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Trichogramma : An Egg Parasitoid As Effective Biocontrol Agent For Insects

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SUMMARY

Trichogramma are minute parasitoid wasps that develop within other insect eggs. They are less than half a millimetre long and smaller than some protozaons. The trichogramma are one of the earlier branching families of chalcidoidae, a diverse super family of approximately half a million species of parasitoid wasps. They proposed to have evolved from a miniaturized ancestor. Trichogramma are frequently used in agriculture and revealed as biological control agent's majority against lepidopteran pests. Additionally, trichogramma are well known for their symbiotic bacteria that induce sexual reproduction in infested females. Knowledge of the genome sequence of trichogramma is a major step towards further understanding its biology and potential applications in pest management programme.

INTRODUCTION

Trichogramma are the most important egg parasitoids which parasitize more than 200 species. Of insect pests and belongs to mainly lepidoptera, but also coleoptera, diptera, hemiptera, neuroptera and hymenoptera although, they have inherent biological limitations and are unable to tolerate the unfavorable conditions. These egg parasitoids are widely used in bio-intesive pest management programme. Trichogramma are released to manage 28 different caterpillars attacking corn, cotton, sugarcane, rice, vegetables, sugar beet, pine, fruit and spruce. (Tanwar et al., 2006). Today, inundative release for managing lepidopteran pests are being investigated in more than 50 countries and use commercially on more than 32 million hectares each year.

Identification and Distribution :

Trichogramma are extremely tiny wasps in the family trichogrammatidae. All members of this family are parasites of insect eggs and they are minute wasps ranging 0.2 – 1.5 mm. within the genus trichogramma, they described 180 species. Worldwide (Rinto, 2006) the genus trichogramma was named by westwood which the best-known genera of trichogrammatidae is along with trichogramatoidea.in india 20 species. Of trichogramma and 6 species. Of old world trichogrammatoidea has been recoded of which *Trichogramma chilonis, Trichogramma japonicum* and *Trichogramma acharae* are widely distributed. A few exotic species have also been introduced, out of which *Trichogramma brasiliensis* and *Trichogramma exiguum* proved effective under Indian conditions. Among them various indigenous species, *T. japonicum* was found to be the weakest one, whereas the exotic species, *T. brasiliensis* is observed to have high fecundity. Parasitiod species are widely distributed throughout the world and by the most important are the tiny wasps of the genus trichogramma. The history of use of trichogramma for managing insect pests has been recorded for long time. But only since 1926, when Filanders developed the first mass production system with *Sitotroga cerealella* eggs, the utilization of trichogramma has been reliazed in many countries of the world. The last 20 years have been seen considerable use of these parasitoids on a large scale particularly on corn, cotton, sugarcane, fruit trees and vegetables in more than 30 countries. However, the success of insect pest management depends on the quality mass production of trichogramma in the bio factories.

Habitat :

Tricogramma species are naturally occurring in field and tree crops, garden, landscapes and wild lands whenever.

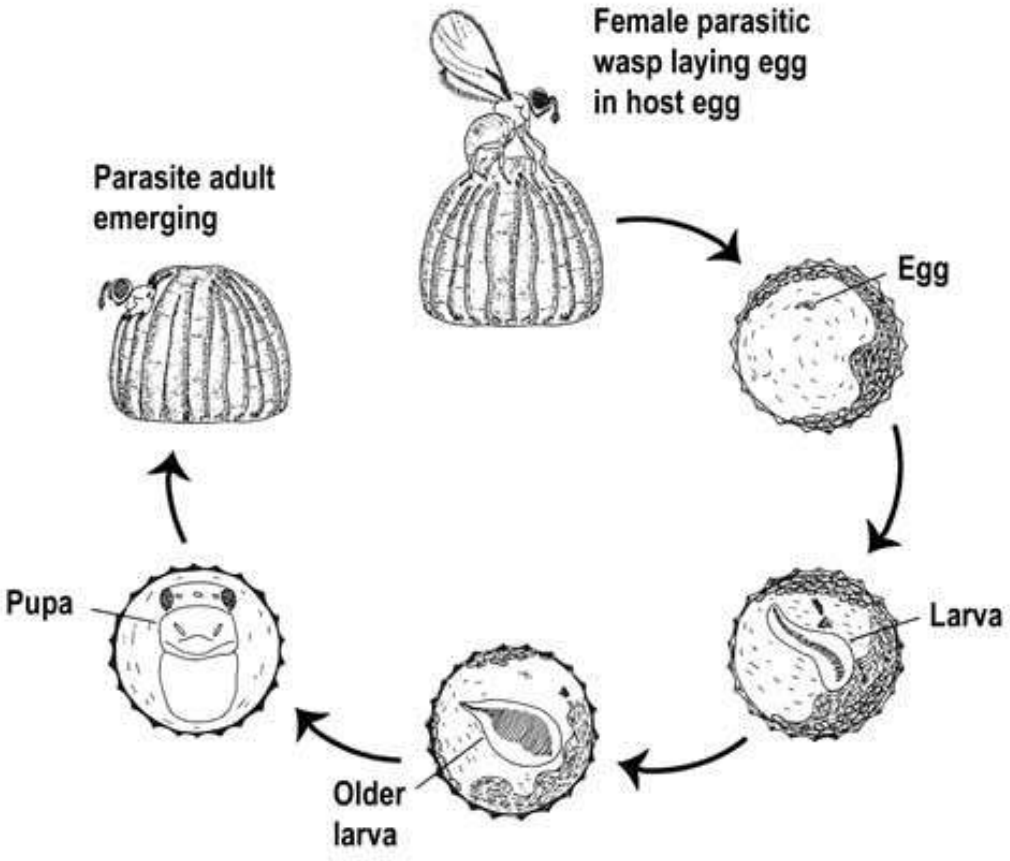
Bionomics :

