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IDENTIFICATION OF NATURAL ENEMIES OF THE HADDA BEETLE, *EPILACHNA VIGINTIOCTOPUNCTATA* (FABR.): PARASITOIDS AND STUDIES ON LIFE CYCLE DURATION OF LARVAL-PUPAL PARASITOID *PEDIOBIUS FOVEOLATUS* (CRAWFORD)

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KEYWORDS

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Pediobius foveolatus
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ABSTRACT

The Studies conducted during April-May of 2014 at Department of Agricultural Entomology, BCKV, Mohanpur, West Bengal .The present investigation revealed that two species of parasitoids namely, *Tetrastichus* sp. attacks the egg stage and *Pediobius foveolatus* attacks the larval and pupal stage of the Hadda beetle, *Epilachna vigintiocto punctata*. *Tetrastichus* sp. parasitized 21.82 % of eggs whereas, the parasitoid, *Pediobius foveolatus* parasitized 48.09 % of fourth instar grubs and 33.87 % of pupae. *P. foveolatus* completed its life cycle in 11.63 days. On the basis of overall performance, *Tetrastichus* sp., *Pediobius foveolatus* were recognised as key mortality factors *i.e.* parsitoids of the pest.

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INTRODUCTION

The number of insect herbivores attacking a host plant is often distressed by the composition and dispersion of the surrounding plant community. It is also known that many specialized herbivorous insects are more likely to attack plants growing in impenetrable monospecific patches (Kareiva 1983). The Epilachninae have long been of considerable entomological interest as the chief plant-feeding Coccinellidae and may be considered among the most economically significant pests in Australia, North America, East Indies, East Asia, Central Asia, Sri Lanka, Malaya, China and India, respectively (Maurice and Ramteke, 2012).

The subfamily Epilachninae (Coccinellidae: Coleoptera) contains phytophagous beetles representing about one sixth of coccinellids. Most epilachnines belong to the world wide genus *Epilachna* that contains about 500 described species. In India, this subfamily is represented by 74 species of which 29 have been recorded from West Bengal. In India, the *Epilachna* beetle is present in higher hills and in plains of Jammu and Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Karnataka and West Bengal and also in the plains (Shankar *et al.*, 2010).

The Hadda beetle, *Epilachna vigintioctopunctata* is generally considered as polyphagous. Pandey and Shankar (1975); Singh and Mukherjee, 1987 and Mandal and Mandal, 2003 considered it as oligophagous on the plants belonging to the family Solanaceae. Both the adults and grubs feed on the leaves by scraping the surface, resulting in characteristic lace like appearance of the leaves. In case of severe infestation bark of shoots, petioles of leaves and even the skin of the fruits are scraped by them. Damage symptoms include white skeletonization of leaves which is whitish initially but gradually turn brown, yellowing and premature dropping of leaves; stunting and even drying of the plants, flower dropping and yield loss.

The increasing pest status of brinjal hadda and its abundance in brinjal fields has raised a number of questions regarding the factors responsible for its population development under natural conditions. Keeping this in view, the present study was aimedat identifying the key mortality factors *i.e.* parsitiods attacking eggs & larva of hadda beetle and abiotic factors existing in the brinjal ecosystem so that these could be exploited in IPM strategy for the management of brinjal hadda beetle and studied the biology of hadda beetle too.

MATERIALS AND METHODS

Field and laboratory studies were undertaken to identify natural enemies of *E. vigintioctopunctata*. Egg masses, larvae and pupae were collected from the field. The egg masses were placed in small glass vials, the mouth of which was plugged tightly with cotton ball. The egg masses were inspected daily for emergence of parasitoids. The parasitoids were identified following literature available elsewhere. The percentage of eggs showing egg parasitisation was calculated. Similarly, the field collected grubs were reared in the petriplates with brinjal leaves and those showing parasitisation were separated and kept individually in glass

vials for emergence of parasitoid. The parasitoids were collected and identified. The per cent parasitisation of grubs was calculated. The pupae collected from the field were kept in small glass vials and the parasitoids emerged were collected, preserved and identified.

