10 days' interval started from one month age of the plants.

Comparative food consumption of Red pumpkin beetle, Epilachna beetle and Epilachna grubs were studied in the laboratory. Five Red pumpkin beetle, five Epilachna beetle and five Epilachna grubs, were released in separate petridishes containing three leaves (one leaf of each selected vegetables namely bitter gourd, snake gourd and ridge gourd). The set was replicated three times. The cut end of leaf petiole was covered with water-soaked cotton pad to prevent withering. Data on consumed leaf area by beetles and grubs were taken at daily basis and fresh leaves were replaced. Percent leaf area consumed (both in the field and in the laboratory) were calculated by using the following formula-

$$\% \text{ Leaf area consumed} = \frac{\text{Consumed leaf area}}{\text{Total leaf area}} \times 100$$

Where,

Consumed leaf area was measured by using millimeter graph

Total leaf area = L×B×K (Kalra and Dhiman, 1977)

L= length of leaf

B= Breadth of leaf and

K= Kemp's constant

Data obtained from different experiments were analyzed using a statistical package program SPSS20. The mean values were ranked by Duncan's Multiple Range Test (DMRT) at 5% level of probability.

RESULTS AND DISCUSSION

Percent leaf infestation in the field

The percent leaf infestation varied significantly among different vegetables at different counting (Table 1). At first counting, red pumpkin beetle caused the most leaf infestations of snake gourd (22.62%) where the minimum infestations were found for bitter gourd (9.43%) although ridge gourd (20.74%) and snake gourd were found statistically identical. On the other hand, Epilachna beetle infested maximum leaf of bitter gourd (46%) and a minimum of ridge gourd (11.2%). A similar phenomenon was found in the second counting where Red pumpkin beetle infested maximum leaves of snake gourd (23%) and a minimum of bitter gourd (3%). Again, Epilachna beetle infested maximum leaves of bitter gourd (39.91%) and a minimum of ridge gourd (14.79%). At third counting, Red pumpkin beetle infested more leaves of snake gourd (28.28%) than the leaves of ridge gourd and the least percentage of infestations were recorded on bitter gourd (5.76%). On the other hand, Epilachna beetle infested the least (18.48%) and the most (28.28%) percentage of leaves of snake gourd and bitter gourd respectively. At all three-consequent counting, snake gourd was most preferable and bitter gourd was found least preferable to the Red pumpkin beetle which agrees the observation of Hasan et al. (2012). In contrast, bitter gourd was found mostly preferable and the snake gourd was found least preferable to the Epilachna beetle.

Comparative leaf area consumption of Red Pumpkin Beetle and Epilachna Beetle in the field

Percent leaf area consumptions of beetles varied significantly on three cucurbits at different counting (Table 2). At first counting, Red pumpkin beetle consumed maximum leaf area of snake gourd (8.84%) where the minimum leaf area consumption by Red pumpkin beetle was recorded for bitter gourd leaves (5.50%) but the leaf area consumption in ridge gourd (6.84%) and snake gourd were statistically identical. On the other hand, maximum leaf area was consumed by Epilachna beetle was found in bitter gourd (11.17%) and minimum in ridge gourd (6.67%) although ridge gourd and snake gourd (14.3%) were statistically alike. Similarly, maximum leaf area was consumed by Red pumpkin beetle from snake gourd (6.93%) and the least was from bitter gourd (1.25%) where leaf area consumption in ridge gourd was found in between bitter gourd and snake gourd. Again, Epilachna beetle consumed the most leaf areas of bitter gourd (15.10%) followed by snake gourd (8.01%) and a minimumof ridge gourd (5.00%). Similar results were found at third counting, the maximum leaf area was consumed (21.67%) by Epilachna beetle and minimum leaf area consumed (3.50%) by Red pumpkin beetle from bitter gourd but the minimum (5.00%) leaf area consumed by Epilachna beetle from ridge gourd and maximum area consumed by Red pumpkin beetle (6.27%) from snake gourd. At all three-consequent counting, Red pumpkin beetle consumed maximum leaf area of snake gourd but a minimum of bitter gourd and this result

is also supported by the findings of Khan et al. (2011). Likewise, Rajak (2001) found bitter gourd as a non-preferable vegetable to the Red pumpkin beetle. On the contrary, Epilachna beetle consumed maximum and minimum leaf area from bitter gourd and ridge gourd, respectively.

Table1. Comparative percent leaf infestation by Red Pumpkin Beetle and Epilachna Beetle on different cucurbits in the field

Parameters	At 1st counting		At 2nd counting		At 3rd counting	
	Red pumpkin beetle	Epilachna beetle	Red pumpkin beetle	Epilachna beetle	Red pumpkin beetle	Epilachna beetle
Bitter gourd	9.43d	46.00a	3.00d	39.91a	5.76b	28.28a
Ridge Gourd	20.74b	11.20cd	20.70bc	14.79c	17.55a	20.93a
Snake Gourd	22.62b	14.30c	23.00b	17.93bc	18.28a	18.48a
$LSD_{0.05}$	3.867		6.27		11.19	

Different letters at same counting are significantly different.

