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Biology on the life stages of *Epilachna* beetle, *Henosepilachna vigintioctopunctata* Fabricius (Coleoptera: Coccinellidae) on brinjal in Bishnupur, Manipur

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Abstract

Henosepilachna vigintioctopunctata (Fab.) (Coleoptera: Coccinellidae) or Hadda beetle, is one of the major pest on Brinjal. Studies on the biology of hadda beetle on brinjal in Bishnupur district, Manipur, revealed that the beetle passes through four instars. The incubation period was 3.47 ± 0.37 days. The total larval period was 18.86 ± 0.28 days. The mean pupal period was 5.33 ± 0.07 days. The adult male longevity was 28.63 ± 0.89 days. The mean lifespan of female beetle of *E. vigintioctopunctata* was observed as 34.03 ± 1.16 days. The mean fecundity was recorded as 48.77 ± 1.74 eggs/female.

Keywords: *Henosepilachna vigintioctopunctata*, brinjal, biology, instars

Introduction

Brinjal (*Solanum melongena* L.) also known as eggplant or aubergine is an important vegetable crop of tropical and subtropical region. The fruits are used as vegetables. It is a perennial but grown commercially as an annual crop by small and marginal farmers in India. It is infested by a dozen of insect pest, among which the most serious and destructive one is the *Henosepilachna vigintioctopunctata*. *H. vigintioctopunctata* (Fabricius) or the spotted leaf beetle or hadda beetle, melon ladybird beetle belongs to the family Coccinellidae of Order Coleoptera. It is a key-pest of the solanaceous (potato, brinjal and tomato) and cucurbitaceous (gourds, melon, cucumber) plants (Islam *et al.*, 2011) [7]. It is an oligophagous, multivoltine, coccinellid beetle, infesting crops in midhills, plains of India and in other countries. The beetle causes considerable economic loss to many crops including brinjal depending on place and season (Islam *et al.*, 2011) [7]. High temperature and humidity during July to September lowered down the duration of life cycle and increased fecundity leading to rapid multiplication of pest resulting in higher population level and thereby, increased crop loss during the period (Gosh and Senapati 2001) [5]. Due to its infestation, considerable economic loss occurs during every crop season, adversely affecting both quality and quantity of crop output. Both grubs and adult beetles feed voraciously on the green matter of the leaf and skeletonize it leaving the upper epidermal tissue intact (Rath *et al.*, 2005) [19] leading to 60% loss of fruit production (Mall *et al.*, 1992) [11]. By studying the biology, nature and behavior of different stages of its life cycle it will be easy to manage the pest population with the help of local resource and skills as well as to avoid poisonous chemicals of this dreaded pest of brinjal.

Materials and Methods

Studies were conducted at the Department of Entomology, Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences (PDDUIAS), Utlou, Manipur. The test insects were obtained from insect cultures. The beetles were reared and maintained on brinjal plants grown in plastic pots kept in netted wooden cages ($65 \times 65 \times 70$ cm). Freshly laid eggs were kept in jar for hatching. The leaves on which eggs were laid were wrapped with moistened cotton to prevent desiccation of the leaves and were placed inside the jars along with a moistened foam disc. The newly hatched grubs were reared in the laboratory in plastic jars ($15 \text{ cm} \times 10 \text{ cm}$) on fresh and tender brinjal leaves until they reached pupal stage. The jars were covered with muslin cloth and fastened with rubber band to prevent escape of adults and also to provide aeration. Pupae were then separated and kept in jars with moistened foam disc (14mm thick).

The emerged adults were collected, paired and kept for egg laying in boxes (Saravanan and Chaudhary, 2012) [20]. Fresh leaves were offered daily to the insects. Observations on fecundity, incubation period, larval duration, pupal duration and total development period (egg to adult) were made. The insect was maintained at 30 ± 5 °C and $65\pm 5\%$ relative humidity.

Results and Discussion

H. vigintioctopunctata undergoes complete metamorphosis with four distinct developmental stages: egg, larva, pupa and adult. This is consistent with Mahendra *et al.* (2022) [10], Sunil and Senapati (2001) [5] and Tara and Sharma (2017) [23] in which *Epilachna* was reported as a holometabolous insect having complete metamorphosis of egg, larva, pupa and adult stages.