Duration of life cycle of *Pediobius faveolatus* (Crawford)

Duration of life cycle of *Pediobius faveolatus* (Crawford) was studied by providing the fourth instar grubs of *E. vigintioctopunctata* to the adults for parasitisation. After 24 hours these were removed and fresh larvae were provided. The larvae removed from the parasitoids were then placed in petriplates provided with brinjal leaves. Blackening and death of the larvae indicated parasitisation. The parasitoid larvae were then removed and kept separately for emergence of adult parasitoids. The duration of egg- adult was recorded after adult emergence and the sex ratio of the emerged parasitoids was calculated.

The data obtained during the present investigation were subjected to standard statistical procedures to calculate out average %, standard deviation.

RESULTS AND DISCUSSION

During the period of study, one species of egg parasitoid and one species of larval - pupal parasitoid were recorded to parasitize *E. vigintioctopunctata* (Table 1).

Natural parasitzation of eggs of *E. vigintioctopunctata* by *Tetrastichus* sp.

The natural parasitisation of eggs of *E. vigintioctopunctata* (Fabr.) by the egg parasitoid *Tetrastichus* sp. (Plate.1) was surveyed during April - May (Fig.3). The per cent egg masses parasitized ranged from 60.00 % during the end of April to 40.54 % during the beginning of May. The per cent of eggs parasitized per egg mass ranged from 12.82 to 100% in different observations (Table 2). However, the average percentage of eggs parasitized ranged from 19.52 during the middle of May to 24.29 during the end of April.

Natural parasitisation of larvae and pupae by the larval - pupal parasitoid, *Pediobius foveolatus*

Natural parasitisation of the grubs of *E. vigintioctopunctata* by the larval - pupal parasitoid, *P. foveolatus* (Fig. 1 and Plate. 2) was recorded in the field during April - May. Maximum parasitisation of the larva was recorded during the 1st week of April (51.70 %). The per cent parasitisation of grubs showed a slight decline after the 1st observation which gradually decreased to 44.69 % during the end of May (shown in Table 3).

Natural parasitisation of the pupae of *E. vigintioctopunctata* (Fig. 2) by the larval - pupalparasitoid, *P. foveolatus*was recorded in the field during April - May. Maximum parasitisation of the pupa was recorded during the 1st week of April (37.25 %). The per cent parasitisation of grubs gradually

Table 1: Parasitoids attacking *E. vigintioctopunctata*

Parsitoids			
Order	Family	Scientific name	Stage of the pest attacked
Hymenoptera	Eulophidae	*Tetrastichus*spp.	Egg
Hymenoptera	Eulophidae	*Pediobius foveolatus* Crawford	3rd and 4th instar larva and pupa

Table 2: Natural parasitzation of eggs of *E. vigintioctopunctata* by *Tetrastichus* sp.

S. No.	Date	% Egg masses parasitized	% Parasitization	Range (%)
1	5th April	54.76	23.62	12.82-100.00
2	12th April	52.50	23.20	17.90 - 100.00
3	19th April	52.27	21.49	15.40 - 89.60
4	26th April	60.00	24.29	23.07 - 83.67
5	3rd May	40.54	19.52	21.73 - 75.60
6	10th May	45.71	20.69	20.51 - 100.00
7	17th May	51.42	22.42	12.82 -100.00
8	25th May	50.00	19.39	12.82- 85.7.00
Average		39.38	21.82	

Table 3: Natural parasitization of *E. vigintictopunctata* later instar larva by *Pediobius foveolatus* (Crawford)

Weekly interval	No. of larva	No. of larva parsitized	% Parasitization
1st week	328	161	51.70
2nd week	311	148	49.80
3rd week	302	153	49.13
4th week	295	142	49.57
5th week	284	37	47.40
6th week	339	156	47.08
7th week	298	137	45.40
8th week	325	145	44.69
Average			48.09

* 1st- 8th week indicates beginning of 1st week of April to last week of May

Table 4: Natural parasitisation pupa of *E.vigintictopunctata*pupa By *Pediobius foveolatus* (Crawford)