Table 2. Comparative percent leaf area consumption by Red Pumpkin Beetle and Epilachna Beetle on different cucurbits in the field

	At 1st counting		At 2nd counting		At 3rd counting	
	Red pumpkin beetle	Epilachna beetle	Red pumpkin beetle	Epilachna beetle	Red pumpkin beetle	Epilachna beetle
Bitter gourd	5.50c	11.17a	1.25d	15.10a	3.50d	21.67a
Ridge Gourd	6.84bc	6.67bc	6.5bc	5.00c	5.84c	5.00cd
Snake Gourd	8.84b	8.07b	6.93b	8.02b	6.27c	9.55b
$LSD_{0.05}$	2.027		1.617		2.11	

Different letters at same counting are significantly different

Percent leaf area consumption by Red pumpkin beetle, Epilachna beetle and Epilachna grubs on different vegetables in the laboratory

The percent leaf area consumption by both insects varied significantly on different vegetables at successive counting in the laboratory. At first counting, the maximum consumed leaf was recorded for bitter gourd by Epilachna beetle (70.12%) and by Epilachna grubs (60.55%) but Red pumpkin beetle consumed maximum leaf area (43.36%) of snake gourd (Table 4). On the other hand, the small areas of leaves were consumed by Red pumpkin beetle, Epilachna beetle and Epilachna grub from bitter gourd (2.67%), snake gourd (7.38%) and from ridge gourd (1.51%) respectively. In the second counting, maximum leaf area consumption was recorded by Epilachna grub (91.46%) followed by Epilachna beetle (61.61%) in bitter gourd however Red pumpkin beetle consumed maximum leaf area of snake gourd (28.11%) leaves. Again, the minimum leaf area consumed by Epilachna grub (2.00%) and Epilachna beetle (4.17%) in ridge gourd followed by snake gourd but Red pumpkin beetle consumed bitter gourd (2.56%) leaves the least. At third counting, more leaf areas were consumed by Epilachna grub (20.76%), Epilachna beetle (38.50%) from bitter gourd leaves and minimum was consumed by Red pumpkin beetle (1.42%) from the same. However, maximum leaf area consumed by Red pumpkin beetle was found on snake gourd (15.15%) leaves but the minimum leaf area consumed by Epilachna grub and beetles from the ridge gourd (0.78%) and snake gourd (4.61%) leaves respectively. Therefore, at all three-successive counting, maximum leaf area was consumed by Epilachna beetle and Epilachna grubs from bitter gourd leaves

and by Red pumpkin beetle from snake gourd leaves. On the other hand, the least leaf area was consumed by Red pumpkin beetle, Epilachna grub and beetles from the leaves of bitter gourd, ridge gourd and snake gourd respectively.

Table 3. Comparative percent leaf area consumption by Red pumpkin beetle, Epilachna beetle and Epilachna grub on different vegetables in the laboratory

	At 1st counting			At 2nd counting			At 3rd counting		
	RPB	**EB**	**EB grub**	**RPB**	**EB**	**EB grub**	**RPB**	**EB**	**EB grub**
Bitter gourd	2.67c	70.12a	60.55ab	2.56d	61.61b	91.46a	1.42c	38.50a	20.76a
Ridge Gourd	9.68c	41.27b	1.51c	6.15d	4.17d	2.00d	2.96c	15.15bc	0.78c
Snake Gourd	43.36b	7.38c	3.36c	28.11c	17.52cd	14.48cd	15.15bc	4.61bc	15.46bc
$LSD_{0.05}$	22.91			15.84			14.97		

Different letters at same counting are significantly different; RPB= Red pumpkin beetle, EB= Epilachna beetle

Therefore, snake gourd followed by ridge gourd and bitter gourd were found mostly preferable vegetable to the Red pumpkin beetle which is supported by the observations of Singh et al. (2000); Sharma et al. (1999); Thapa and Neupane (1992). Kamal et al. (2014) also reported the bitter gourd as the lowest preferable to the Red pumpkin beetle. On the other hand, bitter gourd followed by snake gourd and ridge gourd were found mostly preferable vegetable to Epilachna beetle as well as to Epilachna grub which agrees the finding of Hossain et al. (2009) although it was contradictory to the finding of Rahman (2002). However, Bitter gourd was the most susceptible to pest infestation followed by snake gourd and ridge gourd. On the other hand, Epilachna beetle and grub were identified as damaging to the cucurbitaceous leaves than Red pumpkin beetle in both field and laboratory conditions.

ACKNOWLEDGEMENT

We would like to express our deepest sense of gratefulness to Department of Entomology, Bangladesh Agricultural University for providing space and facilities for conducting research in the departmental laboratory and in the field laboratory. We would like to give thanks to the official and laboratory staffs of the Department for their help and support.

