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Piyush Kant NetamCollege of Agriculture and
Research Station, Kanker IGKV
Chhattisgarh, India**Prmod Kumar Netam**College of Agriculture and
Research Station, Kanker IGKV
Chhattisgarh, India**PS Markam**College of Agriculture and
Research Station, Kanker IGKV
Chhattisgarh, India

Seasonal incidence of natural bio agent of lac insect *Kerria lacca* (Kerr.) in *Semialata* bushy host plant at Kanker district of Chhattisgarh

Piyush Kant Netam, Prmod Kumar Netam and PS Markam

Abstract

Seasonal incidence of associated fauna of lac insect *Kerria lacca* (Kerr.) in *Semialata* bushy host plant *kusmi* strain *aghani* winter crop was conducted during 2015-16 and 2016-17 at Kanker district of Chhattisgarh. In the present studied seasonal incidence of various insect associated with lac insect in *Semialata* bushy host plant *kusmi* strain *aghani* winter seasons was recorded in five blocks of Kanker district. It was indicating that the incidence of various insect viz. *E. amabilis* was recorded with peaked density (8.90 and 8.80/30 cm stick lac) on second fortnight of August and *P. pulverea* with peaked density (6.15 and 6.50 /30 cm stick lac) on first fortnight of September as major and *Chrysopa. sp.* was recorded as minor predators in *Semialata* bushy host plant *kusmi* strain winter seasons. Among the Parasitoids *T. tachardiae* was recorded with peaked density (7.80 and 8.15 /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 *Semialata* bushy host plant *kusmi* strain *aghani* winter crop.

Keywords: Seasonal incidence, associated fauna, lac insect *Kerria lacca* Kerr on *Semialata* bushy host plant

Introduction

Semialata is most suitable for winter season *kusmi* lac cultivation. However, there is few limiting factor. It is a leguminous plant and prefers drained soil and partially sloppy land. Plantation of *Semialata* can be raised within a year and lac cultivation can be started from second year of plantation rising. *Flemingia semialata* has shown great promise for lac production due to its fast growth, tender shoots and suitability for intensive lac cultivation and is a boon to particularly those farmers who do not have lac host trees but are interested in lac cultivation. Singh *et al.*, (2015) ^[1] investigate the profitability of lac production on *F. semialata* in *aghani* (winter) season. The brood lac ratio ranged from 1:3.8 at Bocaro (Jharkhand) to 1:9 at Patna (Bihar) with average brood lac yield ratio of 1:5.5 in *semialata* host plant. Lac is a cash crop of commercial importance providing an importance source of livelihood to millions of resource poor grower inhabiting tribal dominated forests and sub-forests regions of the country. The agricultural production continues to be constrained by a variety of biotic (e.g., pathogens, insects and weeds) and abiotic (e.g., drought, salinity, cold, frost and water-logging) factor that can significantly reduce the quantity and quality of crop production (Wang *et al.*, 2013). Lac cultivation has a potential for generating employment for both men and women. Lac cultivation is being carried by all types of farmer's *i.e.* marginal, small farmers and big farmers (Pal, 2009) ^[9]. Lac cultivation was studies mainly on palas and ber *rangeeni* strain and kusum *kusmi* strain of host plants. Recently a new species of *F.semialata* has been introduced as a bushy lac host plant by limited lac growers in Chhattisgarh Lakra (2005) ^[4]

Jaiswal *et al.*, (1998) ^[3] revealed that the lac insect *Kerria lacca* (Kerr.) associated predators and parasitoids under storage condition. Lac insect predator, *P. Pulverea* parasitoids *A. purpureus* and *Eupelmus tachardiae* predator's parasitoids, *Pristomerus sulci* and to small expand *A. tachardiae* were notice after eight months of storage, whereas predator, *E.amabilis* parasitoids, *T. tachardiae*, *Coccophagus tschirchii*, *Parechthrodryinus clavicarnis* and predator's parasitoids, *Bracon greeni* and *Elasmus claripennis* was initially present during harvested the lac, but not observed during stored condition.

