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Feeding Behavior and Food Preference of Red Pumpkin Beetle, *Aulacophora Foveicollis*

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Abstract: The experiment was laid out in the completely randomized design (CRD) and mean values were ranked by Duncan's New Multiple Range Test (DMRT). Three cucurbit hosts such as sweet gourd, bottle gourd and bitter gourd were selected to conduct this research work. Host suitability was measured following force feeding and choice feeding bioassays. Under laboratory condition, feeding behavior and food preference were studied on three different host plants viz. sweet gourd, bottle gourd and bitter gourd. Food consumption by the larva and the adult was highest on sweet gourd (19600 ±7.9mm^2, 1944.33±89.51 mm^2) followed by bottle gourd (185.00 ± 12.29 mm^2, 1657.00 ± 62.80 mm^2). In case of bitter gourd the larvae died aftertwo days of release and the lowest food consumption (8.00 ± 1.53 mm^2) was found by adult. The larval duration and the adult duration were highest on bottle gourd (20.67 ± 0.99 days, 43.33 ± 0.88 days) followed by sweet gourd (16.67 ± 0.99 days, 40.33 ± 0.88 days). Considering food consumption, sweet gourd appeared to be the best suitable host plant among the three different host plants for *Aulacophora foveicollis*. The study will help researcher, agricultural policy maker and agricultural extension worker for effective pest management, developing resistant variety and cost effective pesticides.

Keywords: Red Pumpkin Beetle, Feeding Behavior, Food Preference, Host Plant, Pest Management

1. Introduction

Red pumpkin beetle, *Aulacophora foveicollis* Lucas (Coleoptera: Chrysomelidae) is a common and major pest of a wide range of cucurbits, especially sweet gourd, bottle gourd, bitter gourd, white gourd, water melon and musk melon. It is polyphagous in nature [1]. Rahman *et al.* (2008) found that both larval and adult stages are injurious to the crop and cause severe damage to almost all cucurbits at seedlings, young and tender leaves and flowers. The adult beetles feed on the leaves making irregular holes and also attack the flowers and flower buds. [2]

Laila Khan *et. al* (2015) found that non significant negative correlation existed between the red pumpkin beetle population and trichome density and leaf area of the cucurbits and significant positive correlation occurred between the red pumpkin beetles and trichome length of cucurbits. [3]

In the field at three different stages of the plant the highest number of beetle per plant was found on the sweet gourd and the lowest number was found on bitter gourd. Similarly both in force feeding and choice feeding bioassays the highest leaf feeding was observed on sweet gourd and the lowest leaf feeding was determined on the bitter gourd. Both in the laboratory and field among the three cucurbit hosts sweet gourd was the most suitable and bitter gourd was the least suitable host for red pumpkin beetle. (Hassan, K. et al. 2012) [4]

M. M. Kamal *et al* (2014) showed that temperature had a profound effect on the oviposition and food consumption by *A. foveicollis* while 30°C was the optimum temperature both for oviposition and food consumption for all selected cucurbits and their varieties. [5]

Kamal *et al* (2014) found that the highest food consumption was recorded on sweet gourd among the crops and the highest leaf area damage was found on Local Misti

Kumra (sweet gourd) in net cage experiment among the nine varieties. Among three cucurbit crops (sweet gourd, bitter gourd and bottle gourd) the total and daily food consumption was found highest on sweet gourd in the laboratory. [6]

It is necessary to have an adequate knowledge on its incidence and host plant preference for feeding and oviposition behaviour for managing this pest properly. Some studies on the different factors relating to the abundance of red pumkin beetle in different crops have already been done [7].

The highest quantity of moisture was recorded in young leaf of bottle gourd (86.49%) and mature leaf of khira (87.95%). The lowest moisture content was obtained in young leaf of snake gourd (79.21%) and mature leaf of ribbed gourd (76.43%). The highest nitrogen content was found in young leaf (6.79%) of sweet gourd and in mature leaf (5.57%) of bottle gourd. The lowest percentage of nitrogen was found in young leaf (3.64%) of bitter gourd and in mature leaf (2.52%) of ribbed gourd. The highest quantity of total sugar was found in young leaf of bottle gourd (4.90%) and mature leaf of sweet gourd (4.76%). The lowest quantity of total sugar was found in young (2.03%) and mature leaves (2.09%) of bitter gourd. The highest quantity of reducing sugar was estimated from young leaves of musk melon (4.14%) and from mature leaves (4.01%) of sweet gourd. The lowest quantity of reducing sugar was in young (1.85%) and matures (1.83%) leaves of bitter gourd. [8]

It is necessary to have an adequate knowledge on its incidence and host plant preference for feeding and oviposition behaviour to manage this pest properly,. Some studies on the different factors relating to the abundance of red pumpkin beetle in different crops have already been done (Mandal, *et al.* 2012). [9]

But unfortunately, information on feeding behavior and food preference of this pest is limited. Considering the above situation and 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 Red Pumpkin Beetle in Bangladesh context based on the insect incidence, feeding behavior and food preference.

