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Biology and Morphometrics of Hadda Beetle (Henosepilachna vigintioctopunctata Fab.) on Indian Ginseng

Neelam Kumari[1*], K C Kumawat[1], Suresh Choudhary[1] and Neetu Choudhary[1]

ABSTRACT

The experiment on biology and morphomatrics of Hadda beetle, Henosepilachna vigintioctopunctata (Fab.) was studied on Indian ginseng, Withania somnifera (L.) Dunal under laboratory, Department of Entomology, Sri Karan Narendra Agriculture University, Jobner, Rajasthan. Result showed that the fecundity ranged from 210 to 327 and incubation period was 7 to 10 days. It has four larval instars, with total larval and pupal period being 12-18 and 4-8 days, respectively. The average longevity of male and female was 50.3 and 64.8 days, respectively. The average body length of male was 6.21 ± 0.17 mm and breadth was 4.62 ± 0.28 mm, whereas, in female length was 7.15 ± 0.28 mm and breadth was 5.19 ± 0.27 mm.

Keywords: Biology, Fecundity, Hadda beetle, Morphometric, Indian ginseng

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INTRODUCTION

Hadda beetle, Henosepilachna vigintioctopunctata (Fabricius) or the spotted leaf beetle or 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). It is an oligophagous, multivoltine, coccinellid beetle, infesting crops in midhills, plains of India and in other countries. Indian ginseng or Indian winter cherry, Withania somnifera (L.) Dunal commonly known as Ashwagandha or Ashgandh belongs to family Solanaceae is an important ancient medicinal plant, the roots of which have been employed in Indian traditional systems of medicines, Ayurveda and Unani. It is being cultivated for centuries in India and used in ayurvedic indigenous medicine for more than 3,000 years (Umadevi et al., 2012).

The crop, Indian ginseng is reported to be attacked by many insect pests (Manjoo and Swaminathan, 2007; Ramanna et al., 2010). The hadda beetle, Henosepilachna vigintioctopunctata (Fab.) is one of the major pests of ashwagandha causing severe damage to crop (Manjoo and Swaminathan, 2007). Sharma and Pati (2011) reported that a large number of plants from family solanaceae have been recorded as the favourable hosts of hadda beetle, H. vigintioctopunctata which include Ashgandh or Indian ginseng, W. somnifera and some other plants. The genus Hensoepilachna is a serious pest of many agricultural crops including potato, egg-plant, tomato, tobacco, bitter gourd, sweet gourd, ribbed gourd, snake gourd, cucumber, pumpkin, zucchini, beet, sugar beet, marrow, cotton melon, rock melon, squash, cowpea, peanut, okra, alfalfa, vetch, clover, cotton, banana, many weeds and grasses (Schaefer, 1983). In India, the beetle is present in higher hills and in plains of Jammu and Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Karnataka and Bengal and also in the plains (Shankar et al., 2010). The incidence of hadda beetle, H. vigintioctopuntata varies from place to place and year to year due to prevailing environment (Konar and Mohasin, 2002). Keeping in view the medicinal importance of H. vigintioctopunctata in Indian ginseng, studies on biology and its morphometrics were done.

MATERIALS AND METHODS

Study on biology and morphometrics of Hadda beetle (H. vigintioctopunctata) on Indian ginseng was conducted during 2021 in the laboratory of Department of Entomology, S.K.N. College of Agriculture, Jobner, Rajasthan. Newly laid egg masses and grubs were collected from the field and confined to glass jars having a circular filter paper spread over the bottom, at suitable temperature ± 24ºC and 53% RH and provided daily fresh Indian ginseng leaves serve as food kept in a glass jar. Cleaning i.e. removal of non-consumed leaves, excavate of grubs was done during the time of feeding. The mouth of the jar was covered with muslin cloth tightly. The moist absorbent cotton was kept over the muslin cloth to maintain the humidity and for better egg laying. Eggs laid by the female in muslin cloth, blotting paper and filer paper were isolated daily with the help of moist hair brush and transferred to petri dish having a circular filter paper spread over the bottom. The petri dish bearing the eggs kept for studying the incubation period. In each petri dish 50 eggs were placed and observations on hatching of eggs were recorded twice daily. The rearing of larvae was carried out individually in petri dish, and observations pertaining to larval and pupal duration, pre-ovipostion, ovipostion, post ovipostion period and longevity were recorded. The male beetles were distinguished from the female by abdominal character, by presence of cut in the sub genital plate. The number of eggs laid by each female during life time was

