



Green lacewing (*Chrysoperla zastrowi arabica*) incidence on Indian lac insect (*Kerria lacca*)*

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Lac is a resinous secretion of commercial importance derived from Indian lac insect, [*Kerria lacca* (Kerr)] (Homoptera: Tachardiidae) and related species and is the only natural resin of insect origin. The specific host plants of lac insects such as; *Schleichera oleosa* (*kusum*), *Butea monosperma* (*palas*), *Zizyphus mauritiana* (*ber*) and *Flemingia semialata* are being exploited for commercial lac production in India. Due to strength and excellent bonding properties as well as non-toxicity of lac, it is being used in wide range of industrial products including varnishes and polishes, pharmaceuticals, confectionery, adhesives, printing inks, electrical, leather and wood finishing and for fruit and vegetable coating. Global awareness on use of eco-friendly and safe natural materials of human contact and consumption has increased the demand of lac and open a new avenue of tremendous export potential. India is a world leader in lac production, processing and export. The other lac producing countries are Indonesia, Thailand, China, Myanmar and Vietnam. The average losses due to insect pests in lac culture are known to be far greater than what is usually witnessed in other agricultural crops. Among the predators, two lepidopteran predators, *Eublemma amabilis* Moore (Lepidoptera: Noctuidae) and *Pseudohypatopa pulvereana* Meyr (Lepidoptera: Blastobasidae) and neuropteran predators, *Chrysopa lacciperda* Kimmins and *C. madestes* Banks (Chrysopidae: Neuroptera) are the most prevalent predators in lac ecosystem.

The loss caused to lac crop by the insect predators amounts to 35-40% annually (Jaiswal *et al.* 2008). The lac insect during its life cycle spends only few hours of active mobility and thereafter spends a complete sedentary life hence they are prone to be attacked by a horde of natural

enemies like predators and parasitoids. The present study is a first record of *Chrysoperla zastrowi arabica* as a new predator of *K. lacca*, which adds to the further cause of concern. Some observations on predation potential of *C. zastrowi arabica* on lac insect are reported in this contribution.

Summer season (*jethwi*) *kusmi* lac crop was raised on about 400 *Schleichera oleosa* (*kusum*) trees by inoculating the broodlac during the month of February 2010 at the Research Farm of Indian Institute of Natural Resins and Gums (IINRG), Ranchi, India. Emergence of lac insect from broodlac was normally completed within three weeks of crop inoculation. Lac insect just after settlement, starts secreting resin over its body as a protective covering. The most critical stage of the predatory insect activity, *i.e.* peak period of its egg laying and hatching as well as incidence of lac insect predators coincides with 30–35 days of crop inoculation. After the settlement of lac insect on tender twigs of *kusum* trees, a heavy incidence of *Chrysopids* was observed on *kusmi* lac crop in the month of March 2010. Subsequently to save the lac crop, spraying of recommended insecticide, ethofenprox 10%EC (0.02%) was carried out on lac bearing *kusum* plantation. Due to knock down effect of the insecticide, a large number of *Chrysopid* adults fall on the ground which appeared to be morphologically different from earlier reported species of *Chrysopa*, viz *C. madestes* and *C. lacciperda* in lac eco-system. The adult chrysopids falling due to insecticidal knockdown effect were collected and counted to assess the infestation level and were brought to the laboratory for identification. Simultaneously, the second and third instar larvae of *Chrysopids* were collected from unsprayed lac bearing *kusum* trees to study the feeding propensity of the larva. The larva was kept in transparent plastic jar (15 cm diameter × 20 cm height) and allowed to feed individually on lac insect bearing tender twigs of *kusum* trees. The jars were capped with muslin cloth to facilitate aeration. The number of lac insects consumed by second and third instar larvae was recorded after 24 hrs till spinning of the cocoon. The field collected and laboratory emerged adult samples were

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sent to the Insect Identification Services of Indian Agricultural Research Institute, New Delhi, India for identification.

The common green lacewing, *Chrysoperla carnea* (Stephens) which has been widely used in India as a potential biocontrol agent in augmentative biological control programme against soft bodied arthropod pests in different agro-ecosystems, was considered a single Holarctic species. In most of the published work from the Indian subcontinent, unidentified sibling species of the *carnea* group from various crops have been widely reported under the name *C. carnea* sensu lato, though the true *C. carnea* does not occur in India (Duelli 2001). The Indian species of *Chrysoperla* (*carnea*-group) have not been systematically studied and characterized so far using modern techniques until studies of Henry *et al.* (2006). This was based on morphological and bio-acoustic characters revealed that the most commonly prevalent species of *Chrysoperla* (*carnea*-group) in peninsular India is *C. zastrowi arabica* Henry *et al.* Later, Venkatesan *et al.* (2008) also studied the acoustic profile of the mating song of *C. carnea* group and confirmed that it belongs to *C. zastrowi arabica* Henry *et al.* (2006). The chrysopids collected from lac ecosystem belonged to one species as *Chrysoperla zastrowi arabica* Henry *et al.* (Fig 1) which was not observed and reported earlier in lac eco-system.

