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**Savita Aditya**  
 Department of Entomology,  
 College of Agriculture, Indira  
 Gandhi Krishi Vishwavidyalaya,  
 Raipur, Chhattisgarh, India

**BP Katlam**  
 Department of Entomology,  
 College of Agriculture, Indira  
 Gandhi Krishi Vishwavidyalaya,  
 Raipur, Chhattisgarh, India

**YK Meshram**  
 Department of Entomology,  
 College of Agriculture, Indira  
 Gandhi Krishi Vishwavidyalaya,  
 Raipur, Chhattisgarh, India

## Parasitoids and predatory fauna of lac insect, *Kerria lacca* (Kerr) on *Rangeeni* and *Kusmi* strain at Raigarh district of Chhattisgarh

Savita Aditya, BP Katlam and YK Meshram

### Abstract

Parasitoids and predatory fauna of lac insect, *Kerria lacca* (Kerr) on *rangeeni* and *kusmi* strain was studied during year 2020-21 and 2021-22 at Raigarh District of Chhattisgarh. The predators viz. *Eublema amabilis* and *Pseudohypatopa puverea* were recorded as key predator fauna of lac reached with maximum number at first fortnight of May with 10.52 and 8.45 insect/30 cm lac sticks in *rangeeni* strain whereas in *kusmi* strain *Eublema amabilis* reached their maximum at II<sup>nd</sup> fortnight of August. In case of *Pseudohypatopa puverea* recorded maximum number in I<sup>st</sup> fortnight of September with 8.80 and 8.65 insect/30 cm lac sticks whereas the incidence of *Chrysoperla sp* was noticed minor predator in both strain. *Tachardiaephagous tachardiae* was noticed a potential parasitoid in both strain and recorded maximum number at II<sup>nd</sup> fortnight of April in *rangeeni* and I<sup>st</sup> fortnight of October in *kusmi* with 8.12 and 8.80 insect/30 cm lac sticks but in case of *Aprostocetus purpureus* and *Eupelmus tachardiae* were exhibited as minor parasitoid in both the strain. The hyper-parasitoids (a beneficial fauna) viz. *Bracon greeni* and *Apanteles sp.* were also noticed as minor status in both strains.

**Keywords:** Predators and parasitoids of lac insect, natural enemies of lac insect, *rangeeni* and *kusmi* strain

### Introduction

Lac cultivation is an important source of income for livelihood of the forest and sub-forest dwellers of Jharkhand, Chhattisgarh, Madhya Pradesh, West Bengal, Maharashtra, Odisha and parts of Uttar Pradesh, Andhra Pradesh, Gujarat and NEH region. Lac production is highly labour intensive process and provides employment to both men and women dwelling in forest and sub-forest areas of these states. It is a highly remunerative crop, paying high economic returns to the farmers and also to foreign exchange of the country through its export.

The Indian lac insect, *Kerria lacca* (Kerr) (order- Hemiptera, suborder- Homoptera, family- Lacciferidae) with its piercing and sucking mouth parts sucks plant sap (Colton, 1984) [1] from its over more than 400 plant species (Ramani *et al.*, 2008) [14]. The most common host trees for lac cultivation are *Palash* (*Butea monosperma*), *Ber* (*Zyziphus mauritiana*), *Kusum* (*Schleichera oleosa*) and *Flemingia semialata*. *K. lacca* on *Acacia tortilis* and *Calliandra surinamensis* reported by (Ramani and Sharma, 2010) [13]. A survey indicates that on an average around 28 per cent of total agriculture income is contributed by lac cultivation (Jaiswal *et al.*, 2006) [4].

Good lac production depends on suitable host plant, cultivation techniques and management of bio-agent timely during cultivation. It has been estimated that on an average, up to 30-35 per cent of the lac cells are destroyed by natural enemies of lac crop. At times, the enemy attack can be so serious as to result in crop failures. The lac insect is prone to attack by insect predators and parasitoids. Among them, two Lepidopteron predators, *Eublema amabilis* Moore (Lepidoptera: Noctuidae) and *Pseudohypatopa papulverea* Mayr. (Lepidoptera: Blastobasidae) are key pests causing a loss of around 30-40 per cent to lac production (Glover, 1937, Narayanan, 1962, Jaiswal *et al.*, 2008) [3, 10, 5]. *Chrysopa lacciperla* Kimmins and *C. madestes* Banks (Chrysopidae: Neuroptera) are the most prevalent in lac ecosystems and they caused considerable damage especially in the winter season (*Aghani kusmi* lac crop). Larvae of *E. amabilis* and *P. pulverea* bore into the lac encrustations where they remain confined while they feed on the lac insects. Chhattisgarh is of one the major lac cultivated area in India after Jharkhand and Madhya Pradesh. It would be better to take precautions for management of lac insect fauna.

**Corresponding Author:**  
**Savita Aditya**  
 Department of Entomology,  
 College of Agriculture, Indira  
 Gandhi Krishi Vishwavidyalaya,  
 Raipur, Chhattisgarh, India

## Materials and Methods

The untreated host plants Ber (*Z. mauritiana*), Palas (*B. monosperma*), Semialata (*F. semialata*) and Kusum (*S. oleosa*) were randomly selected for survey of associated parasitoids and predators of lac insect at farmers field in both season *Rangeeni Baisakhi* (Summer) and *Kusmi Aghani* (Winter) from five villages *i.e.* Sambalpuri, Junvani, Navagaon, Baronakonda and Padigaon at Raigarh district of Chhattisgarh during 2020-21 to 2021-22.

The associated predators and parasitoids of lac insects were recorded from infested lac encrusted twigs of 30 cm length 4 plants (4 twigs of each plants), at fortnightly interval, collected samples will be kept in 60 mesh nylon bag for 10-15 days for the emergence of natural enemies and calculate the total number of egg/larva/pupa/adults of predator/parasitoids/hyper-parasitoids village wise. The collected samples were identified by IINRG, LPU Ranchi (Jharkhand).

## Result and discussion

During the course of study, three predators of lac insect *viz.* *Chrysopa sp.*, *Eublema amabilis* and *Pseudohypatopa pulverea* and three parasitoids *viz.* *Tachardiaephagous tachardiae*, *Aprostocetus purpureus* and *Eupelmus tachardiae* and two hyper-parasitoids *viz.* *Bracon greeni* and *Apanteles sp.* were noticed in both seasons *rangeeni baisakhi* (summer) and *kusmi aghani* (winter) in Raigarh district of Chhattisgarh

during year 2020-21 and 2021-22. (Table 1 & 2)

Fortnightly observations, on the incidence of *E. amabilis* in *rangeeni* strain (summer) crop revealed overall pooled mean population of *E. amabilis* in five villages of Raigarh district, it was 1.25 per 30 cm lac stick in first fortnight of February and gradually increased with peak population of 10.52 per 30 cm lac stick during first fortnight of May. Whereas the population of *E. amabilis* on *kusmi* strain (winter) crop first appeared in second fortnight of July and reached the peak in the second fortnight of August with 8.80 insect per 30 cm lac stick.

Overall pooled mean of *P. pulverea* indicated that the predator first appeared with 0.65 per 30 cm lac stick in first fortnight of January which gradually increased to peak population of 8.45 per 30 cm lac stick in first fortnight of May at harvest of lac in *rangeeni* strain. In case of *kusmi* strain crop the population of *P. pulverea* first appeared in first fortnight of July. The peak density 8.65 insect per 30 cm lac stick was noticed during first fortnight of September.

Based on overall mean of two years the incidence of *Chrysopa sp.* on *rangeeni* strain (summer) crop was active during first fortnight of November to second fortnight of February and reached maximum number with 5.95 insect per 30 cm lac stick in *rangeeni* strain. In *kusmi* strain (winter) crop, it was active first fortnight of July to first fortnight of November and reached maximum population with 3.97 insect per 30 cm lac stick.