Eggs

The freshly laid eggs of *H. Vigintioctopunctata* were elongated or spindle shaped and orange yellow to pale yellow (Kaur and Mavi, 2005; Varma and Anandi, 2008) [9, 25] but became darker as they were about to be hatched. The eggs were laid in clusters on the ventral surface of the host leaves. The female lays on an average 48.77 numbers of eggs with minimum of 46 up to a maximum of 60 (Table 1). The results of present investigation revealed that the incubation period varied from 3 to 4 days with an average of 3.47 ± 0.37 days. Bumpy and Arora (2017) [4], Bindu and Pramanik (2015), Jamwal *et al.* (2013) [8] and Shanmugapriyan *et al.* (2017) [21] also recorded 3.76 ± 0.26 , 3.2, 3.25 ± 0.97 and 3.56 days of incubation period on brinjal and 3.79 ± 0.49 days on *Withania somnifera* (Venkatesha, 2006) [24]. Incubation period of 2.9 ± 0.7 days was reported by Mahendra *et al.* (2022) [10] which was lower than the present findings and might be due to different rearing temperature. The incubation period of eggs of *H. vigintioctopunctata* has also been reported to vary with the host plant on which eggs were laid. It was 4.75 ± 0.24 days on *W. Somnifera* (Vipin and Saravanan, 2011) [26], 7.14 days as reported by Araujo and Almedia (2004) [1] and 5.20 ± 0.87 days by Ramandeep and Mavi, 2005) [9].

Table 1: Mean duration (\pm SE) of developmental stages of *Henosepilachna vigintioctopunctata* on brinjal

Stages	Duration (days) Mean \pm S E	Range
Incubation	3.47 ± 0.37	3-4
Instar I	3.08 ± 0.14	2-3
Instar II	3.74 ± 0.25	3-4
Instar III	4.21 ± 0.12	3-4
Instar IV	4.36 ± 0.33	3-5
Total larval duration	18.86 ± 0.28	18-19
Pre Pupal	2.90 ± 0.26	2-3
Pupal Period	5.33 ± 0.07	4-6
Male Longevity	28.63 ± 0.89	26-30
Female longevity	34.03 ± 1.16	32-36

Table 2: Percentage of Egg viability, mean larval survival, pupation and Adult emergence of *Henosepilachna vigintioctopunctata* on brinjal

Stages	(Mean \pm SE) Days
1. Eggs Viability	78.81 ± 0.45
2. Larval survival	82.08 ± 0.52
3. Pupation	81.40 ± 0.49
4. Adult emergence	80.38 ± 0.75

Grubs: The larvae were light yellow in color when freshly hatched and became darker as they matured. They had soft body covered with spines and possessed functional legs with which they crawled on the leaves of the hosts. The mean duration of first, second, third and fourth instars were 3.08 ± 0.14 , 3.74 ± 0.25 , 4.21 ± 0.12 and 4.36 ± 0.33 days respectively (Table 2). Our findings are in conformity with Shanmugapriyan *et al.* (2017) [21] reporting 3.25, 2.98, 2.55 and 3.22 days mean larval duration. Kaur and Mavi (2005) [9] also reported that the time taken for first, second, third and fourth instar grubs were 3-4, 2-4, 2-4 and 2-5 days with an average of 3.5, 3.1, 2.7 and 3.5 days, respectively. Verma and Anandhi (2008) [25] reported that the average duration of 1st, 2nd, 3rd and 4th instars varied from 2.6 ± 0.48 , 2.9 ± 1.04 , 2.5 ± 0.50 and 6.8 ± 1.94 days. Hossain *et al.* (2008) [6], Ramandeep and Mauvi (2005) [16] reported that the grubs completed 4 instar within 11.30 ± 0.48 and 15.6 days, respectively. The duration of 1st, 2nd, 3rd and 4th grub instars was 2.25 ± 0.13 , 3.25 ± 0.08 , 2.55 ± 0.15 and 3.25 ± 0.12 days, respectively. Mean larval survival was 82.02 ± 0.47 percent (Table 2).

Table 3: Premating, pre-oviposition, oviposition period, longevity of mated and unmated adult of *H. vigintioctopunctata* on brinjal

Activity	Period (days \pm SE)	Range
1. Pre-mating	2.34 ± 0.03	1-3
2. Pre-oviposition	5.91 ± 0.31	5-6
3. Oviposition	20.78 ± 0.90	19-22
4. Fecundity	48.77 ± 1.74	46-60

PUPA

The grub stop feeding for a day or two and transformed to pupa which remained attached below the surface of the leaf. The pupa was light yellow when newly emerged and later became darker brown. The body was spineless and attached itself to the posterior end to the underside of leaves of the host. The pupal period lasted for 4 to 6 days with average of 5.33 ± 0.07 days (Table 1). Our results are in similar line with the findings of Mahendra *et al.* (2022) [10] and Shanmugapriyan *et al.* (2017) [21] reporting pupal duration of 3 to 6 days with average 4.4 ± 1.02 , 5.11 days, respectively. Similarly, Nagia *et al.* (1992) [12] also reported that pupal period of 4.65 ± 0.49 days. Ram and Verma (1998) [15] recorded the pre-pupal and pupal period from 1-3 and 4-10 days, respectively. Our results are also in conformity with the findings of Patel and Purohit (2000) [13] who reported pupal period 4.10 ± 0.30 days on brinjal. Similarly, Kaur and Mavi (2005) [9] observed the mean pupal period of 4.10 ± 0.54 days. Verma and Anandhi (2008) [25] also recorded that the pupal period ranged from 3-6 days with an average of 4.60 ± 0.9 days.

