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# Impact of host plants on the biology of hadda beetle, *Henosepilachna vigintioctopunctata* fab. in laboratory condition

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**Abstract**
Hadda beetle, *Henosepilachna vigintioctopunctata* (Fab.) (Coccinellidae: Coleoptera) is one of the main leaf feeders of eggplant leading to heavy economic yield loss. Due to the vast host range, it occurred throughout the year. The biology of hadda beetle, *Henosepilachna vigintioctopunctata* on three host plants *viz.*, Brinjal (*Solanum melongena* L.), Cape gooseberry (*Physalis minima* L.), Bitter gourd (*Momordica charantia* L.) were carried out under laboratory condition in the Department of Entomology, Annamalai University, Chidambaram, Tamil Nadu. The total life span of each stage such as egg, four stages of larvae, pre-pupae, pupae and adult (both male and female) longevity was recorded. The results revealed that among the life stages of *H. vigintioctopunctata*, the egg period was maximum in the host plant *P. minima* (5.37 days) and minimum (4.00 days) in *M. charantia.* Remaining stages like grub (19.87 days), pre-pupal (2.25 days), pupal (4.25 days) and adult (29.50 and 32.50 days for male and female respectively) were recorded maximum in *M. charantia* and minimum in *P. minima* with grub (15.12 days), pre-pupal (1.50 days), pupal (3.25 days) and adult longevity (24.87 and 27.37 days for male and female respectively). It was found that *P. minima* recorded with a minimum period of life span of beetle and it may be served as a suitable host for *H. vigintioctopunctata*, so it may be utilized as a trap crop in brinjal to minimize the incidence.

**Keywords:** biology, hadda beetle, host plants, *H. vigintioctopunctata*

## Introduction
Hadda beetle, *H. vigintioctopunctata* Fab. is a key pest of solanaceous crops and found all over the world [1]. It is the only pest in the whole Coccinellidae family of order Coleoptera.

It is reported that apart from brinjal, hadda beetle act as the key pest of many cultivated and weed plants. Nearly, 500 phytophagous species of genus *Henosepilachna* is distributed in South East Asia, Sri Lanka, Malaysia, East Indies, America, Siberia, China, Australia and India. In India, the beetle is present in higher hills of Jammu and Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Karnataka and Bengal and also in the plains. Being polyphagous in nature, both adults and grubs feed voraciously by scrapping the chlorophyll of the leaves (in between the veins) resulting in skeletonization of the lamina which seems lace like appearance, later dries up and fall from the plants. It also leads to retardation of the plant growth and thereby reduces the bearing of the plants. All stages of beetle are found on the plant foliage [2, 3]. In severe cases, even the calyx of the fruits may also be infested. The most damaging and voracious stages are 3rd and 4th instars. Under favourable condition the damage may go up to 80% and it depends on place and season. In vegetative stage, the beetle can cause damage up to 65% [4].

It is reported that apart from brinjal, hadda beetle act as the key pest of many cultivated and weed plants. Owing to the attack of hadda beetle, the growth and development of plants is greatly hampered and yield is markedly reduced. Hadda beetle can able to survive in both on and off seasons. Management practices during cropping season may reduce the beetle population in the field but again the population rebuild in a certain period of time from the alternate hosts to the main crop. For effective management of this pest, alternate hosts and its interaction should be known [5]. It is essential to determine the function of host plants on pest biology, the cause of host switches on adult biology and species feeding habits. The increasing pest status, damage and abundance of hadda beetle on brinjal in Tamil Nadu has raised questions about the factors responsible for its development and management under natural conditions. There is a necessity for future work on effect of available host plants on various stages of hadda beetle so that it could be applied in the execution of any pest management strategy against hadda beetle. Hence the present study was carried out to observe the biology of *H. vigintioctopunctata* on various host plants under laboratory condition to find out the host suitability for this insect.

## Materials and Methods
The time taken by developmental stages of hadda beetle, *H. vigintioctopunctata* on various host plants was carried out under laboratory condition (27oC±2oC temperature and 70±5% RH) at the Department of Entomology, Faculty of Agriculture, Annamalai University during the year 2019. Initially adults of *H. vigintioctopunctata* beetles were collected from field and they were confined to the petriplates for egg laying. Egg batches were collected and kept in petriplates provided with moistened filter paper in order to avoid drying of eggs.

