Research article

Bangladesh Journal of Entomology
ISSN (Print): 1021-1004, Website: www.bangladeshes.org
Bangladesh J. Entomol. (2023) 31(2): 47-56

WEATHER PARAMETERS AFFECTING THE INCIDENCE AND DAMAGE OF EPILACHNA BEETLE IN BRINJAL AT PSTU CAMPUS

Md. Mohasin Hussain Khan[1*], Md. Habibullah Niaz[2] and Md. Sarwar Hossain[3]

[1]Department of Entomology, Patuakhali Science and Technology University, Patuakhali-8602, Bangladesh. [2]Deouty Executive, Ispahani Agro Limited, Bangladesh. [3]Agriculture Extension Officer, Rangpur sadar, Rangpur, Bangladesh.

Received: 4 September 2023; Accepted: 2 November 2023

ABSTRACT

The study was done to find out the influence of weather parameters on the abundance and damage severity of epilachna beetle on brinjal, grown at Patuakhali Science and Technology University (PSTU) campus, Patuakhali during June 2021 to May 2022. Results revealed that the highest abundance of grub (34.0) was recorded in May and the lowest abundance (3.0) was noticed in November followed by no beetle in December. The highest leaf area damage (78.0%) was recorded in May and the lowest leaf area damage (36.0%) was noticed in January. The highest damaged area (504.48 sq. mm leaf $^{-1}$) of infested leaf was measured in May, whereas the lowest damaged area (158.98 sq. mm leaf $^{-1}$) was found in January. The population of grubs and adults of epilachna beetles was positively correlated to the maximum temperature while they were negatively correlated to the minimum temperature and relative humidity.

Keywords: Coccinellid beetles, leaf feeders, climatic factors, pest management.

INTRODUCTION

Brinjal (*Solanum melongena* L.) also known as eggplant is referred as "king of vegetables" originated from India and now grown as a vegetable throughout the tropical, sub-tropical and warm temperate areas of the world. Brinjal is a very common and popular vegetable crop grown in tropical and sub-tropical region (Sarker *et al*. 2006). It is grown in many other parts of the world *viz*., Central, South and Southeast Asia, some parts of Africa and Central America (Harish *et al*. 2011). Brinjal occupies an important place among the vegetable crops in Bangladesh. Brinjal is known for its high nutritive value such as phosphorus, iron and vitamins especially B complex (Dhaliwal 2014). Brinjal fruit contains essential amino acids,

*Corresponding author: *mohasin1965@pstu.ac.bd*

minerals and vitamins (Chen NC 1990) and high levels of potassium (Prabhu 2009). It displays a wide range of colour and shapes. It is one of the most popular, year-round and economically important vegetables among small scale farmers and low income consumers globally (FAO 2000). There are number of insect pests known to infest brinjal at various growth stages of the crop. Among them, epilachna beetles *viz*., *Epilachna vigintioctopunctata* Fab. and *Epilachna dodecastigma* (Wied.) are the two serious pest species of vegetables (Khan *et al*. 2000). Among them, epilachna beetle, *Epilachna vigintioctopunctata* (Fabricius) (Coccinellidae: Coleoptera) is one of the most destructive pests leading to heavy economic yield loss (Ali *et al*. 2017, Sharma and Tayde 2017). Both the adult beetles and their grubs feed on the epidermal tissues of leaves by scraping, resulting in drying and falling of the attacked foliage. The damage may reach up to 80.0% of the plants (Rajagopal and Trivedi 1989). Thirty five to seventy five percent leaves were severely damaged by grubs and adults (Srivastava and Katiyar 1991). The grubs confine their attack to the lower surface of the leaves and adults usually feed on the upper surface of the leaves (Pradhan *et al*. 1990). For designing a viable pest management strategy, study is a pre-requisite to find out the seasonal abundance, damage of the pest and the environmental factors affecting its incidence. It is necessary to have basic information on the incidence of the pest in relation to weather parameters which in turn help determine appropriate time of action and suitable management methods to be adopted. Keeping these in view, the present study was conducted to know the incidence of various developmental stages of epilachna beetle and damage on brinjal in response to weather parameters and to evaluate the efficacy of insecticides against pest.

