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Population dynamics of associated fauna of lac insect *Kerria lacca* (Kerr.) in kusum host plant at Kanker district of Chhattisgarh

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Abstract

Population dynamics of associated fauna of lac insect *Kerria lacca* (Kerr.) in kusum host plant *kusmi* strain winter crop was conducted during 2015-16 and 2016-17 at Kanker district of Chhattisgarh. In the present studied population dynamics of various insect associated with lac insect in kusum host plant *kusmi* strain winter seasons was recorded in five blocks of Kanker district. It was indicating that the population dynamics of various insect viz. *E. amabilis* was recorded with peaked density (9.65 and 9.40/30 cm stick lac) on second fortnight of August and *P. pulverea* with peaked density (7.15 and 7.25 /30 cm stick lac) on first fortnight of September as major and *Chrysopa. sp.* was recorded as minor predators in *kusmi* strain winter seasons. Among the Parasitoids *T. tachardiae* was recorded with peaked density (6.85 and 7.15 /30 cm stick lac) as major potential parasitoids whereas *A. purpureus*, *E. tachardiae* and *Parechthrodryinus clavicarnis* was recorded as minor parasitoids and also recorded the beneficial fauna (Hyper-parasitoids) *B. tachardiae*, *Pristomerus sulci* and *B. greeni* in *kusmi* strain winter seasons.

Keywords: Population dynamics, associated fauna, lac insect *Kerria lacca* Kerr on kusum

Introduction

Lac insect secreted product is one of the most valuable gifts of the nature to mankind, only the resin secreted by a lac insect (Pal, 2009; Mohanta *et al.*, 2012) ^[11, 8]. Family of Tachardiidae consists of nine genera, while the number of species reported vary from 87 (Sharma and Ramani, 1999) ^[14], 90 (Varshney, 2009) ^[19] to 100 species (Ben-Dov and Lit, 1998) ^[1]. Two generas are found in India, whereas the nineteen species of genus is commercially industrial importance (Sharma and Ramani, 1999) ^[14]. According to Sharma *et al.*, (2006) ^[15] reported that lac insect *Kerria lacca* is belonging to order Hemiptera, family Tachardiidae. *Kerria lacca* is secreted over the body, their product of commercial value namely, resin, dye, and wax. Lac culture is not only confer the livelihood to millions of lac growing farmers, but also helps in protect huge straighten of forest and biodiversity allies with lac insect fauna. It is the multi-trophic web of fauna and flora of lac ecosystem. 22 species of lac insect predators, 30 species of primary and 45 species of secondary parasites, except several fungal pathogens, associated a rich biodiversity of this ecosystem. The natural lac complex is also maintenance by a diversity of other plant flora, micro-fauna and soil microorganisms, distinct of the predators and parasitoids allies with lac insect are species - specific (exclusive to the ecosystem) and therefore, loss of even one species of lac insect poses a menace losing many other related species. Two lac insect strains *rangeeni* and *kusmi*, former is more vulnerable (Ramani, 2010; Shah *et al.*, 2018) ^[12, 16] whereas the latter is superior (Kumar, 2002; Sharma *et al.*, 2006; Shah *et al.*, 2018) ^[5, 6, 15, 16]. *Kerria lacca* is a sap suckers and thrives well on a range of 250 host plants (Sharma *et al.*, 2006; Singh *et al.*, 2009; Pal, 2009; Mohanta *et al.*, 2012; Shah *et al.*, 2018) ^[15, 11, 8, 16]. However, it is commercially cultivated and preferred in host plant viz. palas (*Butea monosperma*), ber (*Zizyphus mauritiana*), kusum (*Schleichera oleosa*) and *Flemingia semialata* (Roonwal, 1962; Kumar *et al.*, 2002; Pal, 2009; Singh *et al.*, 2009; Mohanta *et al.*, 2014; Shah *et al.*, 2018) ^[13, 5, 6, 11, 9, 16].

The major lac parasitoids viz. *Eupelmus tachardiae* (Hymenoptera: Encyrtidae), *Tachardiaepagus tachardiae* (Hymenoptera: Encyrtidae), *Tachardiaepagus somervilli* (Hymenoptera: Eulophidae), *Choccophagus tschirchii* (Hymenoptera: Eulophidae), *Aprostocetus purpureus* (Hymenoptera: Eulophidae) was observed (Varshney, 1976; Sharma *et al.*, 2006; Jaiswal and Singh, 2013; Daharia and Katlam, 2013) ^[19, 15, 3, 2].