[1]Department of Entomology, Sri Karan Narendra Agriculture University, Jobner, Rajasthan 303329 (India)
[*]Corresponding Author E-mail: choudharyneelam277@gmail.com

observed to study the fecundity recorded. The length and breadth of eggs, different instars of grub, pupa and adult were measured by using a stereoscopic binocular microscope, fitted with an ocular micrometer calibrated with a stage micrometer. The data thus generated were analyzed statistically.

RESULTS AND DISCUSSION

Longevity of different life stages and morphometric parameters of Hadda beetle

Study of life cycle of H. vigintioctopunctata showed complete metamorphosis with four different stages (Table 1 & 2): egg, grub (larva), pupa and adult (beetle).

Table 1: Longevity of different life stages of hadda beetle on Indian ginseng

Stages of the insect	Minimum (Days)	Maximum (Days)	Av.±S.d
Pre - oviposition period	15	22	19.35 ± 2.18
Oviposition period	21	28	24.2 ± 2.62
Post - oviposition period	19	23	20.2 ± 1.28
Fecundity	210	327	257.85 ± 34.22
Hatching per cent	50	59	55.6 ± 3.11
*Incubation period	7	10	7.7 ± 0.99
Larval period			
1st instar	3	5	4.1 ± 0.87
2nd instar	2	3	2.4 ± 0.51
3rd instar	1	3	2.0 ± 0.82
4th instar	5	7	6.0 ± 0.91
Total Larval period	12	18	14.1 ± 2.13
Prepupal Period	1	2	1.5 ± 0.51
Pupal Period	3	5	4.4 ± 0.82
Total pupal period	4	8	5.65 ± 1.38
Adult Period			
Male	48	55	50.3 ± 3.30
Female	61	72	64.8 ± 3.84
Total Life Period			
Male	65	90	78.4 ± 9.28
Female	67	99	80.7 ± 12.76
Total life cycle (Egg to egg)	31	48	38.65 ± 5.19
Average of 20 observations, * Average of 50 observations			

Table 2: Morphometric parameters of hadda beetle on Indian ginseng

Stages	Body length (mm)		Body Breadth (mm)	
	Range	Av.±S.d	Range	Av.±S.d
Egg	1.30-1.55	1.46±0.07	0.30-0.40	0.43±0.06
Larvae				
1st instar	1.58-2.50	2.05±0.34	0.81-1.30	1.11±0.17
2nd instar	2.65-3.42	3.03±0.24	1.32-1.50	1.42±0.06
3rd instar	4.02-4.30	4.18±0.10	1.57-2.20	1.89±0.25
4th instar	5.82-6.55	6.21±0.27	2.70-3.50	3.11±0.29
Per –pupa	4.40-5.50	5.01±0.46	2.25-3.10	2.71±0.33
Pupa	5.91-6.10	5.98±0.05	3.25-3.99	3.64±0.24
Adult				
Male	5.95-6.35	6.21±0.17	4.30-5.05	4.62±0.28
Female	6.80-7.50	7.15±0.28	4.71-5.50	5.19±0.27
Average of 10 observations				

Eggs stage

Freshly laid eggs on the leaves of indian ginseng were yellowish, elongated and cigar shaped often in group of 5 to 45. The female laid as many as 210 to 327 eggs during the life span with an average of 257.85 ± 34.22 eggs. Observations on morphometrics revealed that the length of eggs varied from 1.30 to 1.55 mm (Av.146 ± 0.07) while the breadth varied from 0.30 to 0.40 mm (Av. 0.43 ± 0.06). The incubation period of the eggs under laboratory conditions ranged between 7 to 10 days with an average of 7.7 ± 0.99 days. Hatching of the eggs were 55.6 %. Similarly, Tayde and Simon (2013), observed the incubation period of *H. vigintioctopunctata* on bitter gourd as 5 to 11 days and Qamar et al. (2009) recorded 4.0 days of incubation period on brinjal.