Weekly intervals	No. of pupa	No. of pupa parsitized	% Parasitization
1st week	102	38	37.25
2nd week	129	48	37.20
3rd week	119	43	37.18
4th week	83	29	34.93
5th week	103	35	33.98
6th week	75	25	33.33
7th week	96	28	29.16
8th week	93	28	27.95
Average			33.87

* 1st- 8th week indicates beginning of 1st week of April to last week of May

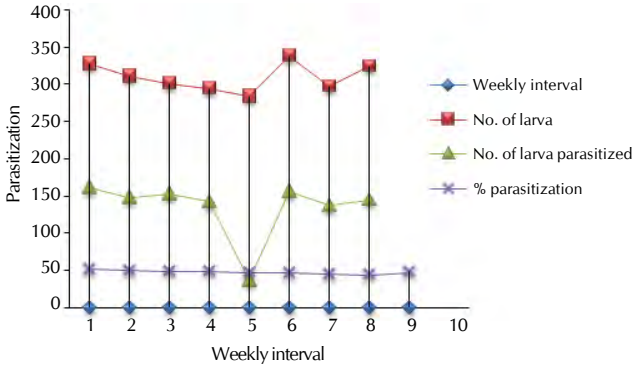


Figure 1: Natural parasitization of *E.vigintictopunctata* later instar larva By *Pediobius foveolatus*

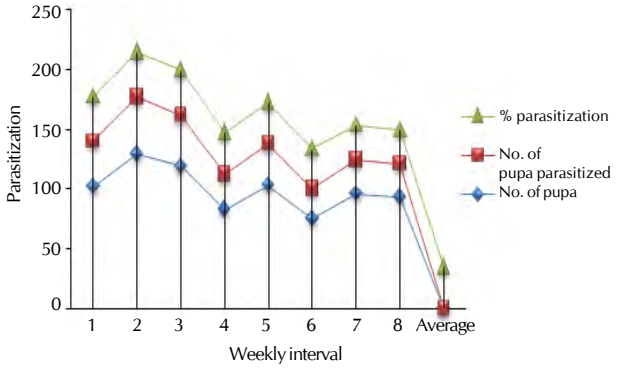


Figure 1: Natural parasitization of *E.vigintictopunctata* later instar larva By *Pediobius foveolatus*

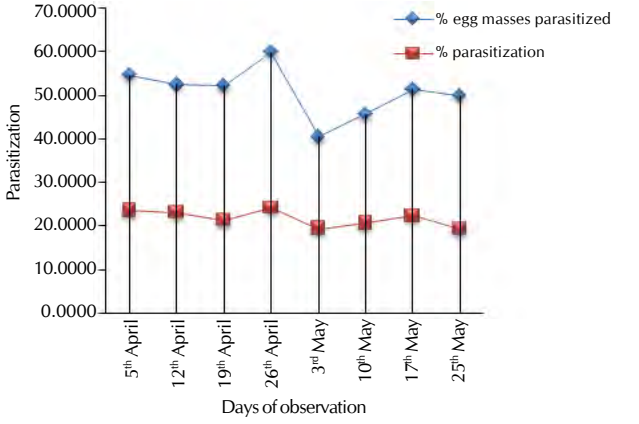


Figure 3: Natural parasitization of *E.vigintictopunctata* eggs by *Tetrastichus* sp.

declined to 27.95 % during the end of May (Table 4).

Rajagopal and Trivedi (1989) reported that, *Pediobius foveolatus* is an important parasitoid destroying fourth instar grubs and pupae during summer months. *Pediobius foveolatus* appeared as an important parasitoid of the larvae and pupae during the present investigation also. The maximum percentage of natural parasitization recorded during the present investigation was of 49.50 % in case of 4th instar larva and 37.25% in pupa of the pest. Average percentage of parasitisation recorded during April – May was 48.09 % on 4th instar grub and 30.93% in pupa. This species is considered to be the most destructive natural enemy recorded by the present author.