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Chhattisgarh is the major lac cultivated area in all over the India. Kanker is the major lac cultivated area and second largest production after Korba in Chhattisgarh. So it is necessary to identify the status of lac insect predators and parasitoid in the crops may help in devising effective management strategies to alleviate crop losses. Farmers will have an idea of specific crop growth stage at which insects emerge/attack the crops. Keeping this in view population dynamics of associated fauna of lac insect *Kerria lacca* (Kerr.) in kusum host plant *kusmi* strain winter seasons was conducted at Kanker district of Chhattisgarh.

Materials and Methods

Population dynamics of associated fauna of lac insect *Kerria lacca* (Kerr.) in kusum host plant *kusmi* strain winter seasons was conducted during 2015-16 and 2016-17 at Kanker district of Chhattisgarh. To recorded the predators and parasitoids of lac insect *K. lacca* Kerr. The untreated host plant, kusum (*Schleichera oleosa*) 4 plants was randomly selected for the survey of associated fauna of natural bio agent (predators and parasitoids) of lac insect at farmers field in kusum host plant *kusmi* strain winter seasons (*aghani*) crop from Kanker, Narharpur, Charama, Durgukondal and Bhanupratappur block of Kanker district of Chhattisgarh.

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

Results and Discussion

In the present studied population dynamics of various insect associated with lac insect in *kusmi* strain was recorded in winter seasons. It was indicate that the population dynamics of various insect viz. *E. amabilis* and *P. pulvereus* was recorded as major and *Chrysopa* sp. was recorded as minor predators. Among the Parasitoids *T. tachardiae* was recorded as major potential parasitoids whereas *A. purpureus*, *E. tachardiae* and *Parechthrodryinus clavicornis* was recorded as minor parasitoids and also recorded the beneficial fauna (Hyperparasitoids) *B. tachardiae*, *pristomerus sulci* and *B. greeni* in *Kusmi (aghani)* strain in five blocks of Kanker district of Chhattisgarh during year 2015-16 and 2016-17. (Table 1, 2 and 3).

Population dynamics on the basis of two year pooled mean population of *E. amabilis* it was active from 1st fortnight of August to 2nd fortnight of December and reached its peak population with 9.53 insect per 30 cm stick lac during 2nd fortnight of August in *Kusmi, aghani* (winter) strain,

Studies was based on pooled mean population of *P. pulvereus* was first appeared with 3.08 per 30cm stick lac in first fortnight of August, which active from 1st fortnight of August to 2nd fortnight of November. Suddenly increased with its peak mean population 7.20 per 30 cm stick lac in first fortnight of September in *Kusmi, aghani* (winter) strain, Two year pooled mean showed its peak population of lac insect predator *Chrysopa* sp. was recorded peak density with 4.10 insect per 30 cm stick lac in first fortnight of August, which active from 1st fortnight of August to 1st fortnight of November in *Kusmi, aghani* (winter) strain,

Based on the pooled mean population of lac insect parasitoid *T. tachardiae* was recorded active from 1st fortnight of September to 2nd fortnight of December. It gradually increased and reached peak mean population with 7.00 insect per 30 cm stick lac in second fortnight of October in *Kusmi, aghani* (winter) strain,

On the basis of pooled mean population of *A. purpureus* was recorded its first appearance in first fortnight of September with 0.50 insect per 30 cm stick lac, whereas the population gradually increased and reached maximum mean population 2.18 insect per 30cm in first fortnight of November in *Kusmi, aghani* (winter) strain,

Investigate based on two year pooled mean population of *E. tachardiae* in *Kusmi, aghani* (winter) strain was recorded first appearance in first fortnight of September with 0.13 insect per 30 cm stick lac. The maximum mean population with 1.20 insect per 30 cm stick lac in second fortnight of November,

Study the two year pooled mean population parasitoid *P. clavicornis* was first observed in second fortnight of August with mean population 0.13 insect per 30 cm stick lac. The highest mean population was observed in second fortnight of October with 1.48 insect per 30 cm stick lac in *Kusmi, aghani* (winter) strain,

Investigate the two years pooled mean population of hyperparasitoids *B. tachardiae* was recorded its first appearance in second fortnight of August with mean population 0.33 insect per 30 cm stick lac. Highest mean population was recorded in second fortnight of October with 1.10 insect per 30 cm stick lac *Kusmi, aghani* (winter) strain.

