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Mass Production of *Chrysopids* (*Chrysopidae*: *Neuroptera*)

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SUMMARY

Chrysopids, or lacewings (Chrysopidae: Neuroptera), are important aphid predators in agricultural and horticultural systems, particularly in the northern hemisphere. Initially thought to be a single species due to their morphological similarity, lacewings have been identified as a complex of cryptic species with distinct courtship songs that maintain reproductive isolation. Chrysopid larvae, commonly known as aphid lions, are crucial for pest management, preying on various agricultural pests, while adults primarily consume nectar, pollen, and aphid honeydew. The use of chrysopids as biocontrol agents offers an eco-friendly alternative to hazardous pesticides, potentially improving crop yield and quality.

INTRODUCTION

Chrysopids (Chrysopidae: Neuroptera), commonly known as lacewings, occur in the northern hemisphere's agricultural and horticultural zones. As most of them are morphologically indistinguishable from each other, they were originally considered to be a single species with a holarctic distribution. However, these have now been identified as a complex of many cryptic, sibling species (Henry et al., 2015). While morphologically indistinct, lacewings possess highly species-specific songs (Henry et al., 2015) that they use to communicate with each other, especially during courtship, which helps in maintaining effective reproductive isolation. Chrysopids are regarded as important aphid predators of several agricultural and horticultural crops, such as cotton crops in Russia and Egypt, sugar beet in Germany, and vineyards in Europe. The Chrysopid larvae are of primary importance in pest management, particularly aphids. They are active predators of a wide variety of pests, including aphids, chinch bugs, mealybugs, scales, whiteflies, leafhoppers, lepidopterous eggs and larvae, and mites (Hydorn, 1971). Lacewing larvae are also known as aphid lions due to their predatory nature. Adults, on the other hand, largely feed on nectar, pollen, and aphid honeydew. Lacewings are considered potential biocontrol agents and possible eco-friendly alternatives to hazardous pesticides used in pest management (Mansoor et al., 2013). While the known hazardous effects of pesticides on human and environmental well-being may be mitigated by the use of natural enemies, further benefits, such as improvement of crop yield and quality, may also be achieved. While the basic characteristics of chrysopid biology have been well documented (McEwen et al., 2007), it is our aim here to outline specifically how chrysopids can be harnessed in the biocontrol of pests and the means of effectively achieving it.

