J. Biol. Control, 22(2): 455-461, 2008

Research Note

Parasitization of *Helicoverpa armigera* (Hubner) on pigeonpea

K. D. BISANE, S. L. BORKAR, G. K. LANDE AND S. K. BHALKARE
Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth,
Akola 444104, Maharashtra, India.
E-mail: kdbisane@yahoo.co.in

ABSTRACT: **The parasitization of *Helicoverpa armigera* (Hubner) larvae and pupae was studied during 2004-05 and 2005-06 from field collected life stages on pigeonpea. The ichneumonid, *Eriborus argenteopilosus* was found to be the most effective and active parasitoid of early instar larvae from 45th Meteorological week (MW) till 51st MW and recorded the highest parasitization in 46th MW (25.00 per cent). The other ichneumonid, *Campletis chlorideae* was observed to be active in December (16.67 per cent). Parasitism by a Braconid, *Bracon* sp., noticed from 45th to 47th MW and 50th MW, was up to an extent of 7.89 per cent. On pigeonpea, these parasitoids contributed to approximately two-third of the total mortality of early instar *H. armigera* larvae. Tachinid parasitoids were found to be associated with the late larval instar and pupae. The parasitization of late larval instars was noticed from 47th MW to 52nd MW and the population reduction was estimated to be 17.86 per cent, which was highest in 48th MW. Similarly, HaNPV disease infection also played an important role in population suppression of early and late instar larvae to an extent of 7.69 and 3.57 per cent, respectively. Pupal mortality by a tachinid was noticed from 46th MW to 52nd MW in the range of 8.33 to 26.32 per cent.**

KEY WORDS: *Bracon* spp., *Campoletis chlorideae*, *Eriborus argenteopilosus*, *Helicoverpa armigera*, pigeonpea, parasitoids.

Pigeonpea [*Cajanus cajan* (L.) Mills Paugh] is one of the major legume crops in India and it acts as a main source of protein in the diet. The area and production under pulses, including pigeonpea, have increased in the last decade, but there is only a small change in productivity (Anonymous, 2005).

Pigeonpea is attacked by a large number of insect pests at all stages of its growth, which is one of the major factors for its low productivity. It is only during flowering and fruiting stage that pigeonpea is usually attacked by the most important pests namely, pod borer, *Helicoverpa armigera* (Hubner). On an average, a single larva of *H. armigera* per plant of pigeonpea could reduce the yield to an extent of 138.5 kg/ha (Reddy, *et al.*, 2001). As a result of repeated application of insecticides for its management, the pest has developed resistance to various groups of insecticides. Biocontrol is now considered as one of the major components of Integrated Pest Management (IPM), which seeks to maximize the contribution of naturally occurring parasitoids, predators and pathogens to the reduction of pest population. In India, altogether 100 parasitoids of *H. armigera* have been reported (Nikam and Gaikwad, 1989). Among these, *Eriborus argenteopilosus* (Cameron), *Campoletis chlorideae*

(Uchida) and tachinids are important (Srinivas and Jayaraj, 1989 and Singh, *et al.*, 1991). There is a need to conserve and augment the active and potential natural enemies. Estimation of the field parasitization is important in order to quantify the natural field mortality of the pest by the action of these parasitoids and hence the present study was initiated.

Various stages of *H. armigera* were collected from an unsprayed field of pigeonpea crop cultivated at the experimental plot of Central Research Farm, Akola, during 2004-05 and 2005-06. These larvae were reared under laboratory conditions at the Department of Entomology, Dr. PDKV, Akola. To record the parasitism of *H. armigera*, early (I-III) and late instar (IV and V) larvae on pigeonpea were collected. To check pupal parasitism, the pre-pupal larvae were collected as soon as they appeared in the field and reared till pupation. The sampling of larvae was done at 7 days interval from 25 plants on a 500 sq. m. non-replicated plot and reared individually in small plastic vials to avoid cannibalism. The larvae were reared on pigeonpea buds and pods and the food was changed regularly as and when required until pupation of the pest or parasitoids. Similarly, the pupae were kept till the emergence of adult moths or parasitoids. The observations on total mortality and parasitization due to different parasitoids were recorded week wise, separately.