2. Objectives

a) To observe the feeding activities of grub and adult of *Aulacophora foveicollis* on leaves of three different host plant in the laboratory.

b) To study the food consumption, food preference and Host suitability for the growth and development of *Aulacophora foveicollis* on leaves of three different host plant in the laboratory.

3. Materials and Methods

The experiments were conducted on the biology of red pumpkin beetle, *Aulacophora fovecollis* (Lucas.) in the laboratory of the Department of Entomology, Bangladesh Agricultural University, Mymensingh, Bangladesh during the period from January to April, 2007. The prevailing room temperature was 30 ± 2 °C with relative humidity 80 ± 5%.

a) Food Sources

Sweet gourd (*Cucurbita moschata*) leaves were used as food for red pumpkin beetle. All the leaves were collected from Char Nilokhia, Mymensingh Sadar Thana, Mymensingh, Bangladesh. Das and lshaque (1998b) recorded the food plants of *A. faveicollis* and the food plants were bottle gourd (*L. siceraria*), cucumber (*C. sativus*), watermelon (*Citrullus lanatus*), ridge gourd (*L. acutangula*), pointed gourd (*T. dioica*) and ash gourd (*B. hispida*).

b) Mass Culture of the Test Insect

In order to meet the demand of test insect, a stock culture of large number of grubs and adult beetles were maintained in the laboratory. For this purpose, the adults of *A. foveicollis* (Lucas.) were collected from the host plants of the farmer's field of Char Nilokhia. Breeding and rearing of the field collected insects were done in 9 cm × 1.5 cm diameter Petridishes in the laboratory. Adult beetles were sexed and confined in pairs in the petri-dishes for mating and oviposition. Fresh and healthy leaves of hostplants were supplied every day for each pair of insect. The cut end of the leaf petiole was provided with water soaked cotton pad to prevent leaf from withering. After oviposition, adults beetle were transferred in different petri-dishes and the eggswere kept undisturbed for hatching. Immediately after hatching, the larvae were transferred indifferent petri-dishes; ten larvae per petri-dish were reared up to adult emergence. The newly emerged adults were again sexed and confined in pairs in petri-dishes for mating and laying eggs. This culture was maintained in order to avoid the effect of previous food plants on the biology of the test insect.

c) Food Consumption

To estimate the food consumption, newly hatched larvae and newly emerged adults were individually placed from laboratory culture in each petri-dish containing leaves of three different plants as food. Three petri-dishes were maintained for each host plant. Fresh leaves were supplied daily. The cut end of petiole was provided with water soaked cotton pad to prevent leaf from withering. Moistened soils were placed to cover the bottom of each petri-dish. Soils are moistened at every 24 hours interval. Food consumption of *Aulacophora foveicollis* was estimated by exposing first, second, third and final instar larvae as well as adult beetles on different host plants. The leaf area consumed by each larval instar and adult beetles were measured by using a square millimeter graph paper. The effect of the host plant on the larval duration and adult duration was also observed. In case of Larvae, this measurement was continued up to pupation and for adult death.

d) Statistical analysis of Data

Data obtained from the experiments were analyzed using analysis of in Completely Randomized Design (CRD) and mean values were ranked by Duncan's New Multiple Range Test (DMRT).

4. Results and Discussion

Food consumption and duration of different developmental stage

4.1. Larval Food Consumption

Food consumption per larvae per instar of *Aulacophora foveicollis* on three different host plants was recorded and presented on Table 1 and figure 2-3. Food consumption gradually increased with the increase of larval age. Food consumption of first instar larvae of *Aulacophora foveicollis* on sweet gourd, bottle gourd and bitter gourd were23.00 ± 1.53 mm^2, 22.67 ±2.33 mm^2 and 0.00 ± 0.00 mm^2respectively. Food consumption of first instar larvae was highest on sweet gourd, lowest on bottle gourd and no feeding was observed on bitter gourd. On bitter gourd the larvae died after two days of release. No feeding was observed on these two days. Same result also found by Dwivedi *et al* (1994) [10]. He reported that the larvae of red pumpkin beetle died within two days of hatching. The food consumption of final instar larvae on sweet gourd, bottle gourd and bitter gourd were 83.33 ± 0.88 mm^2, 77.67 ± 6.36 mm^2 and 0.00 ± 0.00 mm^2respectively.

