PARASITES OF PINK BOLLWORM, *PECTINOPHORA GOSSYPIELLA* SAUND. AND SPOTTED BOLLWORM, *EARIAS Spp.* OF COTTON AT LYALLPUR

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Fortnightly surveys and collections of flower buds, flowers and bolls etc. harbouring pre-imaginal stages of pink and spotted bollworms of cotton at Lyallpur were carried out from August to December, 1972 to find out the parasites and their population dynamics and extent of parasitism. As a result of these collections and rearings in the laboratory, six larval parasites and two pupal parasites were recovered. Population dynamics of these parasites on the larvae of spotted and pink bollworms in flower buds, flowers and bolls were recorded separately. The population of pupal parasites was also recorded. Extent of parasitism of six larval parasites was recorded during the months of October, November and December.

INTRODUCTION

In view of the hazards in the use of insecticides, great emphasis is now being given on integrated and pest management programmes for controlling the insect pests of cotton. These programmes include the use of natural control agents as the most important tool. A soundly devised pest control programme should take maximum advantage of the natural enemies, so that insecticides are employed to the minimum and under urgent situations. Since the first recognition of pink bollworm as a pest in 1847, over 120 species of parasites have been reported to be associated with it in different parts of the world. Out of these, 21 species have been tested for the biological control.

Li (1936) recorded *Microbracon isomera* Cushm., *M. nigrorufum* Cushm., *M. onukii* Watanabe, *Elasmus philippinensis* Ashm., *Brachymeria euploeae* Westm., *B. obscurata* Wlk., *Dibrachy scavus* Wlk., *Eurytoma* sp., *Pimpla* sp., *Pristomerus* sp. and *P. vulerator* Panz. as the parasites of the larvae of pink bollworm. Suer (1938) reared *Perisierola nigrifemur* Ashm., an unidentified Bathylid of the same genus, *Spilachalcis simillima* Ashm., two species of *Microbracon* and a species of *Apanteles* from the larva and an unidentified species of *Ichneumon* from the pupae of *P. gossypiella*. Ahmad and Ghullamullah

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(1939) concluded that high temperature coupled with no rain was markedly injurious to the parasite, *Miscrobracon greeni* and not to the spotted bollworm host. Also that severe winters were more injurious to the parasite than to the host. Bedford (1940) recorded *Microbracon lefroyi* D. and G. as the most important parasite of *E. insulana* and *E. fabia* in the Punjab. Muesebeck (1956) described adults of seven parasites of *P. gossypiella*. These included *Apanteles immitadus* and *A. parakeria* sp. n. from Brazil; *A. angaleti* and *Petalodus gossypiella* sp. n. from India, *Orgilus gossypii* and *Chelonus liber* sp. n. from Argentina; and *Meteorus graciliventris* sp. n. from Japan. *A. hawardi* Blanch was recorded from *P. gossypiella* in Brazil by the same author. Tsai and You (1962) observed *Brachymeria obscurata* Wlk. parasitizing the pupae of *Earias fabia* Stoll., but the population of this chalcid was very low and little control was afforded.

From the foregoing it is clear that in Pakistan, very little information on the native parasites of bollworms was available. Excepting a few casual observations about parasites and their parasitism on the pre-imaginal stages of bollworms, no systematic studies appear to have been carried out on them. The present studies on the parasites of cotton bollworms were therefore, carried out at Lyallpur during the year 1972 to ascertain those that were locally found and to record their population and extent of parasitism.

MATERIALS AND METHODS

Collections of flower buds, flowers and bolls, etc. harbouring pre-imaginal stages of pink bollworm and spotted bollworm were made during August to December from cotton fields at Lyallpur at fortnightly intervals. The material thus collected was brought to the laboratory in cloth bags and glass tubes, etc. where the flower buds, flowers and bolls were opened and examined for the larvae in them. The larvae of pink bollworm and spotted bollworm from different parts of the plant were placed separately in parasite emergence cages at room temperature. For the same purpose the pupae of pink and spotted bollworms were collected from the fields and placed alongwith the plant parts in separate parasite emergence cages. Observations were made daily for the emergence of parasites. The emerged parasites were counted and preserved in 70 per cent alcohol. For recording the egg parasites and their population, the plant parts bearing eggs were examined under a microscope. Counted number of eggs of pink and spotted bollworm were also placed alongwith the plant parts in petri dishes containing moist blotting paper at the bottom. Observations were made daily to record the emergence of any parasite.

Extent of parasitism of larval parasites was studied by examining the host larvae as well as by rearing parasites from them. The parasitised larvae as well those suspected to be so were kept on plant parts from which taken and placed on moist blotting paper in petri dishes. These dishes were observed daily for the emergence of the parasites. The emerged parasites were preserved in 70 per cent alcohol for identification.