The early instar (I-III) larvae of *H. armigera* were noticed on pigeonpea from 45th meteorological week (MW) till 1st MW of next year during both the seasons with mean peak population in 49th MW (Table 1). The maximum mortality of 41.02 per cent was noted in 47th MW. The parasitoids, *E. argenteopilosus* and *C. chlorideae* (Hymenoptera: Ichneumonidae) and *Bracon* sp. (Hymenoptera: Braconidae) were major biotic factors with HaNPV infection associated with the early instar larval mortality of *H. armigera* on pigeonpea. *E. argenteopilosus* was noticed with the initiation of the pest from 45th MW till 51st MW and *Bracon* sp. from 45th to 47th MW and 50th MW, while *C. chlorideae* parasitization was observed in later weeks in 47th, 49th, 51st and 52nd MW. HaNPV infected larvae were noticed in 48th, 49th and 51st MW (Table 1).

The early instar larval parasitization by *E. argenteopilosus* in pooled data ranged from 5.00 to 25.00 per cent and the activity was highest in the third week of November (46th MW) during both years. The population suppression by *C. chlorideae* ranged between 5.13 and 16.67 per cent and was highest at the end of December (52nd MW). Larval parasitization by *Bracon* sp. was to the extent of 5.13-7.89 per cent, the maximum being in 50th MW. HaNPV disease infection was observed to the extent of 7.69 per cent in early December. Parasitism recorded by *E. argenteopilosus* was higher as compared to that by *C. chlorideae* and *Bracon* sp. However, about more than half of the total mortality was caused due to parasitization by these three parasitoids during the crop season. The total parasitization was highest in 47th MW (33.33 per cent), followed by 46th MW (32.14 per cent) and 50th MW (21.05 per cent), while the remaining mortality was caused by unknown reasons.

In the previous studies on key mortality factors, Bilapate *et al.* (1979) reported virus, parasitoids and some unknown reasons as responsible for the mortality of grown up larvae. Bilapate (1981, 1985 and 1989) observed that *C. chlorideae* acted as the key mortality factor in reducing the population of early larval instars. Bilapate *et al.* (1988) further reported that the parasitization of early instar larvae of *H. armigera* was caused by *C. chlorideae* and *Eriborus* sp. on pigeonpea. Nikam (1990) stated that ichneumonids were effective larval parasitoids preferring young larvae up to 2nd instar for parasitization. Singh and Ali (2003) observed *C. chlorideae* activity from December to February in early instar larvae. Gotarkar (2004) recorded *Apanteles* sp., *Eriborus* sp. and *C. chlorideae* and NPV as the major biotic mortality factors of *H. armigera* for population reduction. These earlier findings confirm the observations made during the current experiment.

The late instar (IV and V) larvae appeared in the field from 46th MW to 1st MW (Table 2). The peak infestation was observed in 48th MW and

Table 1. Mortality and parasitization in early instar (I to III) larvae of *H. armigera* on pigeonpea