Trichogramma wasps primarily parasitize eggs of moths and butterflies of lepidoptera. However, the certain species of trichogramma also parasitize eggs of beetles (coleoptera), flies (diptera), true bugs (heteroptera) lacewings with their relatives (neuroptera) and other wasps (hymenoptera). The adult female moth/wasp was chemical clues, called kairomones, and is on the moth scales lift near the egg by the female moth during oviposition. Some of the chemicals are also known as bollworm sex pheromones.

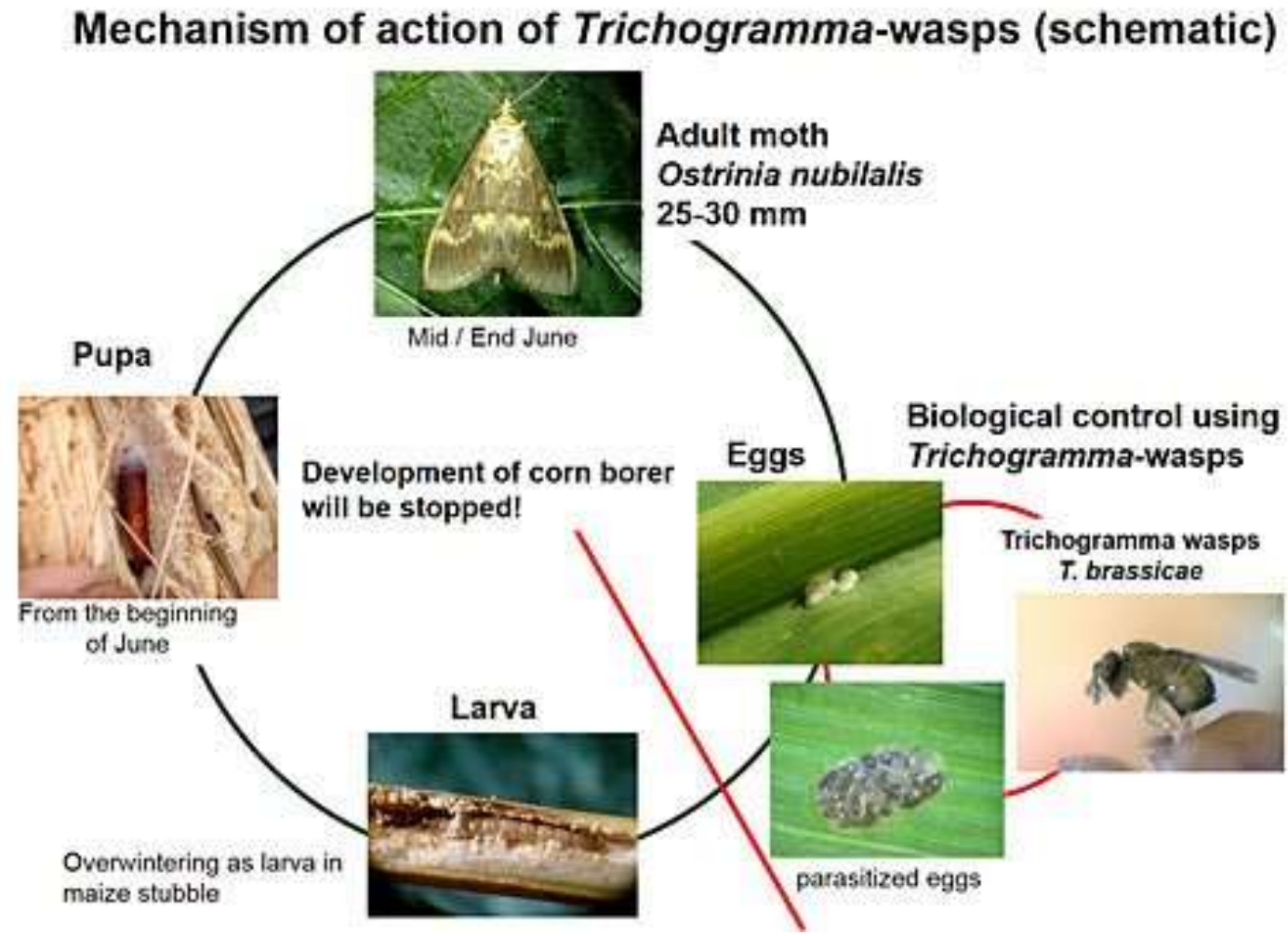
The development of all trichogramma spp is very similar. The female wasp insects its ovipositor through the chorion and deposits its eggs within the eggs of the host. The chorion and the deposits it's eggs within the egg of the host. The internal pressure of the host egg forces a small drop of yolk of the oviposition hole. