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STUDIES ON THE ABUNDANCE OF VARIOUS INSECTS ASSOCIATED WITH THE INDIAN LAC INSECT *KERRIA LACCA* (KERR)

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ABSTRACT

This study was carried out for three years to provide basic data on the abundance of various parasitic and predatory insects associated with the the two strains of the Indian lac insect *Kerria lacca* (Kerr.) (*rangeeni*[1] and *kusmi*[2]) on both the crops (*katki*)[3] and *baisakhi*[4] of *rangeeni* strain and *aghani*[5] and *jethwi*[6] of *kusmi* strain) on two host plants. Data on the abundance of parasites and predators of lac insects in general, have shown that *rangeeni* strain of lac insects suffered more due to these enemies as compared to *kusmi*. Among the two crops of these strains, however, *katki* suffered more than *baisakhi* in case of *rangeeni* strain, whereas *aghani* suffered more than *jethwi* in the case of *kusmi* strain The seasons of the *katki* and *aghani* crops appeared to be favourable for the abundance of parasites. *Tetrastichus purpureus* (Cam) was found to be most abundant parasite of lac insects followed by *Tachardiaephagus tachardiae tachardiae* (How.). The most abundant parasite of lac predators, however, was *Bracon greeni* Ashm Among the predators, the relative abundance varied with the strain of lac insects. *Eublemma amabilis* Moore was the most abundant predator on *rangeeni* lac insects, whereas *Holcocera pulverea* Meyr) dominated on *kusmi*. A number of insects showed preference as well as specificity for certain lac strains or crops. The trend of relative abundance did not vary with the hosts tried.

A deep understanding of the life system of lac insect has tremendous importance in the management of these beneficial insects for improving their

productivity. There are several parasites and predators of lac insects and another set of parasites of lac predators which are intimately associated with each other in the biotic complex (Narayanan, 1962 ; Teotia, 1964 ; Varshneya, 1976). Information on the relative abundance of the various components of this complex, therefore, will be basic and essential towards understanding the life system of the lac insect. Moreover, the inimical insects are held responsible for about 50 per cent loss to the lac produced. Despite considerable attention paid towards this complex, our knowledge on the abundance of the various insects is rather fragmentary and based on unsystematic work which is contained in the Annual Reports of Indian Lac Research Institute (Srivastava *et al.*, 1976). The present study was, therefore, undertaken involving all the insects together.

MATERIAL AND METHODS

The study was conducted on both *rangeeni* and *kusmi* strains of lac insects for three seasons of each of their two crops. The *rangeeni* lac insects were cultured on *palas* and *bhalia* (*Moghania macrophylla* Willd. O. Ktze.) and *kusmi* on *kusum* and *bhalia* in the Institute plantation, Namkum. *Bhalia* was used only for rainy crops viz. *katki* and *aghani*. The lac insects were cultured for each crop in three replicated sets, each of 14 trees of *palas*, 9 of *Kusum* and 34 bushes of *bhalia* for *aghani* and 20 for *katki* crops. The number of *palas* trees for *katki* crop was reduced to half due to shorter duration of the crop and consequently lesser number of samples to be drawn. The samples were collected, caged and the emergence of the insects was recorded according to the method already described (Srivastava *et al.*, 1976).

RESULTS AND DISCUSSION

Abundance of parasites and predators of lac insects and parasites of lac predators in general, in relation to lac strains and their crops

The total number of the adults of parasitic and predatory insects (grouped

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1. *Rangeeni* - one of the two strains of lac insects derived from a source other than *kusum*, or Indian lac-tree (*Schleicera oleosa* (Lour.) Oken.), mainly *palas* the flame of the forest (*Butea monosperma* (Lamk.) Taubert.
2. *Kusmi* - one of the two strains of lac insects which is derived from *kusum*.
3. *Katki* - one of the two crops of *rangeeni* strain of lac insects. Rainy crop of lac (June-July to October-November).
4. *Baisakhi* - one of the two crops of *rangeeni* strain of lac insects. The summer crop of lac (October-November to June-July).
5. *Aghani* - one of the two crops of *kusmi* strain of lac insects. The winter crop of lac (June-July to January-February).
6. *Jethwi* - one of the two crops of *kusmi* strain of lac insects. The summer crop of lac (January-February to June-July).

classwise), that emerged from lac insects are shown in relation to lac strains and their crops in Table 1. It may be seen that the abundance of the parasites and predators of the lac insect and parasites of lac predators varied considerably with the strains of the lac insect and their crops. The number of parasites and predators of the lac insect was distinctly higher on *rangeeni* lac insects than on *kusmi*. The number of parasites of lac predators, however, did not differ much with the two strains of the lac insect. The number of parasites of the lac insect within the two crops of *rangeeni* strain was higher in *baisakhi* crop as compared to *katki*, whereas within the two crops of *kusmi* strain it was higher in *aghani* than *jethwi*. The number of predators, however, was higher in *baisakhi* and *jethwi* crops than that in *katki* and *aghani* respectively. As far as parasites of lac predators are concerned, their number was higher in *katki* and *aghani* crops than that in *baisakhi* and *jethwi* respectively.

