

ECOLOGY AND BEHAVIOR

Seasonal Occurrence of *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) and Its Parasitoid on Ashwagandha in India

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Abstract The outbreak of *Henosepilachna vigintioctopunctata* (F.) was noticed on a medicinal plant, *Withania somnifera* Dunal during 2004-05. The population level of the pest was reached its peak in August. The parasitoid *Pediobius foveolatus* caused 51.94%±12.20% parasitism. The pest completed its life cycle in 20.15±1.50 days on *W. somnifera*. The longevity of the male and female adults of the pest was 22.07±3.71 and 31.07±4.38 days, respectively. The gravid females of *H. vigintioctopunctata* laid an average of 287.64±33.38 eggs during their oviposition period of 10.40±2.80 days.

Key words *Henosepilachna vigintioctopunctata*, *Withania somnifera*, *Pediobius foveolatus*, incidence, parasitism

different parts of India (Krishnamurti, 1932; Jolly, 1962; Bassi, 1963). Rajagopal and Trivedi (1989) reviewed the status, bioecology and management of *H. vigintioctopunctata*. The high incidence of the pest has been reported during temperature range of 24-31°C and relative humidity 58-75% RH in the field (Ramzan *et al.*, 1990; Ghosh and Senapati, 2001). The outbreak of *H. vigintioctopunctata* was noticed during 2004-2005 on *W. somnifera* plants in Bangalore, India. *Withania somnifera* is an important medicinal plant used in Ayurvedic formulations to treat various ailments of mankind (Sangwan *et al.*, 2004). To understand the status of the pest on ashwagandha, observations were made on the population level, biology and parasitization of *H. vigintioctopunctata*.

Introduction

The spotted leaf beetle, *Henosepilachna vigintioctopunctata* (F.) is an important pest of the solanaceous (e.g. brinjal, tobacco, tomato, potato, etc.) and cucurbitaceous (e.g. gourds, melon, cucumber, etc.) plants in India (Krishnamurti, 1932; Puttarudriah and Krishnamurti, 1954; Sengupta and Panda, 1959; Mandal, 1971; Mohansundaram and Uthamaswamy, 1973; Azam *et al.*, 1974). The pest also attacks wild species *Amaranthus caudatus* L. (Hameed and Adlakha, 1973) and some medicinal plants such as *Physalis* spp. (Mohansundaram and Uthamaswamy, 1973), *Datura* spp., *Solanum* spp. and *Withania somnifera* Dunal (Mathur and Srivastava, 1964). *Henosepilachna vigintioctopunctata* is widely distributed in Southeast Asian countries, Korea and Australia (Kapur, 1950). The pest has been noticed since many decades in

Materials and Methods

During the outbreak of the pest in the field in Bangalore city, the number of larvae and adults present on the third and fourth pairs of distal leaves from four middle branches from four cardinal sides of randomly selected four *W. somnifera* plants were recorded once a week. Prevailing climatic factors in the field during the study period were recorded daily. Six to ten medium sized larvae were collected randomly from four infested plants in the field once a week and reared them on fresh aswagandha leaves in the laboratory and parasitism per cent was recorded. To study the biology of *H. vigintioctopunctata* on *W. somnifera* in the laboratory, initially a few field-collected adults were reared in the glass jars (12 cm diameter X 8 cm height) on fresh *W. somnifera* leaves and allowed to lay eggs. Newly emerged larvae in the laboratory were reared in Petri dishes (10 cm diameter) and provided them fresh succulent aswagandha leaves daily until they reached pupal stage. The larvae were monitored regularly and moulting was confirmed by examining for exuviae and head capsules. The egg,

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larval and pupal developmental period, number of instars in a life cycle, longevity of adults were recorded during July, Sept. 2004 under ordinary laboratory conditions. The preoviposition and oviposition periods, and fecundity of female beetles were also documented. During insect rearing, daily temperature and relative humidity were recorded in the laboratory.