Table 4: Mean longevity (days \pm S.E) of mated and unmated adult *H. vigintioctopunctata* on brinjal.

Adult beetle	Longevity (days \pm SE)	Range
Mated males	25.47 ± 0.78	24-26
Mated females	33.82 ± 1.14	32-36
Unmated males	34.27 ± 0.18	32-36
Unmated females	40.33 ± 0.67	39-41

Adults

Adults were oval with cream-yellow color at emergence which later became darker brown at full development. At

emergence, 12 black spots of varying sizes appeared on the dorsal surface of the beetles. Previous studies on *E. vigintioctopunctata* by Verma and Anandhi (2008) [25] and Borgia and Miranda (2016) [3] on brinjal showed similarities in their body morphology as observed in the present study. Adult male beetles were distinguished from the female by the presence of cut in the sub genital plate. Males were slightly smaller than the females in size. The adults were observed feeding on the leaves of the host a day after emergence. Adult longevity was 28.63±0.89 for males and 34.03±1.16 for females. The findings of this study agree with those of Mahendra *et al.* (2022) [10] results recording 27.5±1.68 and 30.5±2.16 days of adult male and female longevity, respectively. On an average the adult longevity varied from 25 to 35 days. Fecundity of female was 48.77±1.74 eggs (Table 1). The adult beetle recorded mean longevity of 25.47±0.78 and 33.82±1.14 for mated males and females, respectively while mean longevity for unmated males and females were 34.27±0.18 and 40.33±0.67 respectively (Table 4). The unmated males and female beetles lived longer than the mated beetles. Our findings are in close range with results obtained by Ram and Verma (1998) [15] reporting complete development in 17-41 days on brinjal. Ghosh and Senapati (2001) [5] also reported that the life cycle duration was shortest (26.74 days) during June-July and longest (33.52 days) in September-October on brinjal. Similar observations have also been recorded by Qamar *et al.* (2009) [14] who observed that the male longevity ranged from 41-69 days with an average of 57.2±7.12 days and female longevity of 45-76 days with an average of 60.80±9.73 days.