Table 1. Number of adults of parasitic and predatory insects associated with lac insect in relation to their strains and crops (Total numbers for 3 seasons of each crop)

Lac insect		Parasites of lac insect		Predators	Parasites of lac predators
Strains	Crop	Total	Except *T. purpureus*		
Rangeeni on *palas*	*Katki*	3134	1627	600	295
	Baisakhi	4372	717	936	137
	Total	7506	2344	1536	432
Kusmi on *kusum*	*Aghani*	2257	862	270	422
	Jethwi	893	372	304	97
	Total	3150	1234	574	519

Thus the higher number of parasites and predators emerging from *rangeeni* lac insects clearly indicates that these insects seem to suffer more from the insect enemies as compared to *kusmi*. on the other hand, the parasites of lac predators recorded more or less equal number on two strains of lac insects. This observation is, somehow, not confluent with the number of hosts of these parasites (predators) which was higher on *rangeeni* than that on *kusmi*. This shows that these parasites are able to control their host perhaps better on *kusmi*. This could possibly be responsible for the higher number of predators on *rangeeni* lac insects.

The lac predators recorded were higher in numbers in *baisakhi* and *jethwi* crops than in *katki* and *aghani* respectively (Table 1). Since they were adults whose peak abundance is known to coincide with the maturity of the *baisakhi* and *jethwi* crops (Srivastava, unpublished), their larvae would naturally appear abundantly in the following *katki* and *aghani* crops. Therefore, *katki* and *aghani* crops should be expected to suffer more from these predators rather than *baisakhi* and *jethwi*. This inference is inagreement with the observations made by Misra *et al.* (1931) and Misra and Gupta (1934).

The total number of parasites of the lac insect was higher in *baisakhi* than the *katki* crop (Table 1). But this was not true for all the species because the numbers in the case of all the parasite species excepting *T. purpureus* were higher in *katki* than *baisakhi* (Table 1). In fact the higher number of total parasites in *baisakhi* crop was only due to remarkably higher abundance of *T. purpureus* in this particular crop, otherwise, total number of parasites was higher in *katki* than that in *baisakhi* crop. In two crops of *kusmi* lac insects, the number of parasites was always higher in *aghani* than that in *jethwi* (Table 1). Just like parasites of lac insect, the parasites of its predators were also more predominant in *katki* and *aghani* crops than *baisakhi* and *jethwi* respectively (Table 1). This shows that *katki* and *aghani* crops are more favourable for the abundance of the parasites possibly owing to the rainy season.

It is thus, indicated that *rangeeni* lac insects out of two strains and *katki* and *aghani* crops out of the 4 lac crops (2 of *rangeeni* and 2 of *kusmi* strains) appear to suffer more due to the insect enemies.

Relative abundance of the various individual parasites and predators of lac insects and parasites of lac predators

The total number of adults of various individual insects associated with lac insects, that were recorded within different crops over three seasons of each are presented in Tables 2 and 3. The relative abundance of these insects was as follows :

A : *Parasites of lac insects* : *T. purpureus* was consistently the most abundant parasite of lac insects. The next parasite in descending order was *T. tachardiae tachardiae*. The numbers of other parasites particularly *Parechthrodryinus clavicornis* (Cam.), *Coccophagus tschirchi* Mahd., *Eupalmus tachardiae* (How. and *Erencyrtus dewitzi* (Mahd.) were low and did not differ much among themselves within the crop. However, there was considerable variations in the various crops (Table 2) and their seasons. Due to this sort of numerical variation the relative abundance of these parasites was inconsistent and not well marked. Some parasites of lac insect also showed either preference or specificity in their abundance on certain lac strains or crops. The abundance of *C. tschirchi* was notably

Table. 2. Relative abundance of parasites of lac insects (adults) (Total number on three crops)

Crop	Host	Parasites of lac insects								
		T. pur pureus	*T. t. tachurdiae*	*P. clavi-cornis*	*C. tschi-rchi*	*E. dewitzi*	*E. tachardiae*	*M. javensis*	*T. t. somervillei*	Total
Baisakhi '72-73 to 74-75	*Palas*	3655	331	261	32	59	29	5	0	4372
Katki '73 to 75	,,	1507	695	307	378	228	16	3	0	3134
,,	*Bhalia*	702	636	239	335	265	0	1	0	2178
Jethwi '73 to '75	*Kusum*	521	246	21	9	89	6	0	1	893
Aghani 73-74 74-75, 76-77	,,	1395	455	63	40	43	127	2	132	2257
,,	*Bhalia*	1081	474	61	29	35	37	1	2	1720

higher in *katki* crops as compared to other crops (Table 2). *Tachardiaephagus tachardiae somervillei* (Mahd.) was recorded only from *kusmi* strain of lac insects Similarly, number of *Marietta javensis* was extremely low.