Total food consumptions per larvae during its whole larval period fed on sweet gourd, bottle gourd and bitter gourd were 196.00 ± 7.90 mm^2, 185.00 ± 12.29 mm^2 and 0.00 ± 0.00 mm^2respectively. The highest food consumption was found on sweet gourd which was statistically different from other hosts. Rahman *et al* (2008) found the similar result.[2]

Figure 1. *Eggs of Red Pumpkin Beetle, Aulacophora foveicollis on Sweet Gourd leaf.*

Table 1. *Area of food consumption (mm^2) by a larvae of Aulacophora foveicollis fed on the leaves of three different host plants in the laboratory.*

Host Plants	Food consumption (mm^2) per larvae (mean ± SE)				Total(mean ± SE)
	1st instar	2nd instar	3rd instar	Final instar	
Sweet gourd	23.00 ± 1.53a	39.00 ± 1.00a	350.67± 4.49a	83.33 ± 0.88a	196.00 ± 7.90a
Bottle gourd	22.67 ± 2.33a	37.33 ± 1.2a	47.33 ± 6.36a	77.67 ± 6.36a	185.00±12.29b
Bitter gourd	0.00 ± 0.00b	0.00 ± 0.00b	0.00 ± 0.00b	0.00 ± 0.00b	0.00 ± 0.00c
Level of significance	0.01	0.01	0.01	0.01	0.01
LSD value	8.44	4.73	15.40	19.44	6.25

Source: Laboratory survey, 2007
Within a column mean followed by common letter are not significantly different.

4.2. Larval Period

Larval period of *Aulacophora foveicollis* on sweet gourd, bottle gourd and bitter gourd were recorded and presented on table 2. It was observed that the larval period was significantly influenced by the type of host plants having highest on bottle gourd (20.67 ± 0.99 days) lowest on sweet gourd (16.67 ± 0.99 days) and on bitter gourd the larvae died after two days of release in all instars. So, the observed result is zero. The duration of larval instars and total larval period were found statistically different from each other when larvae fed on different host plant.

Table 2. *Effect of host plants on larval duration of Aulacophora foveicollis fed on the leaves of three different host plants in the laboratory.*

Host Plants	duration of larval instars in days (mean ± SE)				Total larval instars period in days(mean ± SE)
	1st instar	2nd instar	3rd instar	Final instar	
Sweet gourd	4.00 ± 0.00a	4.33 ± 3.33a	3.67± 0.33a	4.67 ± 0.33a	16.67 ± 0.99b
Bottle gourd	4.67 ± 0.33a	5.33 ± 0.33a	5.33 ± 0.33b	5.67 ± 0.33a	20.67±0.99a
Bitter gourd	0.00 ± 0.00b	0.00 ± 0.00b	0.00 ± 0.00c	0.00 ± 0.00b	0.00 ± 0.00c
Level of significance	0.01	0.01	0.01	0.01	0.01
LSD value	1.00	1.43	1.00	1.43	1.43

Source: Laboratory survey, 2007
Within a column mean followed by common letter (s) are not significantly different.

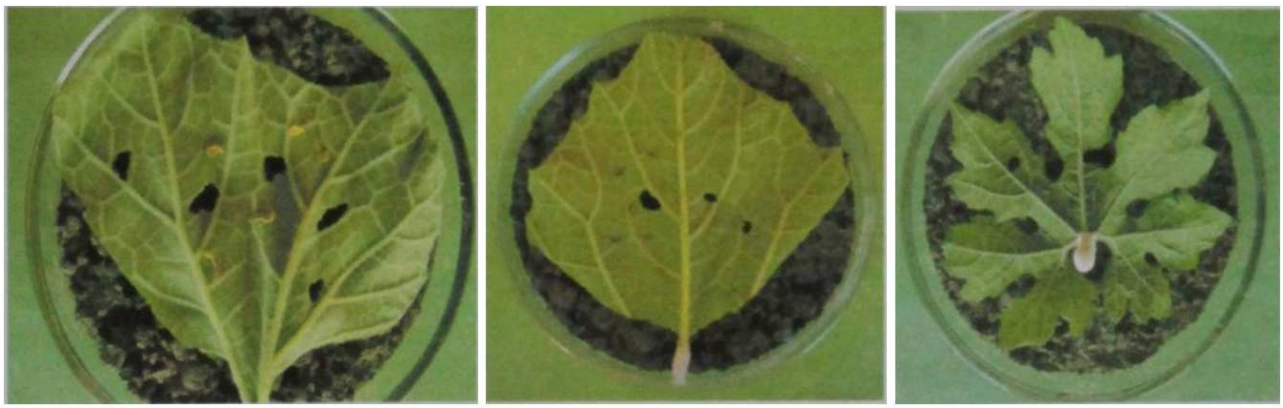

Figure 2. *First instars larvae of Red Pumpkin Beetle, Aulacophora foveicollis on Sweet Gourd (A) bottle gourd (B) and bitter gourd(C) leaves.*