Results and Discussion

The outbreak of *H. vigintioctopunctata* on *W. somnifera* plants was found in the first week of July 2004 and 2005. The incidence of the pest population in relation to parasitism, temperature and relative humidity is given in Fig. 1. The adult and larval populations of the pest were found peak in mid August. However, decrease of the pest incidence was found in the last week of August reached to zero level in October. Similarly, the high level of *H. vigintioctopunctata* incidence on different crops was reported during June to October in various parts of India (Krishnamurti and Appanna, 1951; Mathur and Srivastava, 1964; Thakur, 1966; Hameed and Adlakha, 1973; Ramzan *et. al.* 1990; Ghosh and Senapati, 2001). During the peak period of the pest and its parasitoid the mean

maximum temperature, minimum temperature and relative humidity was $27.56 \pm 0.88^\circ\text{C}$, $19.58 \pm 0.49^\circ\text{C}$ and $75.55 \pm 13.37\%$ RH, respectively. Ramzan *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 raising pest population in August.

Adults of *Pediobius foveolatus* (Crawford) (Hymenoptera: Eulophidae), a larval-pupal parasitoid emerged from the field-collected *H. vigintioctopunctata* larvae that were reared in the laboratory. The per cent of *H. vigintioctopunctata* larvae parasitised by *P. foveolatus* during the incidence period of the pest is given in Fig. 1. The parasitoid caused $51.94 \pm 12.20\%$ parasitism in the field collected larvae of *H. vigintioctopunctata*. *Pediobius foveolatus* is known to be a potential parasitoid of various phytophagous coccinellids and caused up to 62% parasitism in *Epilachna ocellata* Redenbacher (Dhingra *et. al.*, 1986) and 80% in *E. philippinensis* Dieke (Chiu and Moore, 1993). Natural parasitism of *H. vigintiocto-*

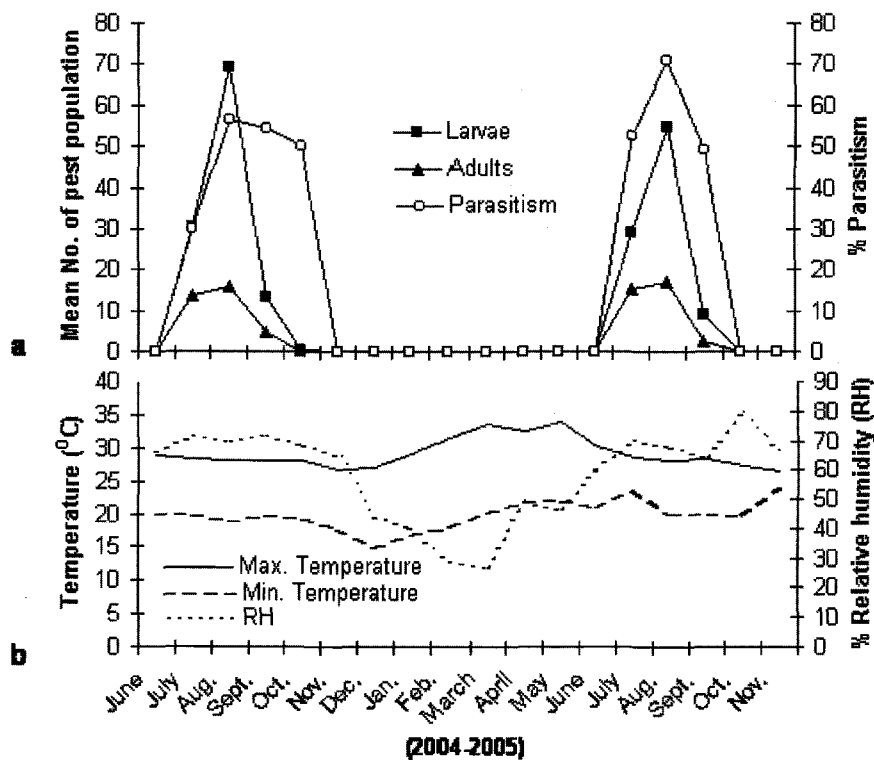


Fig. 1. a, Average monthly incidence of *H. vigintioctopunctata* and its parasitoid *P. foveolatus* on *Withania somnifera* in the field; b, Environmental variables during the pest incidence.

punctata by *P. foveolatus* on eggplant was 47.1-49.5% (Rajendran and Gopalan, 1997), 28.47% on potato and 64.5% on *Solanum nigrum* L. (Sheng and Wang, 1992). Puttarudriah and Krishnamurti (1954) reported about 60% parasitism of *H. vigintioctopunctata* grubs on potato and suggested that insecticide application is not required as parasite activity alone keeps the pest population below economic threshold in the field. Similar condition was noticed in the case of *W. somnifera* infestation.