**Table 1:** Insect fauna associated with lac insect on *rangeeni* strain at Raigarh district during 2020-21 and 2021-22

S. no.	Insect fauna		Range (Number of insect /30 cm lac stick)		Peak density	Active period	Peak activity period
	Name of insect	Status	November 2020 to May 2021	November 2021 to May 2022			
1	<i>Eublema amabilis</i>	Predator (Major)	1.25-10.55	1.45-10.50	10.52	I <sup>st</sup> fortnight of February to I <sup>st</sup> fortnight of May	I <sup>st</sup> fortnight of May
2	<i>Pseudohypatopa pulverea</i>	Predator (Major)	0.65-8.10	0.70-8.80	8.45	I <sup>st</sup> fortnight of January to I <sup>st</sup> fortnight of May	I <sup>st</sup> fortnight of May
3	<i>Chrysoperla sp.</i>	Predator (Minor)	1.20-6.05	1.10-5.85	5.95	I <sup>st</sup> fortnight of November to II <sup>nd</sup> fortnight of February	II <sup>nd</sup> fortnight of November
4	<i>Tachardiphagous tachardiae</i>	Parasitoid (Major)	3.30-7.70	3.85-8.55	8.12	I <sup>st</sup> fortnight of March to I <sup>st</sup> fortnight of May	II <sup>nd</sup> fortnight of April
5	<i>Aprostocetus purpureus</i>	Parasitoid (Minor)	0.25-1.15	0.15-1.30	1.07	II <sup>nd</sup> fortnight of February to I <sup>st</sup> fortnight of May	I <sup>st</sup> fortnight of April
6	<i>Eupelmus tachardiae</i>	Parasitoid (Minor)	0.15-0.95	0.30-0.85	0.90	II <sup>nd</sup> fortnight of December to II <sup>nd</sup> fortnight of January	II <sup>nd</sup> fortnight of January
7	<i>Bracon greeni</i>	Hyper-parasitoid (Minor)	0.10-0.90	0.05-0.80	0.85	I <sup>st</sup> fortnight of December to II <sup>nd</sup> fortnight of April	II <sup>nd</sup> fortnight of February
8	<i>Apanteles sp.</i>	Hyper-parasitoid (Minor)	0.20-0.75	0.05-0.90	0.82	I <sup>st</sup> fortnight of January to I <sup>st</sup> fortnight of May	I <sup>st</sup> fortnight of April

The parasitoid *T. tachardiae* first appeared in *rangeeni* strain (summer) crop in the first fortnight of March with 3.57 and reached maximum number with 8.12 insect per 30 cm lac stick in second fortnight of April whereas on *kusmi* strain crop the population of *T. tachardiae* first appeared on lac insect during first fortnight of September with 2.52 insect per 30 cm lac stick with peak density of 8.80 in the first fortnight of October.

The incidence of *A. purpureus* on *rangeeni* strain (summer) crop first started in second fortnight of February with 0.20 and reached maximum number with 1.07 insect per 30 cm lac stick in first fortnight of April. Similarly, on *kusmi* strain

(winter) crop the population of *A. purpureus* first appeared in first fortnight of October with 0.40 insect per 30 cm lac stick and reached maximum number in the first fortnight of November with 2.52 insect per 30 cm lac stick.

Incidence of *E. tachardiae* on *rangeeni* strain (summer) crop was first observed in second fortnight of December with maximum number 0.90 insect per 30 cm lac stick. However on *kusmi* strain (winter) crop, *E. tachardiae* first appeared in the first fortnight of October with 0.30 insect per 30 cm lac stick. Population reached maximum number with 1.32 insect per 30 cm lac stick in first fortnight of December during growth year 2020-21 and 2021-22, respectively.