5. Adult Food Consumption

Total food consumption per adult of *Aulacophora foveicollis* on sweet gourd, bottle gourd and bitter gourd were recorded and presented on table 3 and figure 1. Significantly highest food consumption was found on sweet gourd (1944.33 ± 89.51 mm^2). The second highest food consumption was found on bottle gourd (1657.00 ± 62.80 mm^2) which is statistically identical with sweet gourd. Significantly lowest food consumption per adult was found on bitter gourd (8.00 ± 1.53 mm^2).

Results on food consumption indicated that both larvae and adults of *Aulacophora foveicollis* consumed highest amount of food from sweet gourd followed by bottle gourd. So, sweet gourd was found to be the most suitable host plant of *Aulacophora foveicollis* followed by bottle gourd among three different host plants. In case of bitter gourd, the larvae died after two days of release and the adult beetle fed only 8.00 ± 1.53 mm^2 food. So, in case of larvae the bitter gourd was resistant host and in case of adult beetle, the bitter gourd was less preferred or not preferred host. Similar trend of result were also found by Johri and John (2003)[11] and kamal *et al* (2014) [5].

Table 3. *Area of food consumption (mm^2) by an adult of Aulacophora foveicollis fed on the leaves of three different host plants in the laboratory.*

Host Plants	Total consumption per adult (mean ± SE)
Sweet gourd	1944.33 ± 89.51a
Bottle gourd	1657.00±62.80a
Bitter gourd	0.00 ± 1.53b
Level of significance	0.01
LSD value	331.00

Source: Laboratory survey, 2007
Within a column mean followed by common letter (s) are not significantly different.

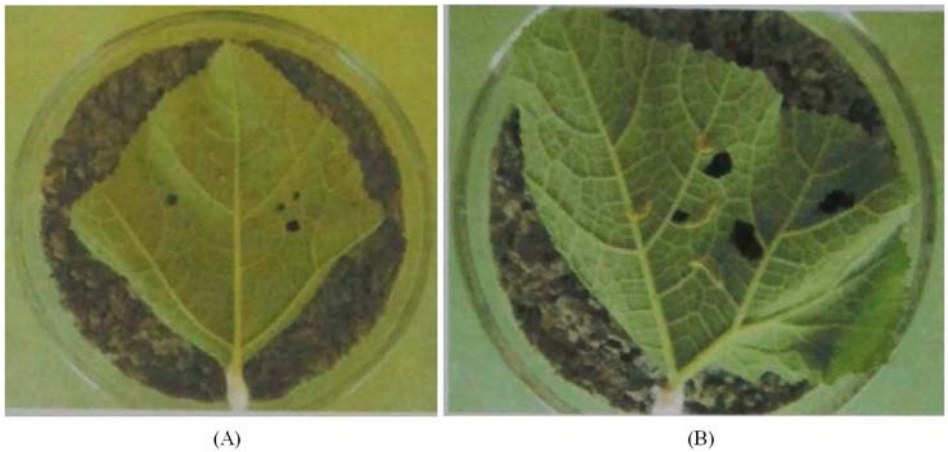

Figure 3. *Final instars larvae of Red Pumpkin Beetle, Aulacophora foveicollis on Sweet Gourd (A) and bottle gourd (B) leaves.*

6. Adult Longevity

Adult longevity of *Aulacophora foveicollis* on sweet gourd, bottle gourd and bitter gourd were recorded and presented on table 4. The longevity of adult was statistically different on various host plants. Highest adult longevity was found on bottle gourd (43.33 ± 0.88 days) followed by sweet gourd (40.33 ± 0.88 days) and their values were identical. The lowest adult longevity was found on bitter gourd (7.33 ± 3.71 days) which was statistically different from bottle gourd and sweet gourd.