RESULTS AND DISCUSSION

Extensive surveys and collections of the pre-imaginal stages of bollworms of cotton from the cotton fields were made at Lyallpur and the parasites were reared from such collections. As a result of these collections and rearings in the laboratory, five larval parasites common to both pink and spotted bollworms viz. *Bracon* sp., *Bracon hebetor*, *Rogas aligarhensi*, *Elasmus johnstoni* and *Goniozus* sp. were found. A sixth species, *Apanteles angaleti* was recovered from the pink bollworm larvae only. In addition, *Brachymeria tachardia* and *Goryphus nursei* were found from the pupae of spotted bollworm while *Goryphus nursei* was recovered from pink bollworm pupae only. No egg parasite could be found. A number of earlier workers viz. Li (1936), Sauer (1937), Bedford (1940), Tsai and You (1962), Muesebeck (1956) had recorded parasites of the different stages of the bollworms of cotton, but no information on the extent of parasitism and their population dynamics was available. Ahmad and Ghullamullah (1939) reported that high temperature coupled with no rain was markedly injurious to *Microbracon greeni* but not to the spotted bollworm host; also that severe winters were more injurious to the parasites than to the host. The present findings are in conformity with these observations. A perusal of table 1 on the population of the parasites of pink bollworm as well as spotted bollworms shows that during August, which was hot month at Lyallpur, the incidence of the parasites was quite low. The population of parasites per hundred larvae of the spotted bollworm, taken from flower buds, flowers and bolls, was 0.42, 1.30 and 0.50 in the first fortnight and 1.23, 1.38 and 1.65 in the second fortnight of August, respectively. In pink bollworm the population was 1.30, 0.40 and 2.00 in the first fortnight and 1.38, 1.48 and 1.76 in the second fortnight respectively, in the larvae from flower buds, flowers and bolls. The mean maximum temperature was 99.2°F and 95.3°F for the first and second fortnights, respectively. The population of parasites went on increasing until with a shower of rain towards the end of September and the consequent rise in relative humidity and fall in temperature, their population shot up to 6.44, 5.17 and 5.20 in flower buds, flowers and bolls, respectively, in case of spotted bollworms and 5.76, 6.40 and 5.00 respectively,

in case of pink bollworm. During the month of October and in the first fortnight of November the population showed a progressive decline This decline in population of parasiees during

TABLE 1. *Population of larval parasites of cotton bollworms per 100 host larvae in flower buds, flowers and bolls at Lyallpur.*

Month	Fortnight	*Peotinophora gossypiella* Saund.			*Earias* spp.		
		Flower buds	Flowers	Bolls	Flower buds	Flowers	Bolls
August	I	1.30	0.40	2.00	0.42	1.30	0.50
	II	1.38	1.48	1.76	1.23	1.38	1.65
September	I	4.73	3.24	3.78	3.33	3.50	3.41
	II	5.76	9.40	5.06	6.44	5.17	5.20
October	I	3.54	3.96	3.50	3.24	3.08	2.49
	II	1.48	2.03	1.75	1.92	2.22	1.28
November	I	1.11	1.40	1.36	1.45	2.10	0.90
	II	2.80	3.41	3.20	2.10	3.20	2.10
December	I	1.30	1.20	0.00	1.08	1.33	1.20

October and first half of November might be due to absence of rains during this period and the consequent low relative humidity (63.4 to 65.86 per cent) which proved unfavourable for the development of parasites. The population of parasites of both the spotted bollworm and pink bollworm again rose in the second fortnight of November. This might be attributed to high relative humidity (72.66) alongwith low maximum temperature (76.96°F) during this period. In the first fortnight of December population of the parasites was very low which might be due to cold coupled with no rainfall/low relative humidity which proved unfavourable for them.

POPULATION OF PUPAL PARASITES:

Brachymeria tachardia Cameron and *Goryphus nursei* Cameron were the two parasites found on the spotted bollworm pupae. The population of *B. tachardia* per hundred host pupae was 0.00, 1.90, 1.48, 0.87 and 0.00 in the months of August, September, October, November and December, respectively, as against 1.3, 0.95, 0.00, 0.87 and zero in case of *G. nursei*. In case of pink bollworm the population of *Goryphus nursei* Cameron during the months of September, October and November was 0.91, 0.81 and 0.90 per hundred host pupae, respectively. The population of pupal parasites was comparatively higher during September which might be due to

rainfall/high relative humidity and rather lower temperature that favoured their development. Pupal parasites seemed more susceptible to severe winter, as none was recovered during the month of December, when the temperature was very low.

EXTENT OF PARASITISM

Extent of parasitism by different parasites may bo seen from Table 2. The

TABLE 2. *Extent of parasitism (percentage) by different parasites of cotton bollworm larvae at Lyallpur.*

Month	*Br. hebetor*		*Bracon* sp.		*A. angaleti*	
	S.B.W.	P.B.W.	S.B.W.	P.B.W.	S.B.W.	P.B.W.
October	0.64	0.41	0.64	0.41	0.00	0.86
November	0.46	0.22	0.46	0.22	0.00	0.66
December	0.24	0.00	0.24	0.00	0.00	0.24
	R. aligarhensi		*E. johnstoni*		*Goniozus* sp.	
	S.B.W.	P.B.W.	S.B.W.	P.B.W.	S.B.W.	P.B.W.
October	0.43	0.41	0.43	0.20	0.21	0.20
November	0.46	0.22	0.23	0.00	0.00	0.00
December	0.24	0.00	0.00	0.00	0.00	0.00

S.B.W. - Spotted bollworm
P.B.W. - Pink bollworm

highest percentage of parasitism during the period from October to December occurred in October, except *R. aligarhensi* which parasitized spotted bollworm to the extent of 0.46 per cent in the month of November as compared to 0.43 per cent and 0.24 per cent during October and December respectively. No larva of either bollworm species was found parasitized by *Goniozus* sp. during the months of November and December, which might be due to higher susceptibility to cold of this species.

The extent of parasitism of *A. angaleti* was maximum (0.86 per cent) during the month of October as compared to the other five larval parasites.

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