Research Paper :

Natural enemies of sorghum earhead caterpillar (*Heliothis armigera*)

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SUMMARY

Studies on the activity of natural enemies of sorghum earhead caterpillar were carried out in field and laboratory conditions. The egg parasitoid, *Trichogramma chilonis* emerged from *Heliothis armigera* eggs was initially recorded during August first week and continued upto second week of November with peak parasitization during September fourth week (57%) coinciding with flowering stage of the crop. The emergence of larval parasitoids, C. *chlorideae, Gonizus* sp., *B. brevicomis* from the larvae of *H. armigera* was observed from August second week to November second week. The peak parasitization of C. *chlorideae* was observed during the first fortnight of October (32.5%). *Gonizus* sp. and *B. breviconl is* were observed during the first week of October. Among the four different predators, *Chrysoperla camea* and *Cheilomenes sexmaculata* were predominant. The peak incidence of these predators was noticed during October first week with 0.80 and 0.90 adult per earhead, whereas *Ropalida marginata* and *Vespa tropica haematodes* were active during September fourth week.

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Key words : *H. armigera, Trichogramma chilonis,*C. *chlorideae, Gonizus* spp., *Chrysoperla camea, Cheilomenes sexmaculata, Ropalida marginata*

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Sorghum [*Sorghum bicolor* (L.) Moench.] is an important cereal food crop of the world. Nearly 75 per cent of the world's sorghum is grown for grain purpose meant for human consumption (Deyoe and Robinson, 1979). Area under sorghum cultivation in the country has remained fairly stable with a productivity of 7.44 q per ha. However, National Research Centre for Sorghum, Hyderabad projects a target of 21.7 million tones by 2020 A.D., which calls for raising the productivity (1200 kg/ha) close to global average.

Grain yield in sorghum has substantially increased with the use of high yielding and management responsive F1 hybrids and varieties. However, these high yielding varieties with higher requirement of fertilizers and difference in maturity have become more susceptible and provide continuous breeding ground for insect pests. Negligence in proper management of these pests, many times, has resulted in complete loss of crop. So far, about 132 species of insect pests have been reported on sorghum (Seshureddy and Davies, 1979).

In recent years, research has provided increasing evidence that substantial yield advantages can be achieved from activity of natural enemies need to be studied in detail under intercropping system with sorghum. Natural enemies are believed to exert very little impact on the population dynamics of the earhead caterpillar. However, explicit instruction for incorporation of these informations in decision making are generally lacking.

MATERIALS AND METHODS

In order to know the activity of natural enemies of *H. armigera,* forty eggs were collected from the field at weekly interval and kept in Petridish in laboratory for observation till the hatching of eggs. The parasitoids emerged from eggs were collected and expressed in per cent parasitization based on total number of eggs collected.

Forty larvae were collected from the field at weekly interval and reared individually in specimen tubes (16 x 2 cm) containing rachis of sorghum earhead. These specimen tubes

were placed in rearing cage (40 x 30 x 24 cm). Food was changed daily till the pupation. The parasitoids emerged from larvae were collected and sent for identification to Project Director of Biological Control, Bangalore for further identification. Based on the emergence of parasitoids, per cent parasitization was worked out and tabulated.

The predatory insect populations of both adults and grubs were recorded from 40 randomly selected sorghum earheads at weekly interval. The mean population per earhead was expressed. These natural enemies of *Heliothis armigera* were got identified at the Project Directorate of Biological Control, Bangalore.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Egg parasitoid of *H. armigera* :

The egg parasitoid, *Trichogramma chilonis* emerged from *H. armigera* eggs was initially recorded during August first week (5.0%), which continued upto second week of November (2.50%) with peak parasitization during September fourth week (57.0%) coinciding with the flowering stage of the crop. The parasitization was constantly high during the period from September-III to October-II week. Further, there was gradual decline in the egg parasitization and reached to 2.5 per cent by the end of second week of November (Table 1).

Larval parasitoids of *H. armigera* :

The emergence of larval parasitoid, *C. chlorideae* from the larvae of *H. armigera* collected from sorghum field was observed from August second week (7.50%) to November second week (2.50%). The peak parasitization was observed during first fortnight of October (30.0% – 32.5%) (Table 1).

The larval parasitoids *Goniozus* sp. and *Bracon brevicornis* were observed from third and fourth week of August to fourth week of October with peak activity, 17.50 per cent during first week of October.

The activity of *Exorista japonica* was started from third week of September with five per cent parasitization. This was gradually increased to its peak (15.0%) during third week of October. Further, the incidence declined to five per cent during third week of November.