**Table 2:** Insect fauna associated with lac insect on *kusmi* strain at Raigarh district during 2020-21 and 2021-22

S. no.	Insect fauna		Range (Number of insect /30 cm lac stick)		Peak density	Active period	Peak activity period
	Name of insect	Status	November 2020 to May 2021	November 2021 to May 2022			
1	<i>Eublemma amabilis</i>	Predator (Major)	0.35-8.55	0.25-9.50	8.80	II <sup>nd</sup> fortnight of July to I <sup>st</sup> fortnight of January	II <sup>nd</sup> fortnight of August
2	<i>Pseudohypatopa pulvereae</i>	Predator (Major)	0.05-8.80	0.05-8.45	8.65	I <sup>st</sup> fortnight of July to I <sup>st</sup> fortnight of January	I <sup>st</sup> fortnight of September
3	<i>Chrysoperla sp.</i>	Predator (Minor)	0.60-4.35	0.09-3.60	3.97	I <sup>st</sup> fortnight of July to I <sup>st</sup> fortnight of November	I <sup>st</sup> fortnight of July
4	<i>Tachardiphagous tachardiae</i>	Parasitoid (Major)	2.15-8.70	2.90-8.90	8.80	I <sup>st</sup> fortnight of September to II <sup>nd</sup> fortnight of November	I <sup>st</sup> fortnight of October
5	<i>Aprostochetus purpureu</i>	Parasitoid (Minor)	0.40-2.40	0.40-2.65	2.52	I <sup>st</sup> fortnight of October to II <sup>nd</sup> fortnight of November	I <sup>st</sup> fortnight of November
6	<i>Eupelmus tachardiae</i>	Parasitoid (Minor)	0.25-1.30	0.25-1.35	1.32	I <sup>st</sup> fortnight of October to II <sup>nd</sup> fortnight of December	I <sup>st</sup> fortnight of December
7	<i>Bracon greeni</i>	Hyper-parasitoid (Minor)	0.30-1.70	0.15-1.20	1.45	I <sup>st</sup> fortnight of August to II <sup>nd</sup> fortnight of October	II <sup>nd</sup> fortnight of September
8	<i>Apanteles sp.</i>	Hyper-parasitoid (Minor)	0.05-0.55	0.05-0.60	0.50	I <sup>st</sup> fortnight of September to I <sup>st</sup> fortnight of November	I <sup>st</sup> fortnight of September

Population of *B. greeni* as hyper-parasitoid (beneficial fauna) on *rangeeni* strain (summer) crop first appeared in the first fortnight of December with 0.10 insect per 30 cm lac stick and gradually increased with 0.85 insect per 30 cm lac stick in second fortnight of February, whereas on *kusmi* strain (winter) crop the population of *B. Greeni* appeared in the first fortnight of August with 0.22 insect per 30 cm lac stick and reached maximum number with 1.47 insect per 30 cm lac stick in second fortnight of September during the year 2020-21 and 2021-22, respectively.

The *Apanteles sp.* on *rangeeni* strain (summer) crop first appeared in the first fortnight of February with 0.02 and reached maximum number of 0.82 insect per 30 cm lac stick in first fortnight of April, whereas on *kusmi* strain (winter) crop, its incidence was first recorded in the first fortnight of September and reached maximum number with 0.50 insect per 30 cm lac stick in first fortnight of September during the year 2020-21 and 2021-22, respectively.

Our research supports their findings according to Monobrullah *et al.* (2015)<sup>[9]</sup>, predators *E. amabilis* and *P. pulvereae* as well as the parasite *T. tachardiae* were more prevalent throughout *rangeeni* summer. Rajpoot *et al.* (2020)<sup>[12]</sup>, reported natural enemies of lac *viz.* *Eublemma amabilis* and *Pseudohypatopa pulvereae* recorded as key or major predator of lac, whereas *Chrysopa sp.* recorded as moderate predator, *Tachardiaephagus tachardiae* was recorded as major parasitoid whereas *Eupelmus tachardiae* and *Aprostocetus purpureu* as a minor parasitoid of *rangeeni* *baisakhi* lac crop. The *E. amabilis* and *P. pulvereae* were recorded as key predators in different district of Chhattisgarh, may be due to availability of foods round the year and this result was in agreement with that of Dahariya and Katlam (2013)<sup>[2]</sup>, Uike (2015)<sup>[15]</sup>, Meshram (2018)<sup>[7]</sup> and Netam (2019)<sup>[11]</sup>. The abundance of predators and parasitoids were recorded in limited number in the present findings. Similarly, Jaiswal *et al.* (2001)<sup>[6]</sup> reported only a few parasitoid species of lac insect and parasitoids of predators in limited numbers in Orissa.

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