The pest deposited the eggs in clusters on the lower surface of the leaves. There were four larval stages as reported earlier (Krishnamurti, 1932; Kapur, 1950; Gupta and Kumar, 1984). First instar larvae fed gregariously and they became non-gregarious form second instar onwards. Kapur (1950) studied the larval morphology of *H. vigintioctopunctata*. The larvae scraped epidermal layer of the leaves and sometimes skeletonized the entire leaf. The developmental period of the egg, larval instars, prepupa and pupa is given in Table 1.

The adult beetles started feeding a day after emergence. The adults also fed on epidermal layer of the leaves as larvae do, but sometimes made tattered holes on the leaves in the field. Newly emerged adults died within 2-3 days without food. The adults first mated in 2-3 days after emergence. Individual pair copulated several times and a single copulation lasted for 1-3 minutes. The preoviposition period was 6.00 ± 1.56 days. The gravid females laid 287.64 ± 33.38 eggs in 4-6 batches during their oviposition period of $10.40 \pm$

2.80 days. The highest number of eggs was deposited on the first day of oviposition and it was gradually decreased in subsequent depositions (Table 2). The longevity of the male and female beetles was 22.07 ± 3.71 and 31.07 ± 4.38 days, respectively. The pest completed its life cycle in 20.15 ± 1.50 days under the variable maximum temperature $28.33 \pm 1.80^\circ\text{C}$, minimum temperature $19.77 \pm 0.68^\circ\text{C}$ and relative humidity $72.03 \pm 13.09\%$. *Henosepilachna vigintioctopunctata* has been known to complete its life cycle in 22-30 days depending upon the species of host plants on which it feeds and prevailing climatic conditions such as temperature and relative humidity (Chowdhuri, 1965; Ramzan *et al.*, 1990; Ghosh and Senapati, 2001).

Although several workers (Jayakumari and Nair, 1969; Hameed and Adlakha, 1973; Peter and Govindarajulu, 1989; Rao *et al.*, 1989; Thomas and Jacob, 1991; Umapathy and Baskaran, 1991; Mala *et al.*, 1992; Rao *et al.*, 1992; Prasad and Logiswaran, 1993; Gupta and Dogra, 1994; Reddy, 1997) suggested different insecticides for the control of *H. vigintioctopunctata*, chemical control measures may not be required because of high level of larval parasitization of the pest on ashwagandha similar to that recorded on other host plants (Puttarudriah and Krishnamurti, 1954; Sheng and Wang, 1992; Rajendran and Gopalan, 1997). Even though *P. foveolatus* parasitizes all larval stages of *H. vigintioctopunctata*, it prefers later instars (Sheng and Wang, 1992). Therefore, it is always essential to retain fully-grown larvae of the pest in the field for parasitic activities to exert maxi-

Table 1. Developmental period (days) of different stages of *H. vigintioctopunctata* on *W. somnifera* under the ordinary laboratory conditions.

Stage	No. of samples	Duration of development Mean \pm SD
Egg		3.79 \pm 0.49
Larva:	20	
I Instar	20	2.50 \pm 0.55
II Instar	20	2.52 \pm 0.54
III Instar	20	2.50 \pm 0.52
IV Instar	20	3.58 \pm 0.54
Prepupa	20	1.06 \pm 0.08
Pupa	20	3.75 \pm 0.56

Table 2. Egg laying trend of *H. vigintioctopunctata* reared on *W. somnifera* under the ordinary laboratory conditions.

Days of oviposition	Batch No. of egg cluster	Number of eggs deposited* Mean \pm SD
1	I	90.89 \pm 12.87
2-3	II	78.56 \pm 12.49
4-6	III	60.67 \pm 15.82
7-9	IV	36.22 \pm 10.12
10-13	V	23.44 \pm 6.80
14-16	VI	17.25 \pm 5.25

*Mean of 10 gravid females

mum natural control that keeps the pest below economic threshold level without the application of any harmful pesticides on the valuable medicinal plant. To avoid the damage caused by early larval stages of *H. vigintioctopunctata* as *P. foveolatus* prefers fourth instar larvae for parasitization, hand picking and destruction of the adults, larval stages and egg masses of the pest in the field could be useful to control the pest population effectively as suggested for *Epilachna* beetles of brinjal (Ayyar, 1984).

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