The overall larval parasitoids activity was observed from second week of August (1.88%) to third week of November (1.25%). The peak parasitization was observed during first week of October (18.88%).

Predators of *H. armigera* in sorghum :

Predators of *H. armigera viz.*, *Chrysoperla carnea, Cheilomenes sexmaculata, Vespa tropica haematodes* and *Rapalida marginata* were noticed in sorghum crop during the present study from August first week to

Table 1 : Seasonal incidence of egg and larval parasitoids on *H. armigera* (2001)

Observed week	Parasitization (%)					
	Egg parasitoid	Larval parasitoids				
	Trichogramma chilonis	*Compoletis chlorideae*	*Goniozus* sp.	*Bracon bravicornis*	*Exorista japonica*	Mean
August I	5.00	0.00	0.00	0.00	0.00	0.00
August II	7.50	7.50	0.00	0.00	0.00	1.88
August III	12.50	10.00	5.00	0.00	0.00	3.75
August IV	17.50	12.50	7.50	5.00	0.00	6.25
September I	25.00	15.00	12.50	7.50	0.00	8.75
September II	32.50	15.00	10.00	7.50	0.00	8.13
September III	40.00	17.50	10.00	10.00	5.00	10.63
September IV	47.00	20.00	12.50	10.00	7.50	12.50
October I	57.50	32.50	17.50	15.00	10.00	18.88
October II	45.00	30.00	15.00	12.50	12.50	17.50
October III	35.00	17.50	7.50	5.00	15.00	11.38
October IV	22.50	7.50	5.00	2.50	10.00	6.25
November I	15.00	5.00	0.00	0.00	7.50	3.13
November II	2.50	2.50	0.00	0.00	5.00	1.88
November III	0.00	0.00	0.00	0.00	5.00	1.25
November IV	0.00	0.00	0.00	0.00	0.00	0.00

Table 2 : Seasonal incidence of *H. armigera* predators on sorghum (2001)

Observed week	Mean number of predators/earhead				
	Chrysoperla carnea	*Cheilomenes sexmaculata*	*Vespa tropica haematodes*	*Rapalida marginata*	Mean
August I	0.10	0.10	0.05	0.10	0.09
August II	0.20	0.20	0.15	0.25	0.20
August III	0.35	0.30	0.20	0.20	0.26
August IV	0.45	0.45	0.30	0.30	0.38
September I	0.50	0.65	0.30	0.35	0.45
September II	0.60	0.75	0.35	0.45	0.54
September III	0.70	0.80	0.30	0.45	0.58
September IV	0.75	0.80	0.45	0.65	0.68
October I	0.80	0.90	0.40	0.60	0.68
October II	0.60	0.65	0.35	0.45	0.54
October III	0.40	0.75	0.25	0.40	0.39
October IV	0.35	0.40	0.25	0.40	0.35
November I	0.25	0.30	0.25	0.25	0.26
November II	0.25	0.30	0.20	0.25	0.25
November III	0.20	0.25	0.20	0.20	0.21
November IV	0.20	0.25	0.10	0.10	0.16

November last week 2001 (Table 2). Among these, *C. carnea* and *C. sexmaculata* were predominant as the incidence was high with population of 0.80 and 0.90 per earhead during their peak period, respectively. Whereas, occurrence of *Rapalida marginata* was medium with 0.65 per cent earhead *V. tropica haematodes* was low with 0.45 per earhead during their peak activity.

The activity of *Chrysoperla carnea* was high during September second week to October-II week, while occurrence of *C. sexmaculata* was more during September-I to October-II week. *R. marginata* was seen more in numbers from III week of September to October II week. Whereas, *V. tropica* was at its peak during IV week of September and I week of October. The incidence was very low compared to other predators. It is clear from the data that peak activity of all predators was observed during September IV (0.68) and October I week (0.68). However, the incidence was noticed from August to November months on sorghum crop.

The natural enemies complex of earhead caterpillar was studied in laboratory as well as field, because *H. armigera* is a serious pest in sorghum. Chemical control is not effective in many situations for various reasons. The use of parasitoids, predators and pathogens for management of this pest is quite encouraging.

During the search for natural enemies of *H. armigera* in sorghum ecosystem, the most common egg parasitoid, *Trichogramma chilonis.* was observed. The rate of parasitization was peak during September fourth week (57.0%) coinciding with flowering stage of crop. Maximum availability of host eggs is restricted to flowering stage (Fig. 1). The present findings are in agreement with Pawar *et al.* (1989) and Chandramohan *et al.* (1990) who observed that *T. chilonis* was egg parasitoid of *H. a nnigera,* parasitizing more than 60 per cent eggs collected from the sorghum field. The parasitization was highest during August and September (Supharngkasen, 1979).