Corresponding Author:**Piyush Kant Netam**College of Agriculture and
Research Station, Kanker IGKV
Chhattisgarh, India

The major lac parasitoids viz. *Eupelmus tachardiae* (Hymenoptera: Encyrtidae), *Tachardiaephagus tachardiae* (Hymenoptera: Encyrtidae), *Tachardiaephagus somervilli* (Hymenoptera: Eulophidae), *Choccephagus tschirchii* (Hymenoptera: Eulophidae), *Aprostocetus purpureus* (Hymenoptera: Eulophidae) was observed (Varshney, 1976; Sharma *et al.*, 2006; Jaiswal and Singh, 2013; Daharia and Katlam, 2013) [14, 10, 2, 1].

Studied was carried out at Korba District of Chhattisgarh during year 2014-15 and 2015-16. Predators allies with lac insect *Kerria lacca* (Kerr.) namely *Eublemma amabilis* and *Pseudohypatopa pulvereae* were recorded as potential predators of lac with 9.30 and 10.10 insect/30 cm lac sticks, whereas the incidence of *Chrysopa sp.* as minor and *T. tachardiae* was noticed a potential parasitoid with 9.60 and 9.80 insect/30 cm lac sticks but in case of *A. purpureus* and *Eupelmus tachardiae* were noticed as minor parasitoid of *rangeeni* lac. The hyper-parasitoids viz. *B. greeni*, *Apanteles fakhruhajiae*, *Apanteles sp.* and *Apanteles tachardiae* were noticed as minor with 1.30, 0.20, 0.90 and 0.90 insect/ 30 cm lac sticks respectively on *rangeeni baisakhi* (Summer) crop. Meshram *et al.*, (2017) [6].

In Kanker district Chhattisgarh forest division during the survey *E. amabilis*, *P. pulvereae*, *H. pulvereae* and *Chrysopa sp.* was recorded as major predators and *E. scitula*, *Pyroperces falcatella* and *Ephestica sp.* as minor predator of lac insect. Soni *et al.*, (2013) [12].

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 identified lac insect predators and parasitoid and takes precaution for management of lac insect fauna. Keeping this in view seasonal incidence of associated fauna of lac insect *Kerria lacca* (Kerr.) in *Semialata* bushy host plant *kusmi* strain winter seasons was conducted at Kanker district of Chhattisgarh.

Materials and Methods

Seasonal incidence of associated fauna of lac insect *Kerria lacca* (Kerr.) in *Semialata* bushy host plant *kusmi* strain *aghani* winter crop 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, *Semialata (Flemingia semialata)* 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 *Semialata* bushy 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 seasonal incidence of various insect associated with lac insect in *Semialata* bushy host plant *kusmi* strain was recorded in winter seasons. It was indicate that the

population dynamics of various insect viz. *E. amabilis* and *P. pulvereae* 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 *Parechthrodyrinus clavicornis* was recorded as minor parasitoids and also recorded the beneficial fauna (Hyperparasitoids) *B. tachardiae*, *pristomerus sulci* and *B. greeni* in *Semialata* bushy host plant *Kusmi (aghani)* strain in five blocks of Kanker district of Chhattisgarh during year 2015-16 and 2016-17. (Table 1, 2 and 3).

Seasonal incidence 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 8.85 insect per 30 cm stick lac during 2nd fortnight of August in *Semialata* bushy host plant *Kusmi, aghani* (winter) strain,

Studies was based on pooled mean population of *P. pulvereae* was first appeared with 2.93 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 6.33 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 4.23 insect per 30 cm stick lac in first fortnight of August, which active from 1st fortnight of August to 1st fortnight of November in *Semialata* bushy host plant *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 7.98 insect per 30 cm stick lac in second fortnight of October in *Semialata* bushy host plant *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 0.48 insect per 30 cm stick lac, whereas the population gradually increased and reached maximum mean population 3.63 insect per 30cm in first fortnight of November in *Semialata* bushy host plant *Kusmi, aghani* (winter) strain,

Investigate based on two year pooled mean population of *E. tachardiae* in *Semialata* bushy host plant *Kusmi, aghani* (winter) strain was recorded first appearance in first fortnight of September with 0.10 insect per 30 cm stick lac. The maximum mean population with 1.50 insect per 30 cm stick lac in first fortnight of December,

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 1.30 insect per 30 cm stick lac in *Semialata* bushy host plant *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 0.23 insect per 30 cm stick lac. Highest mean population was recorded in second fortnight of October with 1.13 insect per 30 cm stick lac *Semialata* bushy host plant *Kusmi, aghani* (winter) strain.