The first instar larvae of *C. zastrowi arabica* were found to attack *kusmi* lac culture soon after settlement of lac insect on tender shoots of *S. oleosa* trees which correspond to 25-30 days after inoculation for winter lac crop, sometimes in August-September and 30-35 days for summer lac crop, sometimes in March-April. During the month of March, all the stages namely egg, larva and adult of *C. zastrowi arabica*

were recorded on lac bearing *kusum* plantation. The incidence of *C. zastrowi arabica* was observed on almost all the *kusum* trees on which *kusmi* lac crop was raised. The average population of adults collected from the ground after the spraying of insecticide was recorded to the tune of 150-200 adults/tree. The lacewing larvae are a surface feeder and move over the surface of the lac encrustation and suck the body fluids from different stages of lac insect with the help of large pincers. In fact this genus has evolved the habit of laying eggs at the top of silken stalks, where they are presumed to be out of reach of their own larvae and other predators. The females lay stalked eggs either on the lac encrustation or any part/substrate of the host trees (Fig. 2). The eggs are light green in colour at the initial stage and become brownish at the time of hatching. The larvae emerge out of the egg shell with the aid of an 'egg buster' climb down the stalk and start feeding immediately on the lac insect by inserting its proboscis. The larva passes through three instars and conceals its body under a covering of wax filaments. Second instar larva consumed about 160-195 lac insect to become third instar larva, whereas, third instar larva consumed about 425-485 lac insect before pupation. The larval periods were 5-7 and 6-9 days for second and third instar larvae, respectively. The larva pupates outside the lac encrustation in silken cocoon which last for a week. Adults are mainly nocturnal in habit and probably feed on honeydew secreted by lac insect, whereas, neuropteran larvae are specialized predators having unique, highly evolved mouthparts for predation. Care should be taken while augmenting this genus as a biocontrol agent against soft bodied insects of agriculture crops in lac producing tracts of the country. At the same time it will open a new window for mass culturing of this chrysopids on *K. lacca* for augmentative release against soft bodied insect pests. Lac culture could also be used as a reservoir for conservation of *C. zastrowi arabica* for other field crops in



Fig 1 Adult of *Chrysoperla zastrowi arabica*



Fig 2 Eggs of *Chrysoperla zastrowi arabica* on twigs of *kusum* tree

non traditional lac growing belts.

Mehra (1965) studied the biology of *C. madestes* and reported that the first, second and third instar larvae of *C. madestes* can consume 20, 24 and 74 mature females of lac insect per day, respectively. Mehra (1966) while studying the bionomics of *C. madestes*, observed another species of neuropteran predator on lac crop, which was identified as *C. lacciperda* and reported the average durations of first, second and third instars as 3.8, 3.2 and 7.3 days, respectively. The life history of *Chrysopa zastrowi* have been studied by Barnes (1975) and reported that the cannibalistic larvae are voracious feeders, especially during the final instar, consuming an average of nearly 500 and over 900 wheat aphids or potato tuber moth eggs, respectively during the larval stage. In India, publications on the common green lacewings in agricultural croplands have used a variety of different names, including *C. carnea* (later *Chrysoperla carnea*), *C. scelestes* and *Brinckochrysa scelestes* (Duelli 2001). The National Centre for Integrated Pest Management at Bangalore, India, issued a list of all chrysopid species known from India and suspected that all the species might be synonyms of a single species, *Chrysoperla sillemi* (Esben-Petersen). Consequently, it was believed that no other *Chrysoperla* species other than *C. sillemi* known from India until the findings of Henry *et al.* (2010). Recently, He reported that the most important lacewing species in Indian agricultural crops, *C. sillemi* (Esben-Petersen), is a subspecies of *C. zastrowi* (Esben-Petersen) (Neuroptera: Chrysopidae).

To the best of our knowledge and literature available, this is the first record of *C. zastrowi arabica* Henry *et al.* incidence on *K. lacca* in lac eco-system from India and elsewhere.

SUMMARY

Lac cultivation plays an important role in ecological balance, environmental sustainability, food security and socio-economic condition of forest and sub-forest dwellers of Asian regions. Chrysopids are one of the major predators of *K. lacca* and a key limiting factor in attaining the potential productivity of lac crop. Earlier only two species of Chrysopids viz., *Chrysopa madestes* Banks and *Chrysopa lacciperda* Kimmins were reported in lac production system. The incidence of *Chrysoperla zastrowi arabica* (Neuroptera: Chrysopidae) was recorded for the first time on *K. lacca* in March 2010 (Henry *et al.* 2010). The first instar larvae of *C. zastrowi arabica* were found to attack *kusmi* lac culture soon

after settlement of lac insect on tender shoots of *S. oleosa* host trees. About 150-200 adults of *C. zastrowi arabica* per *kusum* tree were recorded on summer season *kusmi* lac crop. The predation potential of this pest was very high with the larva feeding on 160-195 and 425-485 lac insects during second and third instar stages, respectively before pupation.

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