Figure 4. *Food consumption of adult Red Pumpkin Beetle, Aulacophora foveicollis on Sweet Gourd (A) bottle gourd (B) and bitter gourd (C) leaves.*

Table 4. *Effect of host plants on the adult duration of Aulacophora foveicollis fed on the leaves of three different host plants in the laboratory.*

Host Plants	Total duration of adult in days(mean ± SE)
Sweet gourd	40.33 ± 0.88a
Bottle gourd	43.33±0.88a
Bitter gourd	7.33 ± 3.71b
Level of significance	0.01
LSD value	11.85

Source: Laboratory survey, 2007
Within a column mean followed by common letter (s) are not significantly different.

7. Conclusion

Food consumptions (mm^2) of different larval instars among sweet gourd, bottle gourd and bitter gourd were highest on sweet gourd. Total food consumptions (mm^2) by a single larva during its whole larval period was also on sweet gourd (196.00 ± 7.90 mm^2) followed by bottle gourd (185.00 ± 12.29 mm^2). No feeding was observed on bitter gourd. The highest food consumption was found on sweet gourd which was statistically different from other hosts. The highest larval duration was found on bottle gourd (20.67 ± 0.99 days) followed by sweet gourd (16.67 ± 0.99 days).

Total by a single adult beetle during its adult life was highest on sweet gourd (1944.33 ± 89.51 mm^2) followed by bottle gourd (1657.00 ± 62.80 mm^2). The lowest food consumption (mm^2) was found on bitter gourd (8.00 ± 1.53 mm^2). Adult longevity was highest on bottle gourd and lowest on bitter gourd.

References

[1] Doharey, K. L. 1983. Bionomics of red pumpkin beetle, *Aulacophora foveicollis* (Lucas) on some fruits. *Indian J. Entomol*. 45: 406-413.

[2] Rahaman, M. A., M.D.H. Prodhan and A.K.M. Maula. 2008. Effect of botanical and synthetic pesticides in controlling Epilachna beetle and the yield of bitter gourd. Int. J. Sustain. Crop Prod. 3(5):23-26.

[3] Laila Khan, Maqsood Shah and Amjad Usman; 2015. Host Preference of Red Pumpkin Beetle (*Aulacophora faveicollis)* Lucas (Chrysomelidae: Coleoptera) among different Cucurbits. Journal of Entomology and Zoology Studies 2015; 3 (2): 100-104.

[4] K. Hassan, M. M. Uddin & M. A. Haque. 2012. HOST SUITABILITY OF RED PUMPKIN BEETLE, *AULACOPHORA FOVEICOLLIS* (LUCAS) AMONG DIFFERENT CUCURBITACEOUS HOSTS. IRJALS (ISSN: 1839-8499), 1 (4).

[5] M. M. Kamal, M. M. Uddin, M. Shajahan and M. M. Rahman; 2013. Role of Host and Temperature on the Feeding and Oviposition Behaviour of Red Pumpkin Beetle *Aulacophora foveicollis* (LUCAS). *Progress. Agric.* 24(1 & 2): 53 – 60.

[6] Kamal M. M., M. M. Uddin, M. Shahjahan, M. M. Rahman, M. J. Alam, M. S. Islam, M. Y. Rafii and M. A. Latif. Incidence and Host Preference of Red Pumpkin Beetle, *Aulacophora foveicollis* (Lucas) on Cucurbitaceous Vegetables. *Life Sci J* 2014;11(7):459-466.

[7] Khursheed, Sheikh, Desh Raj, and Nisar A. Ganie. 2013. Population dynamics of red pumpkin beetle on cucumber in mid-hill Himalayas. *Journal of Applied Horticulture.* 15(2). 5-12.

[8] Dwivedi, V. K.; Tripaitu, S. R. and G. S. 1994. Seffect of different food plants on growth and development of R. foveicollis (Lucas), Indian J. Ecol. 2(1):82-84.

[9] M. M. H. Khan.2013. Biochemical composition of cucurbit leaves and their influence on red pumpkin beetle. International Journal of Research in Applied, Natural and Social Sciences (IJRANSS) 1(2) 131-138.

[10] Mandal, T., S. Biswas and N. Laskar. 2012. Impact of biophysical characteristics of bitter gourd (Momordica charantia L.) on the infestation of foliage feeding coleopteran pests Current Biotica. 6(1):103-106.

[11] Johri, R. A. and Johri, P. K. Survey for host range of red pumpkin beetle, *Aulacophora foveicollis* Lucas (Coleoptera: Chrysomelidae) at Kanpur in Uttar Pradesh Journal-of-Applied-Zoological-Researches. Cuttack, India: Applied Zoologists Research Association 14(1): 31-33.