MW	Period of week		No. of larvae observed	Total per cent larval mortality	*E. argenteopilosus*	*C. chlorideae*	*Bracon* sp.	Total per cent parasitization	Per cent HaNPV infection
45	5-11 Nov.	A	7	28.57	0.0	0.0	14.29	14.29	0.0
		B	8	25.00	12.50	0.0	0.0	12.50	0.0
		C	7.5	26.67	6.67	0.0	6.67	13.33	0.0
46	12-18	A	16	31.25	18.75	0.0	12.50	21.25	0.0
		B	12	41.66	33.33	0.0	0.0	33.33	0.0
		C	14	35.71	25.00	0.0	7.14	32.14	0.0
47	19-25	A	19	36.84	15.79	10.53	0.0	26.32	0.0
		B	20	45.00	30.00	0.0	10.00	40.00	0.0
		C	19.5	41.02	23.08	5.13	5.13	33.33	0.0
48	26-2 Dec.	A	20	25.00	10.00	0.0	0.0	10.00	10.00
		B	19	31.58	15.79	0.0	0.0	15.79	5.26
		C	19.5	28.21	12.82	0.0	0.0	12.82	7.69
49	3-9	A	18	22.22	11.11	11.11	0.0	22.22	0.0
		B	22	27.27	0.0	9.09	0.0	9.09	4.54
		C	20	25.00	5.0	10.00	0.0	15.00	2.50
50	10-16	A	17	35.30	17.65	0.0	0.0	17.65	0.0
		B	21	33.33	9.52	0.0	14.29	23.81	0.0
		C	19	34.21	16.67	0.0	7.89	21.05	0.0
51	17-23	A	12	25.00	0.0	0.0	0.0	16.67	8.33
		B	16	18.75	7.14	12.50	0.0	12.50	0.0
		C	14	21.43	0.0	7.14	0.0	14.29	3.57
52	24-31	A	8	25.00	0.0	12.50	0.0	12.50	0.0
		B	10	20.00	0.0	20.00	0.0	20.00	0.0
		C	9	22.22	0.0	16.67	0.0	16.67	0.0
1	1-7 Jan.	A	3	0.0	0.0	0.0	0.0	0.0	0.0
		B	4	25.00	0.0	0.0	0.0	0.0	0.0
		C	3.5	14.29	0.0	0.0	0.0	0.0	0.0

MW = Meteorological week, A = First year (2004-05), B = Second year (2005-06) and C = Pooled mean.

Table 2. Mortality and parasitization in late instar (IV and V) larvae of *H. armigera* on pigeonpea

MW	Period of week		No. of larvae observed	Total per cent larval mortality	Per cent larvae parasitized by Tachinid fly	Per cent HaNPV infection
46	12-18	A	4	25.00	0.0	0.0
		B	5	0.0	0.0	0.0
		C	4.5	11.11	0.0	0.0
47	19-25	A	8	25.00	12.50	0.0
		B	9	22.22	11.11	0.0
		C	8.5	23.52	11.76	0.0
48	26-2 Dec.	A	15	26.67	13.33	6.67
		B	13	23.08	23.08	0.0
		C	14	25.00	17.86	3.57
49	3-9	A	12	25.00	0.0	0.0
		B	14	35.71	14.28	0.0
		C	13	30.77	7.69	0.0
50	10-16	A	11	27.27	18.18	0.0
		B	16	25.00	6.25	0.0
		C	13.5	25.92	11.11	0.0
51	17-23	A	13	15.38	7.69	0.0
		B	12	16.67	0.0	0.0
		C	12.5	16.00	4.00	0.0
52	24-31	A	7	14.29	14.29	0.0
		B	9	11.11	0.0	0.0
		C	8	12.50	6.25	0.0
1	1-7 Jan.	A	3	14.29	0.0	0.0
		B	6	16.67	0.0	0.0
		C	4.5	22.22	0.0	0.0

MW = Meteorological week, A = First year (2004-05), B = Second year (2005-06) and C = Pooled mean.

Table 3. Mortality and parasitization in pre-pupal larvae and pupae of *H. armigera* on pigeonpea