Two year pooled mean population of hyper-parasitoid *P. sulci* in *Semialata* bushy host plant *Kusmi, aghani* (winter) strain was recorded its first appearance in first fortnight of September with the mean 0.30 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 0.33 insect per 30 cm stick lac. Which increase and reached the peak mean 1.83 insect per 30 cm stick lac in second fortnight of September in *Semialata* bushy host plant *Kusmi*, *aghani* (winter) strain.

Present trends was similar to Jaiswal *et al.*, (1998) [3] was reported that the lac insect beneficial parasitoids of *B. greeni*, *A. Tachardiae*, *Pristomerus sucli* and *B. Tachardiae* population to the extent of 69,60,100 and 100 percent.

According to Uike (2015) [13] The *E. amabilis* and *P. pulverea* 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. pulverea*, *chysopa sp.*, *T. tachardiae*, *E. tachardiae* and *A. purpureus* in Gariaband district of Chhattisgarh. Conformity with present studies. Present studies more or less similar to Meena *et al.*, (2018) [5] 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. pulverea*, *C. zastrowi*; primary parasitoids *T. tachardiae*, *A. purpureus*, *T. clavicornis*, *E. dewitzi* and hyper-parasitoids *A. fakhrulhajiae*, *E. tachardiae*, *B. greeni*, *B. tachardiae*.

Mohansundram *et al.*, (2018) [8] revealed that the variations of lac insect associated predators and parasitoids on different

host plants for both *kusmi* and *rangeeni* strains, during year 2012-2015., *T. tachardiae* and *A.purpureus* population was 14.7 and 62.7. respectively and maximum in ber 50.2, during *katki* crop. While during *baisakhi* crop *rangeeni* strain these two associated fauna 4.3 and 11.9, respectively. Parasitisation recorded was significantly higher 9.5 on palas followed by ber and red gram, is one of the major reasons of lac insect mortality at sexual maturity period during *baisakhi* crop. During *jethwi* crop of *kusmi* strain, *T. tachardiae* and *E. amabilis* population maximum 12.5 and 8.6, respectively. Maximum population of *A. purpureus* was recorded in 10.6 on ber followed by kusum. Population of *T. tachardiae* and *A. purpureus* were recorded maximum in 17.0 and 20.0, respectively. Among the three host plants (ber, semialata and kusum), *T.tachardiae* (3.3), *A. purpureus* (12.6) and *E. amabilis* were recorded more on semialata during *aghani* crop.

Meshram (2018) [7] reported that the natural enemies viz. predators, parasitoids and hyper-parasitoids were recorded from 1st fortnight of July to 1st fortnight of January during the year 2014-15 and 2015-16. *E. amabilis* and *P. pulverea* were recorded as key predators of lac from five blocks of Korba district throughout the crop period. The incidence of *Chrysopa sp.* was noticed as minor. *T. tachardiae* was noticed as a potential parasitoid but *A. purpureus* and *E. tachardiae* were noticed as minor parasitoids of *kusmi* lac. The hyper-parasitoids viz. *B. greeni*, *A. fakhrulhajiae*, *Apanteles sp.* and *A. tachardiae* were noticed as of minor status.