MATERIALS AND METHODS

Experimental site: The study was carried out in the homestead garden of Patuakhali Science and Technology Univesity (PSTU) campus, Patuakhali during the period from June 2021 to May 2022. Geographically, the study area is located at 22^{0}37¢ N latitude and 89^{0}10¢ E longitudes. The area is covered Gangetic Tidal Floodplains and falls under the Agro–ecological Zone "AEZ–13" (Iftekhar and Islam 2004). The area lies at 0.9 to 2.1 metre above the sea level. The soil of the experimental field was silt clay loam having pH value 7.00. The organic matter was found as 1.53% in most cases (Iftekhar and Islam 2004).

Data collection procedure: Five plants per plot were randomly selected from each homestead garden and data on the number of Epilachna grubs and adults per

plant were collected and counted. From these data were worked out percent leaf area damaged caused by Epilachna was also worked out by spot observation. Five damaged leaves were collected randomly from brinjal plant in each month and the damaged area of leaf was measured by using mm graph paper. Simultaneously, the meteorological data, such as maximum and minimum temperature, relative humidity and rainfall were collected from the meteorological office of Patuakhali.

Statistical analysis: Simple correlation and regression analyses among these parameters and the seasonal abundance of epilachna beetles were done.

RESULTS AND DISCUSSION

Abundance of grub and adult of epilachna beetle: The population of epilachna beetle grub and adult was fluctuated during the period from June 2021 to May 2022. The highest incidence of grub was recorded in May (34.0) followed by April, October, March and July while the lowest in December (4.0) followed by November, January, February. The moderate number was observed in the month of June, August and September. In case of adult beetle, the highest incidence was found in May (12.0) and the lowest in November (3.0) followed by no beetle in December (Fig. 1).

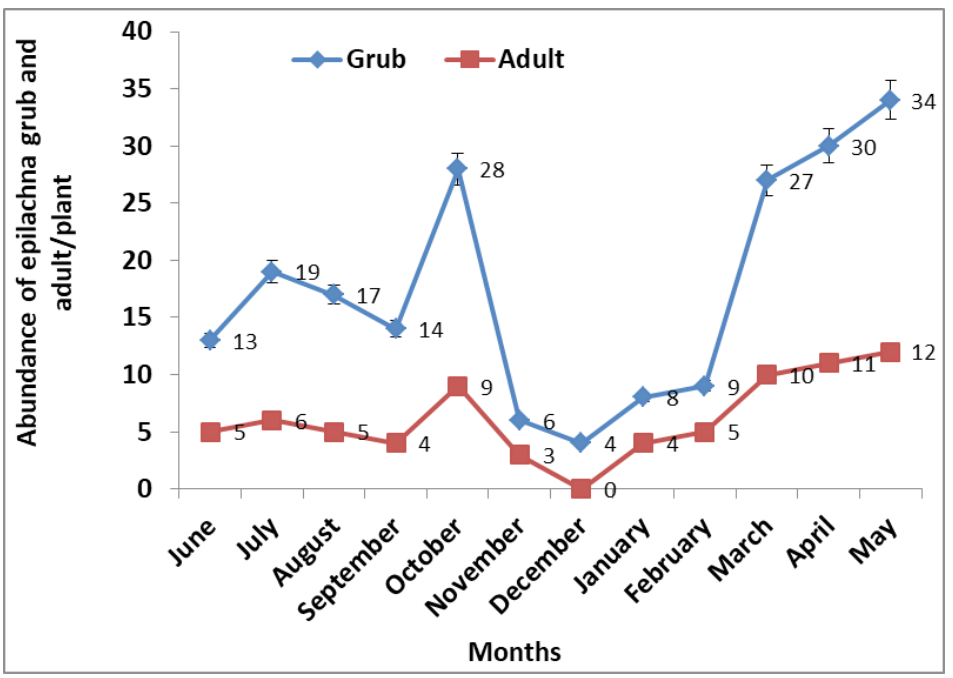

Fig. 1. Abundance of grub and adult per brinjal plant of epilachna beetle during June 2021 to May 2022

Damage caused by epilachna beetle: The highest percentage of leaf area damage was recorded in May (78.0%) followed by April (55.0%) while the lowest per cent leaf area damage was noticed in January (36.0%) followed by February (41.0%) (Fig. 2).

