International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 06-11-2021, Accepted: 22-11-2021, Published: 07-12-2021
Volume 6, Issue 6, 2021, Page No. 163-165

Effect of host plants on the ovipositional behavior of *Epilachna vigintioctopunctata*

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Abstract
Effect of four major host plants on all the biological parameters of the test insect included in the study revealed that grub and pupal development, survival, longevity and fecundity of *Epilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) adults on given host plants under laboratory conditions (29±1ºC, 60-70% RH) differ significantly. In a choice test *E. vigintioctopunctata* females oviposited most on *Solanum melongena* (286.80 ± 19.86 eggs), least on Datura stromonium (164.90 eggs). The incubation period was shortest on S. melongena (3.25) and longest on *Datura Stromonium* (5.40 days) whereas per cent egg hatchability was highest on *Solanum tomentosa* (91.75) and lowest on *Momordica charantia* (82.00).

Keywords: *Epilachna vigintioctopunctata*, ovipositional behavior

Introduction

The beetles belonging to the Epilachninae, constitute one sixth of the known species of the coccinellidae. The genus Epilachna has nearly 500 phytophagous species, and is widely distributed in South East Asia, Australia, Sri Lanka, East Indies, Malaya, America, Siberia, China and India. It is a polyphagous plant feeder and destructive pest of many cultivated and wild crops. (Ahmad *et al*., 2001; Rath, 2005) [1, 10]. About one sixth of all the illustrated species of the family Coccinellidae belongs to the sub-family Epilachninae and more or less all, to a single genus namely Epilachna. They are suppose to attack especially the leaves and feed on the chlorophillous green portion and thereby preventing the synthesis of carbohydrate by the host plants due to lack of sufficient chlorophyll even though the sunlight is present (Endo *et al*., 2004). This pest causes serious damage to the crops of major families namely Cucurbitaceae, Leguminosae and Solanaceae. Both grubs and adults are injurious to the host plants. Infestation primarily begins in colonial form just after hatching of egg mass (Murata *et al.*, 1994). The adults feed irregularly upon the upper surface of leaves and its grubs feed on the lower surface of leaves by scraping, causing net like appearance of the host plant leaves that turn brown in colour, entirely dry up due to extensive infestation by the growing population and finally defoliate (Pradhan *et al*., 1990). Vegetative growth and development of the plants are greatly harmed and their economic yield is noticeably declined (Alam, 1969; Rajagopal and Trivedi, 1989) [8]. From economic stand point, the Epilachna beetle bears great significance because it can alone damage up to 80% of the host plants (Rajagopal and Trivedi, 1989) [8], while it is responsible for 10-20% yield loss in brinjal (Alam, 1969). Infestation period of this insect pest varies with temperature, season and region where temperature plays significant role on its molting, metamorphosis, growth and development and oviposition as well as on its food consumption. It is well recognized that the peak attack of this insect pest is generally observed in July to August *i.e.* during the rainy season and usually there is no movement, activity or infestation by the pest found in winter season when they go to hibernation (Shukla and Upadhyay, 1985). Epilachna beetles feed most actively during morning and evening. The daily fluctuation in the rate of feeding depends mainly on the temperature of the environment which estimates the level of metabolism (Tilavov, 1981). Insect pest prevalence and its degree of infestation vary from season to season, place to place due to the environmental changes especially temperature, and host plant species (Amitava *et al.*, 2002). Ganga and Chetty (1982) [4] recorded that many other naturally occurring solanaceous plants (*Solanum nigrum*, *S. torvum*, *S. esculentum*, *Physalis minima and Datura fastuosa*) act as a reservoir for maintaining the population of *E.vigintioctopunctata* throughout the year. The peak period of infestation of these beetles generally varies with the regions involved. In general the peak activity of this species has been noticed from July to August where both the imago and the larvae energetically feed on the epidermal tissues of the host plants (Khan *et al*., 2000) [5]. Oviposition behavior has been the midpoint of many major debates on the ecology and evolution of interactions between insects and plants: the causes of host specificity, the origin of host shifts, and the potential for sympatric speciation, the modes of coevolution, and the pattern of attack on host plants within local populations. The selectivity of ovipositing females may often present the preliminary foundation for discrepancy of insect populations onto diverse plant species, and it may impel the evolution of some plant defenses. Behavioral, genetic, and ecological determinants of oviposition behavior persuade preference for plants and plant parts in insects (Thompson and Pellmyr, 1991). Food plays a very indispensable role in oviposition as it provides nourishment to the ovarioles that eventually results in egg laying. Both oviposition and feeding of the adults as well as the larvae is distressed by the temperature (Pervez and Omkar, 2004) [7]. To better understand *E. vigintioctopunctata*/crop-plant interactions it is necessary to determine the role of wild hosts on grub and adult biology, the effect of grub to adult host-switches on adult biology, polyphagy/host plant sequences and feeding habits. All of the above factors are critical components of *E. vigintioctopunctata* nutritional ecology, bionomics and management. The objectives of the current study were to catalogue the host plant complex of E. *vigintioctopunctata* and to delineate and quantify their role on the pest biology.