Table 1: Seasonal incidence of lac insect associated fauna on *Semialata* 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. clavicornis</i>	<i>B. tachardiae</i>	<i>P. sulci</i>	<i>B. greeni</i>
33-34	15-Aug	3.70	2.90	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.20
35-36	30-Aug	8.90	5.75	3.65	0.00	0.00	0.00	0.10	0.25	0.00	0.95
37-38	15-Sept	4.20	6.15	3.25	1.85	0.35	0.10	0.55	0.65	0.25	1.10
39-40	30-Sept	3.20	2.85	3.10	3.55	0.70	0.20	1.20	0.70	0.40	1.90
41-42	15-Oct	3.00	2.55	3.00	6.45	0.95	0.25	1.25	1.05	0.50	0.80
43-44	30-Oct	2.85	1.10	2.35	7.80	2.10	0.30	1.30	1.10	0.75	0.55
45-46	15-Nov	2.20	0.95	1.85	4.70	3.25	0.55	0.75	0.70	0.35	0.35
47-48	30-Nov	1.70	0.35	0.00	2.55	1.25	1.05	0.35	0.45	0.25	0.30
49-50	15-Dec	1.40	0.00	0.00	1.90	0.00	1.55	0.10	0.00	0.00	0.00
51-52	30-Dec	0.80	0.00	0.00	1.35	0.00	0.95	0.00	0.00	0.00	0.00

Table 2: Seasonal incidence of lac insect associated fauna on *Semialata* 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. clavicornis</i>	<i>B. tachardiae</i>	<i>P. sulci</i>	<i>B. greeni</i>
33-34	15-Aug	3.35	2.95	4.65	0.00	0.00	0.00	0.00	0.00	0.00	0.45
35-36	30-Aug	8.80	5.80	3.60	0.00	0.00	0.00	0.15	0.20	0.00	1.15
37-38	15-Sept	3.85	6.50	3.35	2.25	0.60	0.10	0.80	0.75	0.35	1.30
39-40	30-Sept	3.00	2.90	2.80	3.65	0.75	0.20	1.10	0.85	0.50	1.75
41-42	15-Oct	2.75	2.60	2.40	6.55	0.85	0.25	1.20	1.00	0.55	0.70
43-44	30-Oct	2.30	1.75	1.95	8.15	1.90	0.35	1.30	1.15	0.70	0.55
45-46	15-Nov	2.20	0.70	1.35	5.15	4.00	0.45	0.95	0.65	0.50	0.25
47-48	30-Nov	2.00	0.50	0.00	2.80	1.20	1.00	0.40	0.40	0.20	0.15
49-50	15-Dec	1.95	0.00	0.00	2.35	0.00	1.45	0.20	0.00	0.00	0.00
51-52	30-Dec	1.35	0.00	0.00	1.75	0.00	1.35	0.10	0.00	0.00	0.00

Table 3: Pooled data seasonal incidence of lac insect associated fauna on *Semialata* 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. clavicornis</i>	<i>B. tachardiae</i>	<i>P. sulci</i>	<i>B. greeni</i>
33-34	15-Aug	3.53	2.93	4.23	0.00	0.00	0.00	0.00	0.00	0.00	0.33
35-36	30-Aug	8.85	5.78	3.63	0.00	0.00	0.00	0.13	0.23	0.00	1.05
37-38	15-Sept	4.03	6.33	3.30	2.05	0.48	0.10	0.68	0.70	0.30	1.20
39-40	30-Sept	3.10	2.88	2.95	3.60	0.73	0.20	1.15	0.78	0.45	1.83
41-42	15-Oct	2.88	2.58	2.70	6.50	0.90	0.25	1.23	1.03	0.53	0.75
43-44	30-Oct	2.58	1.43	2.15	7.98	2.00	0.33	1.30	1.13	0.73	0.55
45-46	15-Nov	2.20	0.83	1.60	4.93	3.63	0.50	0.85	0.68	0.43	0.30
47-48	30-Nov	1.85	0.43	0.00	2.68	1.23	1.03	0.38	0.43	0.23	0.23
49-50	15-Dec	1.68	0.00	0.00	2.13	0.00	1.50	0.15	0.00	0.00	0.00
51-52	30-Dec	1.08	0.00	0.00	1.55	0.00	1.15	0.05	0.00	0.00	0.00

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