Larval parasitoids of *H. armigera viz., Compoletis chlorideae, Goniozus* spp. and *Exorista japonica* were found to parasitize early instal' larvae (1-3) and late instar

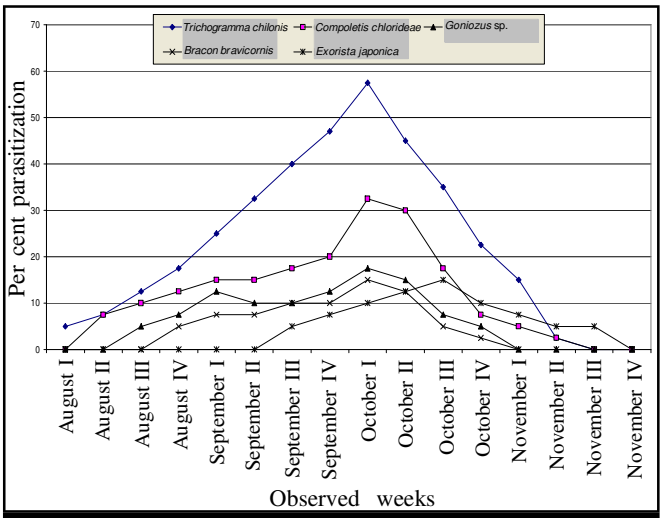

Fig. 1 : Seasonal incidence of egg and larval parasitoids on *H. armigera* (2001)

larvae (4-5), respectively. C. *chlorideae, Goniozus* sp. and *Bracon brevicomis*. were active during late September to early October recording 30.0 to 37.0, 10 to 18 and 10 to 15 per cent parasitization, respectively (Fig.1). While, the activity of *Exorista japonica* was observed during October third week recording 10 to 15 per cent parasitization of late instar larvae (4-5). The results are in conformity with the findings of Pawar *et al.* (1989) who reported that *Compoletis chlorideae* was most common parasitoid attacking 60 per cent of small larvae (1-3 instar) collected from sorghum field. Teggelli (1995) reported that incidence of *C. chlorideae* was maximum in early sown crop than late sown crop. Manjunath *et al.* (1989) recorded that *Goniozus* sp., *B. bravico rnis.* and *Exorista japonica* were larval parasitoid of *H. armigera.*

In the present study, *B. brevicornis* activity was observed during late September to early October months in the sorghum ecosystem. While, Srinivas (1989) reported more activity of this parasitoid between November to January in pigeonpea and lab-lab crops. This variation in the parasitoid activity may be due to the host plants involved in the study.

Predatory activity of *Chrysoperla carnea, Cheilomenes sexmaculata, Vespa tropica haematodes* and *Ropalida marginata* was observed from August to November. Among these *C. carnea* and *C. sexmaculata* were predominant. The peak incidence of *C. carnea* and *C. sexmaculata* was as high as 0.80 and 0.90 per earhead, respectively during October first week (Fig. 2). Whereas, the peak activity of *R. marginata* and *V. tropica haematodes* was recorded during September fourth week.

The present findings are in agreement with Pawar *et al.* (1989) and Krishnamoorthy and Mani (1990) who stated that C. *'carnea* and *C. sexmaculata* are common predators of *H. armigera* in India. They prey upon eggs and small larvae of *H. armigera.* The predatory activity of *C. carnea,* M. *sexmaculata, R. marginata* and *V. tropica haematodes* were in conformity with the findings of Greathead and Girling (1982).

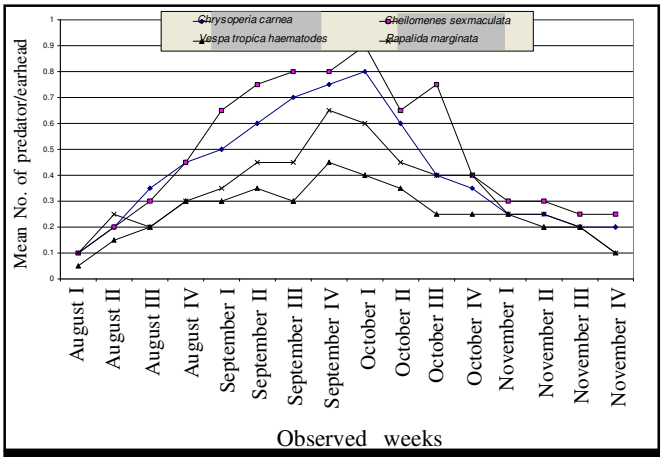

Fig. 2 : Seasonal incidence of *H. armigera* predators on sorghum (2001)

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