



## EMERGENCE PROFILE OF ENTOMOFAUNA ASSOCIATED WITH LAC INSECT *KERRIA LACCA* (KERR) IN WESTERN PLAINS OF INDIA

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### ABSTRACT

Fauna associated with lac insect when analysed revealed that it was represented by the predators- *Eublemma amabilis* Moore, *Pseudohypatopa pulvereana* Meyrick, *Chrysopa zastrowi* (Esbén-Petersen); primary parasitoids- *Tachardiaephagus tachardiae* Howard, *Aprostocetus purpureus* Cameron, *Tyndarichus (Parechthrodryinus) clavicornis* Mashhood Alam and *Erencyrtus dewitzi* Mahdihassan; and the hyperparasitoids- *Apanteles fakhruhlajiae* Mahd., *Eupelmus tachardiae* Howard, *Bracon greeni* Ashmead and *Brachymeria tachardiae* Cameron. Predators emerged up to VIII week during October and up to VI week in July. Parasitoids emerged up to V and IV week in October and July, respectively. Hyperparasitoids emerged upto V week in October and IV-V week during July. All these took more time to complete emergence during October- November than June - July.

**Key words:** *Kerria lacca*, predators, primary parasitoids, hyperparasitoids, seasonal occurrence, time for emergence, proportion

Lac, a natural resin, produced by tiny lac insects mainly *Kerria lacca* (Kerr) belonging to family Tachardiidae (Homoptera). In India, the major lac producing states are Jharkhand, Chhattisgarh, Madhya Pradesh, Maharashtra and West Bengal, which contribute around 96% of the total lac production. Lac cultivation is an important source of income for livelihood of forest and sub-forest dwellers in different states. On an average around 28% of total agriculture income of households is contributed by lac cultivation (Jaiswal et al., 2006). Fast depleting forests are a serious threat to the biodiversity of lac insects. Many lac insects and associated fauna have become endangered where lac cultivation has been abandoned or its habitat destroyed. Promoting and encouraging lac culture not only checks environmental degradation, but also conserve associated fauna and flora for posterity (Sharma et al., 2006).

*Rangeeni* and *kusmi* are the two strains of lac insect that are classified based on their lifecycle and preference for specific host plants. Lac insects can survive on more than 400 plant species (Kapur, 1954; Roonwal et al., 1958); Varshney and Teotia, 1967); Varshney, 1968; Sharma et al., 1997). Of these, the tender twigs of *palas* (*Butea monosperma* Lam), *ber* (*Ziziphus mauritiana* Lamk), *kusum* (*Schleichera oleosa* Oken) and *semialata* (*Flemingia semialata* Roxb) are exploited for commercial cultivation.

Lac insect ecosystem is a complex multitrophic web of flora and fauna and representing a rich biodiversity which includes more than 22 lac predators, 30 primary parasites, 45 secondary parasites, a variety of pests of lachosts and several microbes (Sharma and Jaiswal, 2011). Predators and parasitoids have always been a major limiting factor in lac production. Among predators, *Eublemma amabilis* Moore, *Pseudohypatopa pulvereana* Meyrick and *Chrysopa madestes* Banks are the major predators (Sharma et al., 2006) and cause about 35-40% loss (Malhotra and Katiyar, 1975, Jaiswal et al., 2008). About 30 species of parasites had been reported on lac insect (Varshney, 1976). Earlier studies indicated a parasitisation of only 5-10% (Narayanan 1962), but with changing times and climatic scenario, it had increased to about 20-37% (Srivastava and Chauhan, 1984). In the recent past, summer season *rangeeni* lac crop failure due to parasites had been known (Sharma et al., 2006).

In this study, the different trophic status i.e., predators and parasitoids [primary (inimical) and secondary (beneficial) parasitoids] associated with *K. lacca* in western plains of India are analysed. These are done for duration as well as emergence pattern aspects, and it might help to determine the abundance of these enemies, and extrapolate it for supporting lac cultivation.

## MATERIALS AND METHODS

Intensive surveys were carried out in states of western plain of India i.e., Gujarat, Haryana and Rajasthan during the emergence period of lac insect i.e., June - July and October-November of 2015 and 2017 under one of the cooperating centers (MPUAT, Udaipur) of the Network Project on Conservation of Lac Insect Genetic Resources (funded by Indian Council of Agricultural Research), being implemented and executed by ICAR-Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand. Lac insect samples collected from various parts were caged for emergence of entomofauna. Documentation of lac associated fauna of the region was made after quantification based on identification of predators and parasitoids (both inimical and beneficial) emerged. Samples of lac insect encrustation of 1 m length were kept inside the 60-mesh nylon net bags and wet cotton swab (water) were put at both the ends of lac bearing twigs to maintain the turbidity of samples and for maintaining the lac insects. The mouth of net bags was tied and kept at room temperature for proper aeration. Fauna that emerged were collected at weekly intervals upto eight weeks after sample storage and separated with identification done under microscope.