After hatching ten numbers of grubs, were taken for the experiment and allowed to feed on the various host plants *viz.*, Brinjal (*Solanum melongena* L.), Husk tomato/ wild cape gooseberry (*Physalis minima* L.) and Bitter gourd

(*Momordica charantia* L.). Observations were recorded on time taken for completion of each stage of grub (1st, 2nd, 3rd, 4th instar, prepupal, pupal stages along with adult longevity [6]. Both the sexes were allowed to mate in the oviposition chamber and the eggs were collected for assessing the incubation period. Thus, the effect of different host plants on the developmental period of the test insect was calculated based on the data recorded on incubation period, grub period, pupal period, total life cycle, male and female longevity using statistical analysis one-way ANNOVA [7].

## Results and Discussion

The host plants of *H. vigintioctopunctata* such as eggplant (*S. melongena*), cape gooseberry (*P. minima*) and bitter gourd (*M. charantia*) were evaluated to study the biology of different life stages *viz*., egg, larval, prepupal, pupal period and adult longevity of *H. vigintioctopunctata* are presented in Table 1. The results of the experiment revealed that data on egg period showed that among the three hosts, the maximum egg duration (5.37 ± 1.23) was lasts in *P. minima* followed by *S. melongena* (4.75 ± 1.06) whereas in *M. charantia*, the egg period was 4.00 ± 0.70 days and it was comparatively lower than other the two hosts. The variation in the incubation period might be due to the presence or absence of nutritional factors [8]. Similar results were recorded by [9] that the incubation period of these beetles were 5.30 days in brinjal. The egg period lasts up to 4.0 days on *S. melongena*also was noticed by [10]. Likewise, [11] reported that egg period of *H. vigintioctopunctata* was 3.20 ± 0.84 days in *S. melongena*. The incubation period of egg stage (6.62 ± 0.55 days) on *M. charantia* was reported by [12]. Similarly, [13] observed that the incubation period of egg was ranged from 5 to 7 days in *M. charantia*. Further, [14] found that *H. vigintioctopunctata* egg period lasts up to 8.00 ± 2.23 days on *M. charantia*. It is in contrary to the present findings that egg period was 4.75 days in *M. charantia.*

The observations recorded on the larval instars (first to fourth instar) of *H. vigintioctopunctata* for their life potency on the above three hosts demonstrated that the 1st instar stage of these grubs survived for a maximum period of 3.25 ± 1.06 days on *M. charantia* followed by *S. melongena* (2.62 ± 1.23) and *P. minima* (2.12 ± 1.23). The survival duration of 2nd instar grubs were taken maximum (5.37 ± 1.94) on *M. charantia* and there was a significant difference in other treatments such as *S. melongena* and *P. minima* with the duration of 4.75 ± 1.76 and 3.75 ± 1.41 days respectively. The 3rd instar grubs were survived maximum on *M. charantia* (5.62 ± 1.94 days) queued by *S. melongena* (5.37 ± 2.29) and minimum (4.50 ± 2.12) on *P. minima.* The 4th instar grubs were taken 5.62 ± 1.59 days on *M. charantia*, followed by 5.12 ± 2.29 days on *S. melongena* and 4.75 ± 2.12 days on *P. minima*. The total larval (grub) period was noticed and thus showed that among the three hosts, the grubs preferred to shelter maximum days (17.87 ± 7.60) on *S. melongena* followed by *P. minima* (15.12 ± 6.89) and *M. charantia* (19.87±6.54). the total larval period on *M. charantia* was 15.1 ± 4.90 days and 14.9 ± 0.43 days was reported by [9, 10] respectively. Further, [13] mentioned that the grub period was 13.2 ± 5.43 days on *M. charantia*. However, the grub period was observed as 17.87 ± 7.60 days on *S. melongena* which was 20.8 ± 3.35 days on same host as reported by [11]. The grub stage of *H. vigintioctopunctata* had continued upto 25.5 days on *M. charantia* [14]. The extended pre-pupal stage was occurred on *M. charantia* with an average of 2.25 ± 0.70 days which was contrary to the statement given by [13] as they were reported 1.60 ± 0.89 days taken for pre-pupal stage on *M. charantia*. The pupal stage lasts between 3 to 5 days in all the three hosts, where longest pupal period was obtained in *M. charantia* with an average of 4.25 ± 0.35 days.