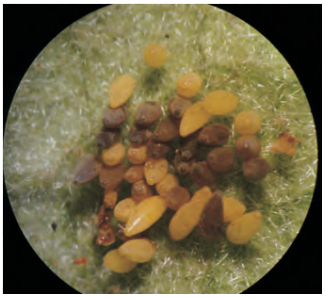
Duration of life cycle and Sex ratio of *Pediobius foveolatus* (Crawford)

The duration of lifecycle, number of individuals developing per grub and sex ratio of *P. foveolatus* (Plate 3) was studied in the laboratory. The duration of life cycle (Egg to adult) was10-13 days, with an average of 11.63 days. Four (4) to thirty one (31) numbers of P. *foveolatus* adults developed in a single grub of *E. vigintioctopunctata*.The average no. of parasitoids developed per grub was 15.2. The female: male ratio recorded in the population was to 2:1(Table 5).

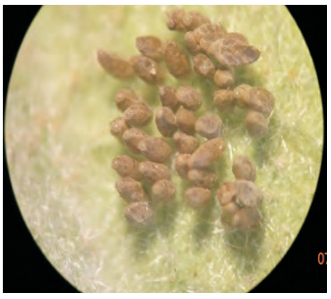
Several species of predators, parasitoids and pathogens have been reported to attack different stages of *E. vigintiocto punctata,* of which a few are known to play appreciable role in the natural suppression of pest population. Rajagopal and Trivedi (1989) has summarized a list of 15 parasitoids on this pest. *Tetrastichu sovularum* Ferr., *Pleurotropisfoveolatus* Craw., *P. eplichnae* and *Tetrastichus* sp., were important in reducing the pest population, of which the eulophid egg parasitoid, *Tetrastichus ovularum* Ferr. was effective in bringing the pest population under control. During the present investigation, *Tetrastichus*sp. was found to parasitize the eggs of *E. vigintioctopunctata*. The parasitoid could not be identified

Table 5: Duration of life cycle and sex ratio of *Pediobius foveolatus* (Crawford)

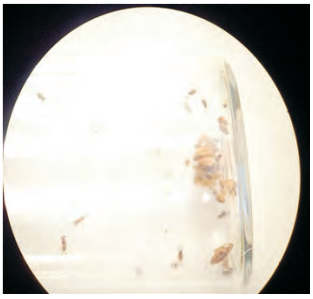
S. No.	Life cycle (days)	No. of parasitoids emerged
Range	11-13	4-24
Average	11.63	15.2



1. Field collected partially parasitized eggs



2. Completely parasitized egg mass of Hadda



3. Egg Parasitoid, *Tetrastichus sps.* emergence

4. *Tetrastichs Sps.* (microscopic view)

Plate 1: *Epilachna vigintioctopunctata* egg stage parasitization by *Tetrastichs Sps*

5. Grubs and pupa parasitized in field

6. Parasitized 2nd, 3rd and 4th instar grubs

7. Completely parasitized pupa

8. Larval-pupal parasitoid emergence hole

Plate 2: Hadda beetle grub & Pupal parsitization by *Pediobius foveolatus* (Crawford)

9. Larval-pupal parasitid emergence

10. *Pediobiusfoveolatus* Crawford (microscopic view)

11. Oviposition of *P. foveolatus* on Grub

12. Larval-pupal parasitoids emergence

Plate 3: Life Cycle Duaration of *Pediobius foveolatus* (Crawford)

up to the species level. The rate of parasitism by this wasp was quite higher; 21.82 % during April – May. Similar results were obtained by SavitaVarma and Anandhi, 2008. Patnaik and Mohapatra, 2004 observed upto 57.20 % parasitisation of the eggs of *E. vigintioctopunctata* by *Omphale* sp., which could not be recorded during the present investigation. Climatic conditions play role in build-up of Mite population development as mite population was significantly negatively correlated with rainfall (r= -0.576) (Singh and Singh, 2014). Kumar et al (2014) also reported *Tetranychus ludeni* population to have negative correlation with relative humidity and rainfall on cowpea in Varanasi. In present investigation the abiotic factors like temperature & relative humidity factors plays key role for the encouragement of parasitoids.

On the basis of the results obtained during the present investigation, the egg parasitoid, *Tetrastichus* sp., larval – pupalparasitoid, *Pediobius foveolatus* are considered as key mortality factors of *E. vigintioctopunctata* on brinjal. Attempt should be made for their conservation and possible augmentation for effective management of this pest.

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