REFERENCES

1. Anonymous, 1994. Annual Research Report (1993-94), Entomology Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur 132p.
2. Bhaduri M, DP Gupta, S Ram, 1989. Effect of vegetable oils on the ovipositional behaviour of *Callosobruchus maculatus* (Fab.). Proc. 2nd Int. Symp. On Bruchids and Legumes (ISLB-2) held at Okayama, Japan; 6-9 September pp. 81-84.
3. Desmarchelier YM, 1985. Bolivian of pesticide residues on stored grain, Aciar Prof. Series, Australian Centre for International Agricultural Research, 14: 19-29.
4. Fishwick RB, 1988. Pesticide residues in grain arising from post-harvest treatments. Aspects Applied Biology, 17: 37-46.
5. Ghosh SK, SK Senapati, 2001. Biology and seasonal fluctuation of *Henos Epilachna vigintioctocto punctata* Fabr. On brinjal under terai region of West Bengal. Indian Journal of Agricultural Research, 35: 149-154.
6. Guruswamy T, SR Desai, M Veerangouda, 1995. Host preference of pumpkin beetle, *Aulacophora foveicollis* (Lucas) (Coleoptera: Chrysomelidae). Karnataka Journal of Agricultural Sciences, 8: 246-248.

7. Hagen KS, JM Franz, 1973. A history of biological control. In: Smith RF, TE Mittler, CN Smith, (eds.). History of Entomology. Annual Reviews Inc, Palmetto, California, pp. 433-467
8. Hasan MK, MM Uddin, MA Haque, 2012. Host suitability of red pumpkin beetle, *Aulacophora foveicollis* (Lucas) among different cucurbitaceous hosts. International Research Journal of Applied Life Sciences, 1: 91-100.
9. Hossain MS, AB Khan, MA Haque, MA Mannan, CK Dash, 2009. Effect of different host plants on growth and development of Epilachna beetle. Bangladesh Journal of Agricultural Research, 34: 403-410.
10. Imura O, S Ninomiya, 1978. Quantitative measurement of leaf area consumption by *Epilachna vigintioctopunctata* (Fabricius) (Coleoptera: Coccinellidae) using image processing. Applied Entomology and Zoology, 33: 491-495.
11. Kalra GS, SD Dhima, 1977. Determination of leaf area of wheat plants by rapid methods. Journal of Indian Botanical Society, 56: 261-264.
12. Kamal MM, MM Uddin, M Shahjahan, MM Rahman, MJ Alam, MS Islam, MY Rafii, MA Latif, 2014. Incidence and Host Preference of Red Pumpkin Beetle, *Aulacophora foveicollis* (Lucas) on Cucurbitaceous Vegetables. Life Science Journal, 11: 459-466.
13. Kavadia VS, BL Pareek, KP Sharma, 1984. Residues of Malathion and Carbaryl in stored sorghum. Grain Technique Bulletin, 22: 247-250.
14. Khan MMH, MZ Alam, MM Rahman, 2011. Host preference of red pumpkin beetles in a choice test under net case condition. Bangladesh Journal of Zoology, 39: 231-234.
15. Pradhan S, MG Jotwani, S Prakash, 1990. Comparative toxicity of insecticides to the grub and adult of *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae). Indian Journal of Entomology, 24: 223.
16. Rahaman MA, MDH Prodhan, 2007. Effects of net barrier and synthetic pesticides on red pumpkin beetle and yield of cucumber. International Journal of Sustainable Crop Production, 2: 30-34.
17. Rahman MM, 2002. Studies on the biology, feeding behavior and food preferences of Epilachna beetle, *Epilachna dodecastigma* Muls. on different host plants. M.S. thesis Deptment of Entomology, Bangladesh Agricultural University, 50p.
18. Rajagopal D, TP Trivedi, 1989. Status, biology and management of Epilachna beetle, *Epilachna vigintioctopunctata* (Fab.) (Coleoptera: Coccinellidae) on potato in India. Tropical Pest Management, 35: 410-413.
19. Rajak DC, 2001. Host range and food preference of the red pumpkin beetle, *Aulacophora foveicollis* (Lucas) (Chrysomelidae: Coleoptera). Agricultural Science Digest, 21: 179-181.
20. Rashid MA, MA Khan, MJ Arif, N Javed, 2014. Red Pumpkin Beetle, *Aulacophora foveicollis* Lucas; A Review of Host Susceptibility and Management Practices. Academic Journal of Entomology, 7: 38-54, 2014.
21. Sharma SS, JP Bhanot, VK Karla, 1999. Host preference, extent of damage and control of red pumpkin beetle, *Raphidopalpa foveicollis* (Lucas). Journal of Insect Science, 12: 168-170.
22. Singh SV, M Alok, RS Bisen, YP Malik, A Misra, 2000. Host preference of red pumpkin beetle, *Aulacophora foveicollis* and melon fruit fly, *Dacus cucurbitae*. Indian Journal of Entomology, 62: 242-246.
23. Srivastava KP, D Butani, 1998. Pest management in vegetable. Research Periodical and Book Publishing House, 197-225.
24. Thapa RB, FP Neupane, 1992. Incidence, host preference and control of the red pumpkin beetle, *Aulacophora foveicollis* (Lucas) on Cucurbitae. Journal of the Institute of Agriculture and Animal Science, 13: 71-77.