## RESULTS AND DISCUSSION

### Fauna associated

During the study, eleven species of associated fauna i.e., predators, primary parasitoids, hyperparasitoids were observed on lac insect. These fell under 8 families and 3 orders. Amongst these, 8 species belong to the order Hymenoptera, 2 of Lepidoptera, and 1 of Neuroptera. These results corroborate those of Sharma et al. (1997) on 14 species. The predators were represented by *Eublemma amabilis* Moore, *Pseudohypatopa pulverea* Meyrick, *Chrysopa zastrowi* (Esben-Petersen); Primary parasitoids of lac insect viz., *Tachardiaephagus tachardiae* Howard, *Aprostocetus purpureus* Cameron, *Tyndarichus (Parechthrodryinus) clavicornis* Mashhood Alam, *Erencyrtus dewitzi* Mahdihassan; whereas, hyperparasitoids' species were represented by *Apanteles fakhrulhajiae* Mahd., *Eupelmus tachardiae* Howard, *Bracon greeni* Ashmead and *Brachymeria tachardiae* Cameron. Findings of present study gets support from observation of Chiu et al. (1985) who recorded *E. tachardiae*, *Parechthrodryinus* sp., *Tachardiaephagus* sp., *T. tachardiae*, *T. purpureus*, *Chrysopa* sp., *E. conspersa*, *E. roseonivea* and *Telsimia*

*chujoi* as pests of lac insect from Taiwan. Sharma (1993) recorded *Bracon greeni*, *B. hebetor*, *Aphrastobracon flavipennis*, *A. fakhrulhajiae* and *A. tachardiae* as parasitoids of predator (*P. pulverea*) of *K. lacca*. Sharma et al. (2008) reported two species of predators, viz., *E. amabilis* and *P. pulverea*, five primary parasitoids, i.e., *A. purpureus*, *E. dewitzi*, *P. clavicornis*, *T. tachardiae* and *T. somervilli* and two hyperparasitoids, viz., *B. greeni* and *Pristomerus sulci* on *Kerria* sp. from the surveyed areas of Assam, Jharkhand, Karnataka and Tamil Nadu.

Varshney (1976) reported 30 parasitoids and 22 predators closely associated with lac insect. *E. amabilis*, *P. pulverea* and *Chrysopa* sp. are the major predators, causing 35- 40% damage (Malhotra and Katiyar, 1975). Sharma and Jaiswal (2011) reported more than 22 predators, 30 primary parasitoids, 45 secondary parasitoids.

### Emergence profile of fauna

Table 1 reveals that the predator *E. amabilis* emerges till the VIII week after storage; whereas *P. pulverea* emerged up to VI week of storage. Among primary parasitoids of lac insect, *T. tachardiae*, *A. purpureus* and *E. dewitzi* emerged up to V week of sample storage; whereas, there was no emergence of *T. clavicornis* after IV week of sample storage. However, there was gradual decrease in numbers with later weeks of sample storage. Hyperparasitoids, *A. fakhrulhajiae* and *E. tachardiae* emerged up to IV week after storage, while *B. greeni* emerged only in IV week after storage.

Emergence profile of predators during July 2016 shows that emergence of *E. amabilis* and *P. pulverea* did not take place after the VI week from the stored samples; whereas *Chrysopa* emerged in negligible numbers only in II and III week. Parasitoids, *T. tachardiae*, *A. purpureus* and *E. dewitzi* continued emergence till IV week, whereas *T. clavicornis* emerged up to III week from the stored samples. Hyperparasitoid, *A. fakhrulhajiae* emerged up to II week only, whereas *E. tachardiae* and *B. greeni* emerged up to II and III week, respectively. Data shows the week-wise emergence pattern of associated fauna during October 2016. Data obtained demonstrate that *E. amabilis* and *P. pulverea* emerged up to VII week from the samples. Primary parasitoids, *T. tachardiae*, *A. purpureus* and *T. clavicornis* emergence did not take place after IV week, whereas *E. dewitzi* continued emerging till the V week. Emergence of *A.*