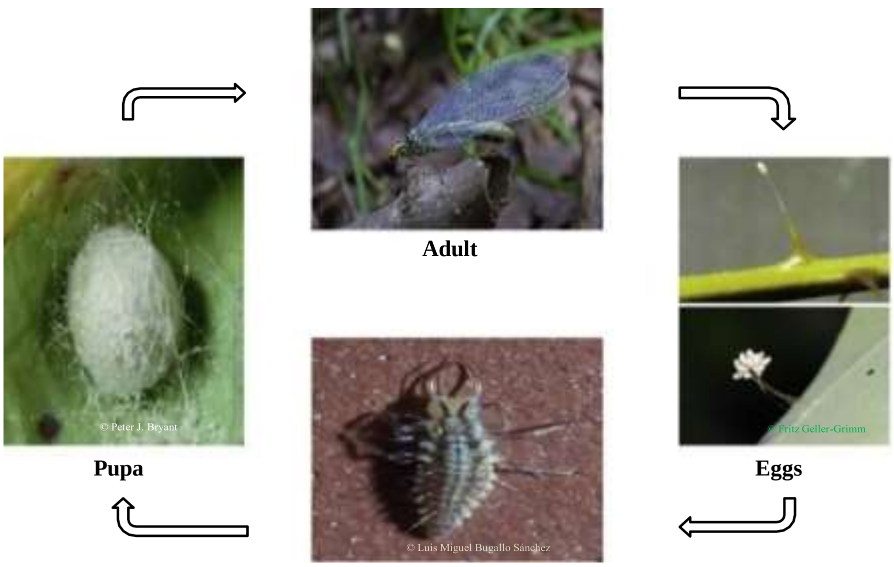

Fig. 1: Life cycle of a *chrysopid.*

Rearing Techniques

Rearing of larvae is most costly in mass-production of *Chrysoperla* largely because all three instars are predaceous. Most of the insectaries depend on mass-produced insect prey as food, which is relatively expensive compared with artificial diets. Mass-rearing of insects, especially the cannibals, is both space-demanding and labor-intensive. Space-efficient, automated mass-rearing systems for *Chrysoperla* are the need of the hour. Compact holding units for adults, with mechanical devices for feeding adults and larvae and harvesting eggs, as well as automated systems for packaging are much required and would make production of these bioagents very cost-effective while greatly enhancing production. This requires the getting together of engineers as well as biologists. In the traditional and conventional methods of rearing, 200 pairs of adults are kept in oviposition units measuring 75 × 30 cm, with sides lined by nylon wire mesh. The sliding top cover is slid over a comb and is fitted with a black cloth as a substrate for oviposition. The sliding top cover is replaced everyday starting from the fourth day. In the meantime, adults are provided daily with cotton swabs dipped in water, 50% honey, castor pollen, and equal quantities of protinex, fructose, honey, and powdered yeast dissolved and mixed together in little water. One day after laying, the eggs are removed by gently working with sponge and then stored for future use at low temperature (Anonymous, 1995). In larval rearing, 120 three-day-old eggs of chrysopids are mixed with 0.75 ml of *Corcyra* eggs, to provide instant nutrition to the neonates. Three-day-old larvae are then transferred to 2.5 cm cubical cells of plastic louvers, with each louver capable of holding 192 larvae. Total quantity of *Corcyra* eggs required for rearing 100 chrysopid larvae is 4.25 ml. The louvers are secured on one side by organdy or brown paper to facilitate pupation. These louvers are stacked in racks. A single 2 × 1 × 0.45 m angle iron rack can hold 100 louvers containing 19,200 larvae (TNAU Agritech Portal, 2013).

Newer and less space-consuming units are being developed worldwide. Two cylindrical and cubical adult feeding and oviposition units for *Chrysoperla* have been developed that contain 5.4 and 9.3 times internal surface area (with higher internal surface: volume, ratios) of the traditional 11.30 l cardboard units. These new units can hold 2500 and 4500 adults, respec- tively, compared with 500 adults in traditional units. Harvesting of eggs from both new units involves the use of a sodium hypochlorite-based egg harvest procedure which takes only 1 min/unit and yields stalk-free eggs. A cylindrical adult feeding and oviposition unit (AFOU) unit has been developed to ease the rearing of chrysopids. This can be unrolled to facilitate egg harvesting with a new harvest system, the hot wire system. The hot wire egg harvesting system consists of two devices with a pneumatic cylinder to pull the cylinder portion of the AFOU past the hot wire, which is used to harvest eggs from the top of the AFOU. This improved system requires less manual labor. Egg recovery was found to be higher with a hot wire egg harvesting system than with the traditional loose ball of nylon netting. The hot wire method did not affect the hatching percent of the recovered eggs. An even more compact method of mass-production is the Biosec Bioassay tray. Each tray (44 × 21 cm) comprises eight blocks, each block containing 16 wells; thus each tray has a total of 128 wells. The dimension of each well is 2 × 1.5 cm. The eggs of *C. carnea* are transferred along with 0.045 cc *Corcyra* eggs. The Pull-N-Peel tab is pulled firmly over the wells and the trays stacked one over the other. It takes 12–16 days for the adults to emerge. The recovery is approximately 95%. These trays give better adult recovery, prevent the larvae from escap-ing, occupy less space, and are also relatively cheaper. This method is being tried out at the National Bureau of Agricultural Insect Resources, Bangalore, India. Glass cages have been found to be better for rearing than Perspex and wooden cages (Sattar and Abro, 2011). The filler material used in the units and the degree of filling also influence the development of chrysopids. The percentage pupation is significantly higher in most of the filler materials when used at 75% of the container's capacity. Maximum pupation (88%) is obtained in larvae reared in wood shavings and was at par with those reared in injection vials (93%) and plastic louvers (91%). Pupal weight was highest when larvae were reared in dried plant leaves; how- ever, it was on a par with those reared in injection vials (9.53 mg/pupa) and plastic louvers (9.37 mg/pupa). Thermocol pieces and plastic chips when used as filler material resulted in low pupal weight (Mahabaleshwar and Kulkarni, 2000).

CONCLUSION

Based on the above information, it is safe to conclude that Chrysopids are quite effective biocontrol agents for number of insect pests. Also the advancement of techniques for their mass-production, storage, and release make them easily available for use in effective pest management. These tiny insects are especially strong predators of aphids and can be used much more effectively against them. Lots of pest management successes have been achieved with chrysopids but still there are major lacunae in landscape management studies as a means of further improving the efficacy. This will be especially important because the major problem in chrysopid use is to keep the adults in the desired area. More work on landscape management will make biocontrol of pests easier and the chrysopids more effective.

REFERENCES

Anonymous, 1995. Technology for the production of natural enemies. In: Singh, S.P. (Ed.), Technical Bulletin No. 4. ICAR. Anonymous, 2002a. Lacewing Little Helpers.

Henry, C.S., Brooks, S.J., Johnson, J.B., Haruyama, N., Duelli, P., Mochizuki, A., 2015. A new East–Asian species in the *Chrysoperla carnea* group of cryptic lacewing species (Neuroptera: Chrysopidae) based on distinct larval morphology and a unique courtship song. Zootaxa 3918 (2), 194–208.

Hydorn, S.B., 1971. Food Preferences of *Chrysopa rufilabris* (Burmeister) in North Central Florida (M.S. thesis).