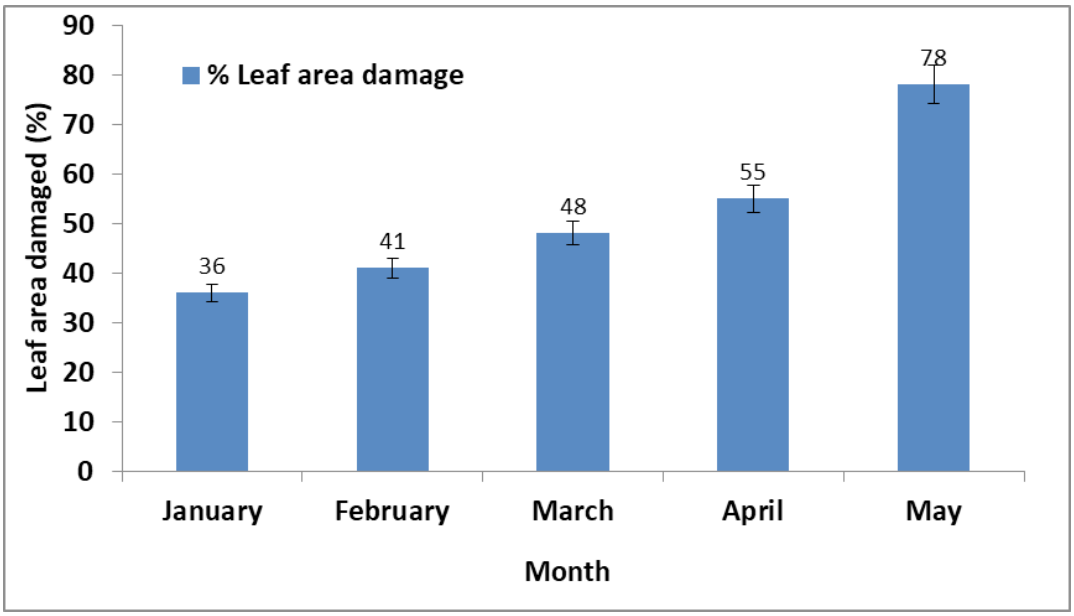

Fig. 2. Percentage of leaf area damaged by epilachna beetle in homestead garden during January to May 2022

Leaf area (sq. mm) damaged by epilachna beetle: The highest damaged area of infested leaf (504.48 sq. mm leaf $^{-1}$) was measured in May followed by April (356.24 sq. mm leaf $^{-1}$) while the lowest damaged was noticed in January (158.98 sq. mm leaf $^{-1}$) followed by February (286.56 sq. mm leaf $^{-1}$) (Fig. 3).