Two year pooled mean population of hyper-parasitoid *P. sulci* in *Kusmi, aghani* (winter) strain was recorded its first appearance in first fortnight of September with the mean 0.33 insect per 30 cm stick lac, the highest mean population was recorded during the second fortnight of October with the mean population 0.73 insect per 30 cm stick lac. The study of two year pooled mean population of *B. greeni* was noticed first appearance in the first fortnight of August with 0.40 insect per 30 cm stick lac. Which increase and reached the peak mean 2.10 insect per 30 cm stick lac in second fortnight of September in *Kusmi, aghani* (winter) strain.

Present trends was similar to Jaiswal *et al.*, (1998) [4] was reported that the lac insect beneficial parasitoids of *B. greeni*, *A. Tachardiae*, *Pristomerus sulci* and *B. Tachardiae* population to the extent of 69,60,100 and 100 per cent respectively.

According to Uike (2015) [18] The *E. amabilis* and *P. pulvereus* were recorded as key predator and *Chysopa* sp. was recorded as minor predator. Among the parasitoids *T. tachardiae* recorded as a major status in Kanker district of Chhattisgarh, and seasonal incidence of predators and parasitoids viz. *E. amabilis*, *P. pulvereus*, *chysopa* sp., *T. tachardiae*, *E. tachardiae* and *A. purpureus* in Gariaband district of Chhattisgarh. Comformity with present studies. Present studies more or less similar to Meena *et al.*, (2018) reported that during the investigation 11 species of fauna associated with *Kerria lacca* (Kerr.) from 8 families under 3 were recorded representing predator species *E. amabilis*, *P. pulvereus*, *C. zastrowi*; primary parasitoids *T. tachardiae*, *A. purpureus*, *T. clavicornis*, *E. dewitzi* and hyper-parasitoids *A. fakhruhajiae*, *E. tachardiae*, *B. greeni*, *B. tachardiae*.

Present findings are agreement with Mohansundram *et al.*, (2018) who reported that variation in lac associated fauna in relation to different lac host plant for both *rangeeni* and *kusmi* strain. Lac associated fauna viz. *T. tachardiae*, *A. purpureus*,

P. clavicornis, *E. amabilis*, *P. pupverea* and hyper parasitoids *B. greeni*, *B. tachardiae* and *Elasmus clavipennis* was observed in *katki*, *baisakhi*, *jethavi* and *aghani* crop of

different host plant viz. palas, ber, kusum, semialata and redgram.

Table 1: Population dynamics of lac insect associated fauna on Kusum host of *kusmi* strain at Kanker during 2015-16

SMW	Fortnightly interval dates	Population density of lac insect associated fauna on <i>kusmi</i> strain (Number of insect per 30 cm stick lac)									
		Predators			Parasitoids				Hyper-parasitoids		
		<i>E. amabilis</i>	<i>P. pulverea</i>	<i>Chrysoperla spp.</i>	<i>T. tachardiae</i>	<i>A. purpureus</i>	<i>E. tachardiae</i>	<i>P. clavicarnis</i>	<i>B. tachardiae</i>	<i>P. sulci</i>	<i>B. greeni</i>
33-34	15-Aug	3.55	3.15	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.45
35-36	30-Aug	9.65	6.65	3.45	0.00	0.00	0.00	0.15	0.30	0.00	1.05
37-38	15-Sept	5.20	7.15	3.35	2.85	0.65	0.10	0.65	0.75	0.40	1.30
39-40	30-Sept	4.30	2.85	3.00	4.65	0.70	0.15	1.30	0.80	0.50	2.15
41-42	15-Oct	2.40	1.35	2.95	6.65	1.10	0.40	1.45	0.80	0.60	0.55
43-44	30-Oct	1.45	0.90	1.85	6.85	1.20	0.85	1.50	1.05	0.75	0.40
45-46	15-Nov	1.30	0.55	1.35	5.00	2.25	1.25	0.75	0.70	0.45	0.30
47-48	30-Nov	1.25	0.25	0.00	2.65	0.85	0.95	0.35	0.50	0.15	0.20
49-50	15-Dec	1.10	0.00	0.00	2.10	0.00	0.65	0.10	0.00	0.00	0.00
51-52	30-Dec	0.90	0.00	0.00	1.65	0.00	0.45	0.00	0.00	0.00	0.00