Grub stage

Newly hatched first instar grub were yellowish in color and had six rows of long branched spines. The average duration of 1st, 2nd, 3rd and 4th instar was 4.1 ± 0.87, 2.4 ± 0.51, 2.0 ± 0.82 and 6.0 ± 0.91 days, respectively while 2.6, 2.9, 2.5 and 6.8 days were reported by Verma and Anandhi (2008) and 4.8, 3.4, 2.6 and 6.2 days were reported by Tayde and Simon (2013) in bitter gourd.

Observations on morphometrics revealed that the average length of 1st, 2nd, 3rd and 4th instar was 2.05 ± 0.34 mm, 3.03 ± 0.24 mm, 4.18 ± 0.10 mm and 6.21 ± 0.27 mm, respectively. The average breadth was 1.11 ± 0.17 mm, 1.42 ± 0.06 mm, 1.89 ± 0.25 mm and 3.11 ± 0.29 mm, respectively. The total larval period was between 12-18 days with an average of 14.1 ± 2.13 days. Similarly, Verma and Anandhi (2008) observed the larval period as 15.1 ± 4.90 days while 14.9 ± 0.43 days was reported by Qamar *et al.* (2009) and Tayde and Simon (2013) observed

the larval period as 13.2± 5.43 days. Mahendra *et al*. (2022) also recorded 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.

Pupal stage

The full grown 4th instar grub stopped feeding and roaming for 10-15 minute to locate suitable site for pupation. The colour of the grub gradually fainted and the body shrank. The full fed grubs spent 1-2 days in the pre-pupal stage with an average of 1.5 ± 0.51 days. The average pre-pupal length was 5.01 ± 0.46 mm and breadth was 2.71 ± 0.33 mm.

The freshly formed pupa was shining yellow, which turned to yellowing black latter. The pupal period lasted for 3- 5 days with an average of 4.4 ± 0.82 days. Similar results were obtained by Verma and Anandhi (2008), Qamar et al. (2009) and Tayde and Simon (2013). The average pupal length was 5.98 ± 0.05 mm and breath was 3.64 ± 0.24 mm.

Adult stage

The newly emerged adult was shiny yellow in colour latter changed to copper brown in colour mottled with black spots. Body was spherical with convex ventral surface and flat dorsal surface and appeared like 'D' when viewed from side. The difference in adults was observed under binocular microscope by sub genital plates: in males a cut was present in this plate. Females were bigger in size than males. The average body length of male was 6.21 ± 0.17 mm and breadth was 4.62 ± 0.28 mm. Whereas, in female length was 7.15 ± 0.28 mm and breadth was 5.19 ± 0.27 mm. The average longevity of male and female was 50.3 and 64.8 days, respectively and the per-oviposition, oviposition and postoviposition periods were 19.35, 24.2 and 20.2 days, respectively. The average fecundity of female was 257.85 eggs/ female. While 279.8 eggs were reported by Tayde and Simon (2013), 272.32 eggs were reported by Verma and Anandhi (2008) and 302.5 by Qamar *et al*. (2009).

CONCLUSION

The average duration of egg, grub, pupa and adult stages were found to be 7.7, 14.5, 5.9 and 57.5 days respectively. Both grubs and adults were found destructive in nature. The identification of this pest's biotypes and the management of them may also benefit from observations on morphometric and life cycle parameters.

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