Materials and Methods

The investigations on ovipositional behavior of the *Epilachna vigintioctapunctata* were carried out using four host plants *viz.*, Bitter gourd (*Momordica charantia*), Brinjal (*Solanum melongena*), Datura (*Datura stromonium*), Tomato (*S. esculentum).* These four host plants were singly planted in pots in a green house at Department of Entomology, Faculty of Agriculture, Annamalai University and were maintained insecticide free. The plants were used when they had 4-5 true leaves. Initial culture of the test insect was collected from field and raised in the laboratory on potted host plants species under study. 20 specimens replicated five times of the beetle were collected and confined to Petridishes (10 cm diameter). Fresh leaves of the respective host plants were provided daily as food after cleaning the Petri dishes. For these experiments 20 specimens of freshly laid eggs were kept separately for all the host plant species. The specimens were observed daily and data on fecundity, per cent hatchability of eggs. Thus, the effect of different host plants was calculated by statistical analysis of data recorded on fecundity, per cent hatchability, incubation period using one way ANNOVA (Tukey's-b, P<0.05), Maurice *et al.* (2012) [6]

Results and Discussion

The present findings are in agreement with those of (Ahmad *et al*., 2001., Rath, 2005) [1, 10] who recorded many cultivated and wild crops belonging to Solanaceae, Cucurbitaceae, Fabaceae, Convulvulaceae and Malvaceae families as host plants such as brinjal, tomato, tobacco, melon, cucumber, gourds, pumpkin and potato have been attacked by *E. vigintioctopunctata*. Similar findings have also been reported on some medicinal plants like *Datura stromonium, D. metel, D. innoxia, Solanum aviculare, S.nigrum, Withania sominfera, Physalis minima* and wild species of *Amaranthus caudatus* (Rajagopal and Trivedi, 1989 [8]. Factors determining oviposition choice include quantity and/or quality of resources, plant morphology, natural enemies, inter- orintra speciûc competition, and allelochemicals (Ballhorn and Lieberei, 2006) [2].

The data revealed that the host biology relation of *E. vigintioctopunctata* varies when reared on different host plants. The average fecundity of *E. vigintioctopunctata* on different hosts differ significantly (F =68.390, P = 0.001) in the descending order of host preference of the hadda beetle *S.melongena* (286.80), *S. tomentosa* (261.25) and *Momordica charantia* which promote a higher egg laying (211.80) in comparison to Datura (164.90). The present findings are in conformity with Dhamdhere *et al.* (1990) who also reported the fecundity of female reared on brinjal was the highest (603) followed by (486), Tomato (355) and was lowest on Datura (297). Similarly, Ramzan *et al*. (1990) [9] also recorded highest fecundity on Brinjal and potato. The incubation period of eggs varied significantly (F = 20.131, P = 0.0001) on the host plants and ranged from 3.25 days (*S. melongena*) to 5.40 days *(D. stromonium*). Similar results have been obtained by Dhamdhere *et al.* (1990) who reported that the average incubation period of eggs was shortest on Brinjal (4.00 days) followed by Tomato (4.13 days) and Datura (5.20 days). Further Ramzan *et al*. (1990) [9] also reported incubation period of 4.30 days on Brinjal followed by Potato (3.50 days) Per cent egg hatchability differed significantly (F = 9.324, P = 0.0001) and highest was observed in case of *S. tomentosum* (91.75 ± 3.73 per cent) followed by *Solanum melongna* (91.25 ± 3.93, *Momordica charantia* (89.25) and lowest *on Datura metal*

Our study finally concludes that *Solanum melongena* supports oviposition in this lady beetle and the total number of eggs laid by the female during her lifetimes starts increasing, reaches a peak and then finally declines as the female undergoes ageing. The total number of eggs laid and the total number of adults emerged was also found to be significant.

Effect of different host plants on the ovipositional behavior of *Epilachna vigintioctopunctata*

Table 1

S. no	Host plants	Fecundity (No of eggs)	Incubation period (Days)	Egg hatchability (%)
1	*Solanum melongena*	286.80	4.00	91.25
2	*Solanum tomentosa*	261.25	4.13	91.75
3	*Momordica charantia*	211.80	5.70	89.25
4	*Datura metal*	164.90	5.20	84.50
SE	0.366	1.435	0.816	0.946
CD	0.792	3.108	1.766	2.048

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