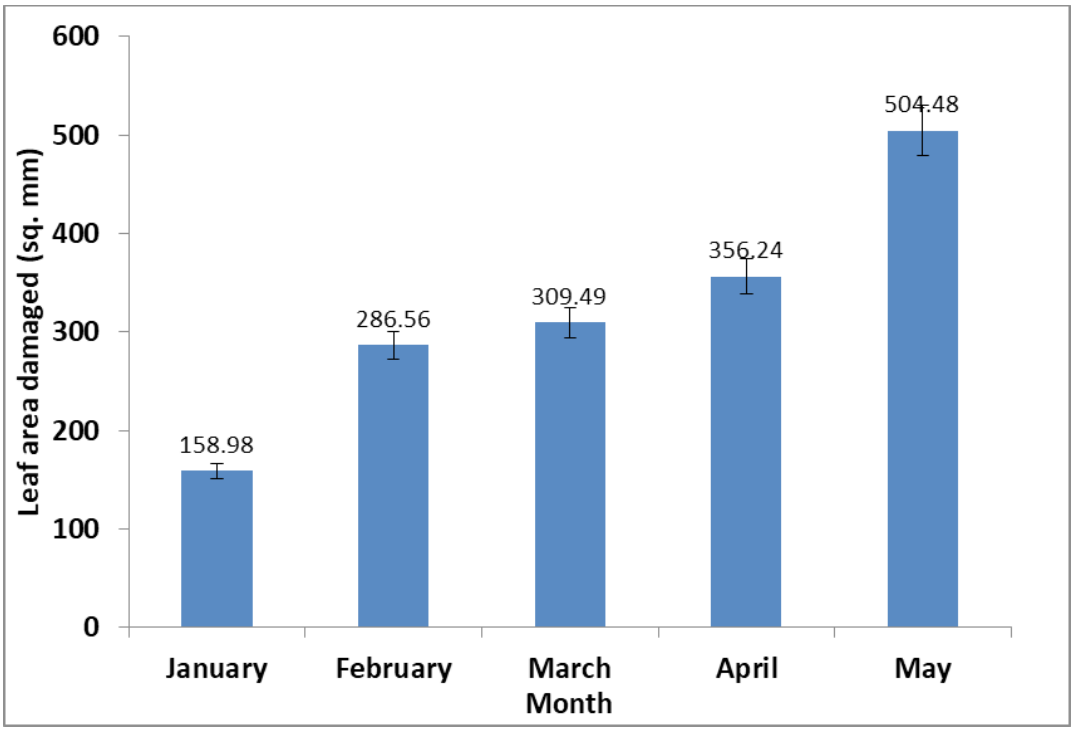

Fig. 3. Leaf area (sq. mm) damaged by epilachna beetle leaf $^{-1}$ in homestead garden during January to May 2022

Weather parameters affecting the incidence of epilachna beetle: The population of grubs and adults of epilachna beetle was positively correlated to the maximum temperature and negatively correlated to the minimum temperature and relative humidity. The multiple linear regression analysis of the beetle abundance to weather parameters influenced 29-42 percent of the epilachna beetle grub population and 30-47 per cent of the epilachna beetle adult population. The leaf damage was highly significant with a negative correlation to the minimum temperature (-0.583). The regression analysis showed the influence of weather parameters on epilachna beetle grub (66.0%), adult (71.0%) and damaged leaf (73.0%) (Table 1).

Table 1. Correlation and regression analysis of weather parameters on the abundance of epilachna beetle on brinjal during January to May 2022

Weather parameters	Grub	Adult	Leaf
Max. Temperature	0.045	0.037	-0.278
Min. Temperature	-0.292	-0.295	-0.583*
Relative humidity	-0.089	-0.078	0.168
Regression equation	$Y=0.163+0.039X_1-0.042X_2+0.001X_3$	$Y=-0.281-0.004X_1+0.047X_2-0.005X_3$	$Y=171.44-1.178X_1-3.410X_2-0.580X_3$
R^2	0.66	0.71	0.73

**Significant at 5% level, X1-Maximum temperature; X2-Minimum temperature; X3-Relative humidity; Y= Number of insect pests, R2 =Coefficient of determination*

The results of the present study are in conformity to Ghule *et al*. (2014) who found that the population of epilachna beetle remained active during March to May. Bhowmik and Saha (2017) reported epilachna beetle as a serious pest of bottle gourd causing its infestation from early September. Uikey *et al*. (2016) observed that the population of epilachna beetle on bottle gourd remained active during the warmer part of the crop growing season and found a maximum of 8.4 grubs plant^{-1} during the 4th week of March. An increased occurrence of grubs had also been reported by Raghuraman and Veeravel (1999). The peak abundance of grubs was occurred in the early mid-season crop and then it was started to decline. This was in accordance with the findings of Haseeb *et al*. (2009). The adult beetle occurred on a very low intensity throughout the cropping season. This was supported by Varma and Anadhi (2008). The average number of epilachna grubs per plant indicated their abundance starting from sixth standard week till 14th standard week. The damage decreased with decreasing number of grubs. Rarnzan *et al*. (1990) and Ghosh and Senapati (2001) reported the peak incidence of *H. vigintioctopunctata* under similar climatic conditions. Irrespective of the availability of host plants throughout the year and favourable climatic factors, the pest population level was started to decrease from the last week of August onwards and reached to trace level in the first week of October perhaps due to high parasitic activities, which reached its peak along with the rising pest population in August. An average beetle consumed 1429.5±131.6 (Mean±S.D.)