B. *Predators of lac insects* : The relative abundance of the major lac predators differed with the two strains of lac insects. In fact, the number of *E. amabilis* was higher than that of *H. pulverea* (Mayr.) on *rangeeni* lac insects, whereas it was just the reverse on *kusmi* lac insects (Table 3). Another predator, *Chrysopa* spp. was recorded only from *kusmi* lac insects casually and in low numbers (Table 3).

C. *Parasites of lac insect predators* (=lac predators) : *B. greeni* was found to be the most abundant parasite of lac predators. The other parasites of lac predators such as *Apanteles tachardiae* Cam., *Pristomerus sulci* Mahd. and Kalub., *Brachymeria tachardiae* (Cam.) and *Apanteles fakhrulhajiae* Mahd. did not show a consistent and well marked trend of their abundance, similar to many of the lac parasites due to their low numbers which did not vary much among themselves but fluctuated considerably between the various crops (Table 3) and their seasons. The abundance of the parasites of lac predators, *Elasmus claripennis* (Cam.) was higher particularly in rainy crops like *katki* and *aghani* as compared to summer crops like *baisakhi* and *jethwi*.

The trend of relative abundance of the various insects reported above did not vary with the hosts tried (Tables 2 and 3).

Studies on the inimicial and beneficial insects associated with lac insects were initiated as early as 1926 at the Indian Lac Research Institute and the informations which is incomplete on several aspects are contained in the Annual Reports of this institute. The present record of the most abundant parasites of lac insects is, however, in conformity with the earlier reports in this regard (Anonymous, 1928, 1930, 1931, 1932, 1956, 1964, 1966, 1968 and 1969). The position with regard to abundance of *C. tschirchi* has remained fairly inconsistent (Anonymous, 1928, 1930-32) but the present observations have almost consistently shown that its abundance is particularly high in *katki* crop (Table 2). Its comparatively low numbers in *aghani* crop which continues through same season and *baisakhi* crop which belongs to same strain atleast indicates that it is neither the effect of season nor of the strain. It would be worthwhile to investigate the key factor governing its abundance. Similarly, present record of *T. tachardiae somervillei* exclusively from *kusmi* lac insects (Table 2) is not in conformity with the earlier reports recording it from *rangeeni* insects (*katki* crop) of Mirzapur (U.P.) and Damoh (M.P.) (Anonymous, 1964, 1966, 1969 and 1972). This could perhaps be due to preference of this parasite for *kusmi* lac insects over *rangeeni* whose expression

Table 3. Relative abundance of lac predators and their parasites (adults) (Total number on three crops)

Crop	Host	Lac Predators				Parasites of lac predators							
		E. amabilis	*H. pulverea*	*Chrysopa* spp	Total	*B. greeni*	*A. tachar-diae*	*P. sulci*	*B. tachar-diae*	*E. clari pennis*	*A fakhrul-hajiae*	*C. cyclo-pyra*	Total
Baisakhi '72-73 to 74-75	*Palas*	609	327	0	936	86	23	15	3	9	1	0	137
Katki 73 to 75	,,	429	171	0	600	114	74	15	4	85	0	3	295
,,	*Bhalia*	263	251	0	314	49	6	15	0	46	1	0	117
Jethwi 73 to 75	*Kusum*	70	229	5	304	65	21	4	6	1	0	0	97
Aghani 73-74 74-75m76-77	,,	106	159	5	270	297	36	54	0	14	21	0	422
,,	*Bhalia*	152	103	2	257	287	26	15	0	82	1	0	411

might not have been possible in areas of Damoh and Mirzapur because of exclusive culturing of *rangeeni* lac insects. The parasite, therefore, might have parasitised *rangeeni* lac insects out of compulsion rather than preference as observed in the present case which provided an environment having both the lac strains cultured together. The presence of *M. javensis* in extremely low number suggests that perhaps it is not an important parasite of lac insects as far as its role as an enemy is concerned.

The strain specific relative abundance of the two major predators of lac is reported herewith, perhaps for the first time. The number of these predators *E. amabilis* and *H. pulverea* is, however, usually noticed to increase with the decrease in the number of their main parasites viz. *B. greeni* and *A. tachardiae* respectively and vice-versa (Table 3). This could also lead to the strain differences mentioned above. However, the exact basis of this difference is yet to be ascertained. Considerable differences exist in literature in this regard. Imms and Chatterjee (1915) reported *H. pulverea* even more abundant than *E. amabilis*. Misra and Gupta (1934) stated that *E. amabilis* was more prevalent in field, whereas *H. pulverea* was more abundant in storage. Apart from that, there are a number of inconsistent reports about the relative abundance of these two predators (Anonymous, 1932, 1942, 1956, 1957, 1965 and 1966). According to these reports which are based on studies conducted at Mirzapur, Damoh and Umaria (M.P.), *H. pulverea* has generally been found dominant over *E. amabilis*. These records are not in conformity with the present observations. This could possibly be due to the differences in the two areas and the plantation, in that the former have the availability and cultivation of only one strain of lac insects, and the latter having that of both providing thereby altogether a different host situation.

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