(Contd.) Table 1

		October, 2016									
Weeks after storage	Predators			Trophic level status Primary parasitoids			Hyperparasitoids			Total	
	E a	Pp	T t	A p	T c	Ed	A f	E t	B t		
I	4.00	6.00	254.00	148.67	36.67	252.00	23.33	14.67	0.00	739.34	
II	7.33	2.00	231.33	27.33	7.33	256.00	2.00	17.33	2.00	552.65	
III	4.67	1.33	64.00	15.33	2.67	127.33	0.00	4.00	2.00	221.33	
IV	28.67	4.00	26.67	8.00	2.00	30.00	1.33	0.67	-	101.34	
V	4.67	0.00	-	-	-	2.67	1.33	-	-	8.67	
VI	0.67	0.67	-	-	-	-	-	-	-	1.34	
VII	0.67	2.00	-	-	-	-	-	-	-	2.67	
VIII	0.00	0.00	-	-	-	-	-	-	-	0	

  

		July, 2017									
Weeks after storage	Predators			Trophic level status Primary parasitoids			Hyperparasitoids			Total	
	E a	Pp	T t	A p	T c	Ed	A f	E t	B t		
I	4.00	1.33	38.00	85.33	8.67	82.67	2.00	1.33	-	223.33	
II	4.00	3.33	42.00	72.00	10.67	92.00	2.00	1.33	-	227.33	
III	9.33	6.00	55.33	36.67	14.67	51.33	4.67	2.00	-	180.00	
IV	11.33	3.33	22.67	16.00	6.67	18.67	1.33	2.00	-	82.00	
V	6.00	6.67	-	-	-	-	-	-	-	12.67	
VI	1.33	2.00	-	-	-	-	-	-	-	3.33	
VII	-	-	-	-	-	-	-	-	-	-	
VIII	-	-	-	-	-	-	-	-	-	-	

Ea: *Eublemma amabilis* Pp: *Pseudohypatopa pubvrea* Tt: *Tachardiaephagus tachardiae* Ap: *Aprostocetus purpureus*  
 Tc: *Tyndarichus clavicornis* Ed: *Erenyrtus dewitzi* Af: *Apanteles fakhrullajiae* Et: *Eupelmus tachardiae* Bg: *Bracon greeni*  
 Bt: *Brachymeria tachardiae*

*fakhrulhajiae* continued till the V week, *E. tachardiae* kept emerging till IV week and *B. tachardiae* was observed in negligible numbers only in the II and III week.

Observation on weekly emergence profile of fauna associated with lac insect during July 2017 indicated that *E. amabilis* and *P. pulvereae* continued to emerge up to VI week of storage. Primary parasitoid, *T. tachardiae*, *A. purpureus*, *E. dewitzi* and *T. clavicornis* emergence did not occur after the IV week of sample storage. Hyperparasitoid, *A. fakhrulhajiae* and *E. tachardiae* emerged up to the IV week of sample storage.

Weekly emergence profile of fauna associated with lac insect during 2015- 2017 revealed that predator *E. amabilis* emerged till VII- VIII week during October season whereas in July up to VI week after storage. Present results partly agree with the findings of Sharma et al. (2008) who observed that the emergence of *E. amabilis* started in first week of November and continued for 22 weeks up to April. However, difference might be due to the fact as reported by Narayanan (1962) that *E. amabilis* and *P. pulvereae* complete six and five generations, respectively in a year and the winter generation is the longest (119- 125 days). Predator *P. pulvereae* continued emergence up to VI-VII week during October and up to VI week after storage during July. Jaiswal et al. (1998) reported that *P. pulvereae* can feed and breed on stored lac for about eight months. However, this difference might be due to difference in agroclimatic conditions as well as difference in relative density of the predator. *Chrysopa* emerged in negligible numbers in II and III week of storage.

Primary parasitoids *T. tachardiae* and *A. purpureus* emerged up to IV-V week during October months, whereas during July emerged upto IV week only. Parasitoid *E. dewitzi* continued the emergence up to V week during October and IV week of sample storage during July. *T. clavicornis* emerged upto IV week during October and III-IV week after storage during July. Present findings agree with those of Sharma et al. (2008) who reported primary parasitoids emergence up to seven weeks after storage. However, there was gradual decrease in numbers after peak emergence.

Hyperparasitoids, *A. fakhrulhajiae* and *E. tachardiae* emerged up to IV- V and V week after storage, respectively during both the months; whereas, *B. greeni* emerged only in IV and III week of storage,

during October 2015 and July 2016, respectively. *B. tachardiae* observed in negligible numbers only in the II and III week during October 2016. Present findings are in agreement with the findings of Sharma et al. (2008) who reported complete emergence of hyperparasitoids i.e., *Bracon greeni* and *Pristomerus sulci* within five weeks.

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