sq. mm of leaves to complete its larval development and consumed 2510.9±306.2 (Mean±S.D.) sq. mm of leaves during the first 10 days of its adult stage (Imura and Ninomiya 1978). In this study, population of epilachna beetles was found to be active in the months of March, April, May and October. Variability in abiotic factors found to be responsible for certain changes in incidence and abiotic factors such as temperature (both maximum and minimum) and relative humidity had significant role on incidence of epilachna beetle attacking brinjal. The positive correlation between Epilachna beetle incidence and temperature was supported by the findings of Chandrakumar *et al*. (2008) and Koushik *et al*. (2014). These results were also in conformity to Raghuraman and Veeravel (1999) who reported that epilachna beetle infestation had a significant positive correlation to maximum atmospheric temperature. Bhowmik and Saha (2017) described that relative humidity and rainfall had negative correlation to epilachna beetle population. In contrast, Kalaiyarasi *et al*. (2017) reported rainfall, high relative humidity and high temperature favoured the population of epilachna beetle.

CONCLUSION

In this study, the incidence of epilachna beetle found to be active on brinjal from March to May as well as in the month of October. The highest percentage leaf area damaged was recorded in May and at 72 hour after release in the laboratory. The larval damage was higher than adult. The population of grubs and adults of epilachna beetle showed a positive correlation to maximum temperature and negative correlation to minimum temperature and relative humidity.

REFERENCES

ALI, A., KHADIJA, J., HUMAYUN, J., AJMAL, K. K., ASLAM, M. R., HUSSAIN, K. & AHMAD, T. 2017. Screening of different brinjal (*Solanum melongena* L.) cultivars against hadda beetle (*Epilachna vigintioctopunctata* F.) in Pothwar region. *J. Entomol. Zool. Stud.* **5(1)**: 786-791.

BHOWMIK, S. & SAHA, S. 2017. Study on the pest complex of bottle gourd in the gangetic plains of West Bengal. *J. Entomol. Zool. Stud*. **5**: 725-727.

CHANDRAKUMAR, H. L., KUMAR, C. A., KUMAR, N. G., CHAKRAVARTHY, A. K. & RAJU, T. P. 2008. Seasonal occurrence of major insect pests and their natural enemies on brinjal. *Current biotica.* **2**(1): 63-73.

CHEN, N. C. & LI, M. H. 1990. Vegetable production training manual, Asian Vegetable research and development Center, Shanhua, Taiwan. P. 447.

DHALIWAL, M. S. 2014. Handbook of vegetables crops, Kalyani Publishers. P 54.

FAO (FOOD AND AGRICULTURE ORGANIZATION). 2000. Area and Production of aubergine. Year Book. **48**: 136.

GHOSH, S. K. & SENAPATI, S. K. 2001. Biology and seasonal fluctuation of *Henosepilachna vigintioctopunctata* Fab. on brinjal under Terai region of West Bengal. *Indian J. Agric. Res*. **35**: 149-154.

GHULE, T. M., DEVI, L. L. & JHA, S. 2014. Seasonal incidence of Epilachna beetle (*Henosepilachna septima* Dieke) in relation to weather parameters on pointed gourd (*Tricosanthes dioica* Roxb.). *J. Crop Weed.* **10**(2): 430-432.

HARISH D. K., AGASIMANI, A. K., IMAMSAHEB S. J. & PATILSATISH S. 2011. Growth and yield parameters in brinjal as influenced by organic nutrient management and plant protection conditions. *Res. J. Agric. Sci*. **2**(2): 221-225.

HASEEB, M., QAMAR, M. & SHARMA, D. K. 2009. Seasonal Incidence of Brinjal Hadda Beetle, *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) in Aligarh, Uttar Pradesh. *Biosci. Trends* **2**(1): 31-32.

IFTEKHAR, M. S. & ISLAM, M. R. 2004. Managing mangroves in Bangladesh: A strategy analysis. *J. Coast. Conserv.* **10**: 139-146.

