

**Bio control:: Mass production::Predators****Mass production of *Chrysoperla carnea*****Introduction**

In India, 65 species of chrysopids belonging to 21 genera have been recorded from various crop ecosystems. Some species are distributed widely and are important natural enemies for aphids and other soft bodied insects. Amongst them, *Chrysoperla carnea* is the most common. It has been used in cotton ecosystem for protection from aphids and other soft bodied insects. *C. carnea* is now used extensively all over the country.

Morphology and Biology

The eggs are stalked and green in colour. The length of the egg in various species ranges between 0.7 to 2.3 mm and that of the stalk between 2 to 26 mm. The eggs are laid singly or in clusters. Eggs turn pale whitish and then black before hatching. Egg period lasts 3-4 days. The larva is white in colour on hatching. The larva has 3 instars which are completed in 8-10 days. The larva spins a cocoon from which the adult emerges in 5-7 days. Adults on emergence mate repeatedly. Generally, pre-oviposition period lasts for 3-7 days. Adult females start laying eggs from 5th day onwards and peak egg-laying period is between 9-23 days after emergence. The male longevity is 30-35 days and female can even live up to 60 days. Fecundity is 600-800 eggs/female. The sex ratio Male: Female is 1: 0.85. The adult males and females live 41 and 53 days, respectively.

Production procedure

In mass production, the adults are fed on various types of diets. The larvae are either reared in plastic tubes or empty injection vials or in groups in large containers or in individual cells. The adults are collected daily and transferred to pneumatic glass troughs or G.I. round troughs (30 cm x 12 cm). Before allowing the adults, the rearing troughs are wrapped inside with brown sheet which act as egg receiving card. About 250 adults (60% females) are allowed into each trough and covered with white nylon or georgette cloth secured by rubber band. On the cloth outside three bits of foam sponge (2 sq.in) dripped in water is kept. Besides an artificial protein rich diet is provided in semisolid paste form in three spots on the cloth outside. This diet consists of one part of yeast, fructose, honey, Proteinex R and water in the ratio 1:1:1:1. The adults lay eggs on the brown sheet. The adults are collected daily and allowed into fresh rearing troughs with fresh food. From the old troughs, the brown paper sheets along with *Chrysopa* eggs are removed.

*Chrysoperla* eggs*Chrysoperla* nymphs**Storage and destalking of eggs**

The brown paper sheet kept inside the adult rearing troughs contain large number of eggs each laid on a stalk or pedicel. As such the sheets are stored at 10°C in B.O.D. incubator or refrigerator for about 21 days. When the eggs are required for culturing or for field release the egg sheets are kept at room temperature for a day and the eggs during this period turn brown and hatch on 3 days later. The first larvae are either taken for culture or for recycling or for field release.

Group rearing of grubs

It is done in GI round basins (28 cm dia) @ 250 larvae/basin, covered with *khada* cloth. The eggs of *Corcyraephalonica* is given as feeding material for the larvae in the laboratory. For rearing 500 *Chrysopa* larvae the total quantity of *Corcyra* eggs required is 22 cc @ 5 cc/feeding for five feedings in alternate days. The *Chrysopa* larvae pupate into round white coloured silken cocoons in 10 days. The cocoons are collected with fine brush and transferred into 1 lit plastic containers with wire mesh window for emergence of adults. From the cocoons, pale green coloured adults with transparent lace like wings emerge in 9-10 days.

Individual rearing of grubs

In the first step of larval rearing, 120 three day old chrysopid eggs are mixed with 0.75 ml of *Corcyra* eggs (the embryo of *Corcyra* eggs are inactivated by keeping them at 2 feet distance from 15 watt ultraviolet tube light for 45 minutes) in a plastic container (27x18x6 cms). On hatching, the larvae start feeding. On 3rd day the larvae are transferred to 2.5 cm cubical cells of plastic louvers @ one per cell. Each louver can hold 192 larvae. *Corcyra* eggs are provided in all the cells of each louver by sprinkling through the modified salt shaker. Feeding is provided in two doses. First feeding of 1.5 ml *Corcyra* eggs for 100 larvae and second feeding of 2 ml for 100 larvae with a gap of 3-4 days is done. Total quantity of *Corcyra* eggs required for rearing 100 chrysopid larvae is 4.25 ml. The louvers are secured on one side by orgami or brown paper sheet and after transfer of larvae covered with acrylic sheet and clamped. Orgami or brown paper is used for facilitating pupation and clear visibility of eggs. The louvers are stacked in racks. One 2m x 1m x 45 cms angle iron rack can hold 100 louvers containing 19,200 larvae. Cocoons are collected after 24 hours of formation (when they get hardened) by removing orgami or paper from one side. The cocoons are placed in adult oviposition cages for emergence (Adults are sometimes allowed to emerge in louvers and released on glass window panes from where they are collected using suction pumps).