Table 2: Population dynamics of lac insect associated fauna on Kusum host of *kusmi* strain at Kanker during 2016-17

SMW	Fortnightly interval dates	Population density of lac insect associated fauna on <i>kusmi</i> strain (Number of insect per 30 cm stick lac)									
		Predators			Parasitoids				Hyper-parasitoids		
		<i>E. amabilis</i>	<i>P. pulverea</i>	<i>Chrysoperla spp.</i>	<i>T. tachardiae</i>	<i>A. purpureus</i>	<i>E. tachardiae</i>	<i>P. clavicarnis</i>	<i>B. tachardiae</i>	<i>P. sulci</i>	<i>B. greeni</i>
33-34	15-Aug	3.75	3.00	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.35
35-36	30-Aug	9.40	6.85	4.20	0.00	0.00	0.00	0.10	0.35	0.00	0.85
37-38	15-Sept	5.05	7.25	3.15	3.60	0.35	0.15	0.60	0.60	0.25	1.15
39-40	30-Sept	4.00	2.90	2.80	5.25	0.65	0.20	1.20	0.80	0.35	2.05
41-42	15-Oct	2.75	1.10	2.45	6.40	0.95	0.35	1.35	0.95	0.65	0.60
43-44	30-Oct	1.70	0.95	1.55	7.15	1.05	0.55	1.45	1.15	0.70	0.55
45-46	15-Nov	1.40	0.65	1.40	2.85	2.10	0.95	0.75	0.50	0.50	0.45
47-48	30-Nov	1.25	0.35	0.00	2.25	1.15	1.45	0.40	0.35	0.30	0.25
49-50	15-Dec	1.15	0.00	0.00	1.35	0.00	0.95	0.10	0.00	0.00	0.00
51-52	30-Dec	0.80	0.00	0.00	1.15	0.00	0.75	0.00	0.00	0.00	0.00

Table 3: Pooled data population dynamics of lac insect associated fauna on Kusum host during 2015-16 & 2016-17

SMW	Fortnightly interval dates	Population density of lac insect associated fauna on <i>kusmi</i> strain (Number of insect per 30 cm stick lac)									
		Predators			Parasitoids				Hyper-parasitoids		
		<i>E. amabilis</i>	<i>P. pulverea</i>	<i>Chrysoperla spp.</i>	<i>T. tachardiae</i>	<i>A. purpureus</i>	<i>E. tachardiae</i>	<i>P. clavicarnis</i>	<i>B. tachardiae</i>	<i>P. sulci</i>	<i>B. greeni</i>
33-34	15-Aug	3.65	3.08	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.40
35-36	30-Aug	9.53	6.75	3.83	0.00	0.00	0.00	0.13	0.33	0.00	0.95
37-38	15-Sept	5.13	7.20	3.25	3.23	0.50	0.13	0.63	0.68	0.33	1.23
39-40	30-Sept	4.15	2.88	2.90	4.95	0.68	0.18	1.25	0.80	0.43	2.10
41-42	15-Oct	2.58	1.23	2.70	6.53	1.03	0.38	1.40	0.88	0.63	0.58
43-44	30-Oct	1.58	0.93	1.70	7.00	1.13	0.70	1.48	1.10	0.73	0.48
45-46	15-Nov	1.35	0.60	1.38	3.93	2.18	1.10	0.75	0.60	0.48	0.38
47-48	30-Nov	1.25	0.30	0.00	2.45	1.00	1.20	0.38	0.43	0.23	0.23
49-50	15-Dec	1.13	0.00	0.00	1.73	0.00	0.80	0.10	0.00	0.00	0.00
51-52	30-Dec	0.85	0.00	0.00	1.40	0.00	0.60	0.00	0.00	0.00	0.00

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