IMURA, O. & NINOMIYA, S. 1978. Quantitative measurement of leaf area consumed by *Epilachna vigintioctopunctata* (Fabricius) (Coleoptera: Coccinellidae) using image processing. *Appl. Ent. Zool***. 33**(4): 491- 495.

KALAIYARASI, L., ANANTHI, R. L. & MADHANAGOPAL R. 2017. Effect of weather parameters on the incidence of different life stages of a serious pest *H. vigintioctopunctata* (Fab.) on Brinjal in Chennai locality. *India. J. Entomol. Zool. Stud*. **5**(4): 1520-1525.

KHAN, M. H., ISLAM, B. N., RAHMAN, A. K. M. M. & RAHMAN, M. L. 2000. Life table and the rate of food consumption of Epilachna beetle, *Epilachna decastigma* (Wied.) on different host plant species in laboratory condition. *Bangladesh J. Entomol*. **10**(1-2): 63-70.

KOUSHIK, N. R., MANJUNATHA, M., SHIVANNA, B. K. & LATHA, M. 2014. Seasonal incidence of major insect pests and their natural enemies on brinjal in Shimoga, Karnataka. *J. Eco- friendly Agric*. **9**(1): 53-56.

PRABHU M, NATARAJAN S, VEERARAGAVATHATHAM D & PUGALENDHI L. 2009. The biochemical basis of shootand fruit borer resistance in interspecific progenies ofbrinjal (*Solanum melongena*). *Eur. Asian J. Bio. Sci*. **3**: 50-57.

PRODHAN, S., JOTWANI, M. G. & PRAKASH, S. 1990. Comparative toxicity of insecticides to the grub and adult of *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae). *Indian J. Ent*. **24(**4): 223-230.

RAGHURAMAN, M. & VEERAVEL, R. 1999. Influence of abiotic factors on the incidence of spotted leaf beetle, *Henosepilachna vigintioctopunctata* (F.) in brinjal. *Pest Manage. Hortic. Ecosyst.* **5**(1): 17-20.

RAJAGOPAL, D & TRIVEDI, T. P. 1989. Status, bioecology and management of *Epilachna* beetle, *Epilachna vigintioctopunctata* (Fab.) (Coleoptera: Coccinellidae) on potato in India: A review. *J. Pest Manage*. **35**(4): 410-413.

RAMZAN, M., SINGH, D., SINGH, G., MANN, G. S. & BHALLA, J. S. 1990. Comparative development and seasonal abundance of hadda beetle, *Henosepilachna vigintioctopunctata* (Fabr.) on some solanaceous host plants. *J. Res. Punjab Agric. Uni.* **27**(2): 253-262.

SARKER, R. H., YESMIN, S. & HOQUE, M. I. 2006. Multiple shoot formation in eggplant (*Solanum melongena* L.) *Plant Tissue Cult. Biotechnol.* **16**: 53-61.

SHARMA, J. H. & TAYDE, A. R. 2017. Population dynamics of Brinjal Fruit and Shoot borer, *Leucinodes orbonalis* Guen. and Hadda Beetle, *Epilachna Vigintioctopunctata* Fab. on Brinjal at Allahabad Agroclimatic Region. *Int. J. Curr. Microbiol. Appl. Sci*. **6**(6): 2055-2060.

SRIVASTAVA, A. S. & KATIYAR, S. S. L. 1991. *Epilachna vigintioctopunctata* (Fab.) and *E. dodecastigma* (Muls.) (Coleoptera: Coccinellidae) as a pest of cow pea. *Zeits-fur Angewandte Entomol.* **71**(2): 169-172.

VARMA, S. & ANANDHI, P. 2008. Assessment of mortality factors, biology and morphometrics of hadda beetle, *Henosepilachna vigintioctopunctata* (F.) on brinjal. *Ann. Pl. Protec. Sci.* **16**(1): 119–123.

UIKEY, B. L., BHUPENDRAKUMAR, GHULE, T., JHA, S. & KEKTI, R. K. 2016. Incidence pattern and biology of epilachna beetle, *Henosepilachna septima* Dieke on bottle gourd in gangetic new alluvial zone of west Bengal. *J. Insect Sci*. **29**(1): 63-66.