MW	Period of week		Pre-pupal larvae			Pupae		
			No. of larvae observed	Total per cent larval mortality	Per cent larvae parasitized by Tachinid fly	No. of pupae observed	Total per cent pupal mortality	Per cent pupae parasitized by Tachinid fly
46	12-18	A	4	25.00	0.0	3	33.33	33.33
		B	3	0.0	0.0	3	33.33	0.0
		C	3.5	14.29	0.0	3	33.33	16.67
47	19-25	A	7	0.0	0.0	7	28.57	0.0
		B	8	12.50	0.0	7	14.29	0.0
		C	7.5	6.67	0.0	7	21.43	0.0
48	26-2 Dec.	A	12	16.67	8.33	10	30.00	20.00
		B	11	18.18	9.09	9	33.33	11.11
		C	11.5	17.39	8.70	9.5	31.58	15.79
49	3-9	A	11	27.27	9.09	8	37.50	25.00
		B	13	15.38	15.38	11	36.36	27.27
		C	12	20.83	12.50	9.5	36.84	26.32
50	10-16	A	10	10.00	0.0	9	33.33	22.22
		B	16	18.75	6.25	13	30.77	15.38
		C	13	15.38	3.85	11	31.82	18.18
51	17-23	A	8	25.00	12.50	6	33.33	0.0
		B	10	10.00	0.0	9	22.22	0.0
		C	9	16.67	5.56	7.5	26.67	0.0
52	24-31	A	6	16.67	0.0	5	20.00	0.0
		B	7	0.0	0.0	7	28.57	14.28
		C	6.5	7.69	0.0	6	25.00	8.33
1	1-7 Jan.	A	0	0.0	0.0	0	0.0	0.0
		B	4	25.00	0.0	3	33.33	0.0
		C	2	25.00	0.0	1.5	33.33	0.0

MW = Meteorological week, A = First year (2004-05), B = Second year (2005-06) and C = Pooled mean.

highest mortality of 30.77 per cent noticed in the second week of December (49th MW) in pooled data. An unidentified tachinid (Diptera: Tachinidae) caused the parasitization of late instar larvae of *H. armigera* and was seen from last week of November till December. The mean parasitization due to this tachinid was 4.00-17.86 per cent with the maximum activity in 48th MW, when pest infestation was highest. This parasitoid recorded about one third of total mortality during crop season and the remaining mortality was due to unknown factors. HaNPV caused 3.57 per cent mortality during the first week of December.

Earlier, Bilapate *et al.* (1979 and 1988) reported that NPV and some unknown factors caused mortality of grown up larvae. Further, Bilapate (1981, 1985 and 1989) observed NPV, *Carcelia* sp. (Tachinidae) and unknown reasons as major contributors in population reduction of late larval instars of *H. armigera* on pigeonpea, which is comparable with the present findings. Srinivas and Jayaraj (1989) observed that the early larval stages of noctuids were more prone to attack than later stages on pigeonpea, as in the present investigation. Gotarkar (2004) recorded the larval mortality to the extent of 44.44 per cent due to different mortality factors along with NPV infection on pigeonpea, which is in agreement with the present findings.

Pre-pupal larvae were noticed from 46th to 1st MW and the maximum mortality was observed in 1st MW (25.00 per cent) and 49th MW (20.83 per cent) (Table 3). Parasitization of pre-pupae by tachinids was recorded (3.85 to 12.50 per cent) from 48th to 51st MW and was highest in 49th MW. The pupae obtained from pre-pupal larvae were noticed from 46th till 1st MW (Table 3). The mean mortality was 21.43-36.84 per cent with the maximum in 49th MW. Tachinids also emerged as major parasitoids from the pupae of *H. armigera* in November and December except in 47th and 51st MW. Tachinids suppressed pupal population by 8.33-26.32 per cent by leaving empty puparium with maximum parasitization in 49th MW. As an average, half of the total mortality was caused by tachinids and the other mortality reasons were unknown.

Previously, Bilapate (1981, 1985, 1989) and Bilapate *et al.* (1979, 1988) recorded *Goniophthalmus halli* and unknown reasons were the major mortality factors for pupal reduction of *H. armigera* in generation survival on pigeonpea. Gotarkar (2004) reported the activity of *G. halli* from 47th to 51st MW parasitizing pupae in the range of 20 to 36.36 per cent. The above findings are in accordance with the present studies.

ACKNOWLEDGEMENT

The authors are grateful to Dr. J. Poorani and Dr. S. Ramani, Taxonomists, Project Directorate of Biological Control, Bangalore for identifying the parasitoid specimens.

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(Received: 12.10.2007; Revised: 07.02.2008; Accepted: 31.03.2008)