Data obtained on prepupal stage showed that maximum duration of 2.25 ± 0.70 days on *M. charantia* and *S. melongena* with 2.00 ± 0.70 days was followed suit and the minimum duration of 1.50 ± 0.35 days was noticed in *P. minima*. The pupal stage of *H. vigintioctopunctata* also differred from each host and noticed that, *M. charantia* had taken 4.25 ± 0.35 days for completion of pupal stage followed by *S. melongena* (3.87 ± 0.53) and on *P. minima*, *it* lasts 3.25 ± 0.35 days to complete the pupation. Observation on adult longevity of both male and female were recorded and the results indicated that male and female insects grown on *M. charantia* was alive for a maximum duration of 29.5 ± 6.71 and 32.5 ± 9.19 days respectively. while *S. melongena* was observed with 27.75 ± 6.71 and 31.37 ± 8.30 days respectively and the minimum adult longevity was recorded 24.87 ± 4.06 and 27.37 ± 6.18 days on *P. minima* by male and female beetles respectively. The variation in the developmental period of different stages of *H. vigintioctopunctata* was due to suitability to the host plants as food and variability in food values present in the varieties [15]. Similar results were obtained by [9, 10, 11, 13, 14 16]. The adult longevity of both male and female had extended when they cultured on *M. charantia* with a mean of 29.5 ± 6.71 and 32.5 ± 9.19 days respectively. The above results were in contrast to the report by [11] where the adult male and female were survived an average of 33.6 ± 2.70 and 38.4 ± 1.52 days on *M. charantia* respectively.

**Table 1:** Biology of *H. vigintioctopunctata* on various host plants

| Developmental stages of *H. vigintioctopunctata* | Developmental period on (Days) | | |
|---|---|---|---|
| | ***S. melongena*** | ***P. minima*** | ***M. charantia*** |
| | **Mean ± SD*** | **Mean ± SD*** | **Mean ± SD*** |
| Incubation period | 4.75 ± 1.06 | 5.37 ± 1.23 | 4.00 ± 0.70 |
| Larval (grub) instars | | | |
| 1st instar | 2.62 ± 1.23 | 2.12 ± 1.23 | 3.25 ± 1.06 |
| 2nd instar | 4.75 ± 1.76 | 3.75 ± 1.41 | 5.37 ± 1.94 |
| 3rd instar | 5.37 ± 2.29 | 4.50 ± 2.12 | 5.62 ± 1.94 |
| 4th instar | 5.12 ± 2.29 | 4.75 ± 2.12 | 5.62 ± 1.59 |
| Total larval (grub) period | 17.87 ± 7.60 | 15.12 ± 6.89 | 19.87 ± 6.54 |
| Prepupal period | 2.00 ± 0.70 | 1.50 ± 0.35 | 2.25 ± 0.70 |
| Pupal period | 3.87 ± 0.53 | 3.25 ±0.35 | 4.25 ± 0.35 |
| Adult longevity | | | |
| Male | 27.75 ± 6.71 | 24.87 ± 4.06 | 29.50 ± 6.71 |
| Female | 31.37 ± 8.30 | 27.37 ± 6.18 | 32.50 ± 9.19 |

*Each value is a mean of ten individuals
*Mean values followed by Standard Deviation (SD)
*One factor ANOVA

## Conclusion

The developmental parameters such as duration of various stages of life cycle and longevity of adult male and female of *H. vigintioctopunctata* beetles will be helpful for providing knowledge on population build up on various host plants. Based on the results of present study, it is concluded that *P. minima* recorded with a minimum period of life span when compared to other two host plants and it served as a suitable host for *H. vigintioctopunctata*. Hence, it can also

be incorporated in IPM modules as a suitable trap crop so as to minimize the pest load on the main crop i.e., brinjal.

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