References

- Araujo SM and Almedia L. Behaviour and life cycle of *Epilachna vigintioctopunctata* (Fabricius) (Coleoptera: Coccinellidae) in *Lycopersicum esculentum* Mill. (Solanaceae). *Revista Brasileira de Zoologica*. 2004;21(3):543-550.
- Bindu, SP, Pramanik A. Studies on biology and biometry of Epilachna beetle, *Epilachna vigintioctopunctata* Fabricius (Coccinellidae: Coleoptera) on brinjal in West Bengal, India *The Bioscan*. 2015;10:149-51.
- Borgia MN, Miranda MT. Bionomics, damage caused biology and morphometrics of 28 spotted lady beetle *Epilachna vigintioctopunctata* (Fab) (Coleoptera)- A serious pest of bitter gourd, *Momordica charantia* in Kerala. *International journal of applied and pure science and agriculture (IJAPSA)*. 2016, 02(06)
- Bumpy K, Arora R. Impact of Alternating Temperature and Elevated CO₂ on Hadda Beetle, *Henosepilachna vigintioctopunctata* (Coleoptera: Coccinellidae). *The Bioscan*. 2017;12(2):743-747.
- Ghosh SK, Senapati SK. Biology and seasonal fluctuation of *Henosepilachna vigintioctopunctata* (Fabr.) on brinjal under Tarai region of West Bengal. *Indian Journal of Agriculture Research*. 2001;35:149-154.
- Hossain MA, El-Taj HF, Haque MA, Ara A, Uddin MN. Biology, food consumption and natural enemies of *Epilachna* beetle, *Epilachna dodecastigma* (Wied.). *International Journal of Sustainable Agriculture Technology*. 2008;4(2):59-64.
- Islam K, Islam M, Ferdousi Z. Control of *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae) using some indigenous plant extracts. *J Life Earth Sci*. 2011;6:75-80.
- Jamwal VVS, Ahmad H, Sharma D. Host biology interactions of *Epilachna vigintioctopunctata* Fabr. *The Bioscan*. 2013;8:513-17.
- Kaur R, Mavi GS. Biology of *Epilachna vigintioctopunctata* (Fab.) (Coleoptera: Coccinellidae) on brinjal in Punjab. *Crop Research*. 2005;29(1):141-144.
- Mahendra, Acharya VS, Rukshana. Biology of hadda beetle, *Henosepilachna vigintioctopunctata* on brinjal. *The Pharma Innovation Journal*. 2022;11(11):218-220
- Mall NP, Panday RS, Singh SV, Singh SK. Seasonal incidence of insect pests and estimation of the losses caused by shoot and fruit borer on brinjal. *Indian J Entomol*. 1992;53:241-247.
- Nagia DK, Kumar S, Sharma P, Meena RP, Saini ML. Mass multiplication of *Henosepilachna vigintioctopunctata* (Fabricius), (Coleoptera: Coccinellidae) on *Physalis minima* L. *Plant Protection Bulletin*. 1992;44(3):24-25.
- Patel KN, Purohit MS. Host preference of epilachna beetle, *Henosepilachna vigintioctopunctata* (Fabr.). *Gujarat Agricultural University Research Journal*. 2000;25(2):94-95.
- Qamar M, Masarrat H, Sharma DK. Biology and morphometrics of *Henosepilachna vigintioctopunctata* (Fab.) on brinjal. *Annals of Plant Protection Sciences*. 2009;17(2):303-306.
- Ram C, Verma JP. The bionomics of hadda beetle, *Epilachna elatrii*. In: *National Seminar on Entomology in 21st century, Biodiversity, Sustainability, Environmental Safety and Human Health*. April 30-May 2, 1998. Rajasthan College of Agriculture, Udaipur; c1998.
- Ramandeep K, Mavi GS. Biology of *Epilachna vigintioctopunctata* Fab. (Coleoptera: Coccinellidae) on brinjal in Ludhiana, Punjab. *Crop Res. Hisar*. 2005;29(1):141-144.
- Ramzan M, Singh D, Singh G, Mann GS, JS. Comparative development and seasonal abundance of hadda beetle *Henosepilachna vigintioctopunctata* (Fab.) on some solanaceous host plants. *Journal Research*. 1990;27(2):253-262.
- Wang CB, He TL, Li HE, Zhou C. Two new species of *Lucanus* Scopoli, 1763 from Yunnan, Southwest China (Coleoptera, Lucanidae, Lucaninae). *Int. J. Biol. Sci*. 2020;2(2):68-79. DOI: 10.33545/26649926.2020.v2.i2a.93
- Rath LK. Antibiosis mechanism in eggplant against *Epilachna* beetle, *Henosepilachna vigintioctopunctata* (Fabr.). *Indian Journal of Plant Protection*. 2005;33(1):82-84.
- Saravanan L, Chaudhary V. Temperature-dependent development and degree-day model of *Epilachna vigintioctopunctata* (Coleoptera: Coccinellidae) on Ashwagandha (*Withanai somnifera*). *Indian J Plant Prot*. 2012;40: 237-39.
- Shanmugapriyan R, Remia KM, Dhanalakshmi V. Studies on Biology of *Henosepilachna vigintioctopunctata* (fab.) on bitter gourd. *World Journal of Pharmaceutical Research*. 2017;6(1):1121-1132.
- Sunil KG, Senapati SK. Biology and Seasonal Fluctuation of *Henosepilachna vigintioctopunctata* Fabr. On Brinjal under Teraj Region of West Bengal. *Indian Journal of Agricultural Research*. 2001;35(3):149-154.

23. Tara JS, Sharma S. Biology and Life Cycle of *Henosepilachna vigintioctopunctata* Fabricius, a serious defoliator of bitter gourd (*Momordica Charantia*) in Jammu region (Jammu & Kashmir) India. Indian J Sci. Res. 2017;13(1):199-203
24. Venkatesha MG. Seasonal Occurrence of *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) and its parasitoid on Ashwagandha in India J Asia Pac Entomol. 2006;9:1-4.
25. Verma S, Anandhi P. Assessment of mortality factors, biology and morphometrics of hadda beetle, *Epilachna vigintioctopunctata* on brinjal. Annals of Plant Protection Sciences. 2008;16(1):119-123.
26. Vipin C, Saravanan L. Biology and seasonal incidence of *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) on Ashwagandha [*Withania somnifera* (L.) Dunal] in charotur region of Gujarat. Pest Management in Horticultural Ecosystems. 2011;17(2)132-139.
27. Ramzan M, Singh S. Studies on the biology of hadda beetle *Epilachna vigintioctopunctata* (Fab.) on different host plants at Ludhiana. In: Symposium on Insect Ecology and Resource Management. October 2-4, 1982. Department of Zoology, S. D. College, Muzaffamagar India; c1982.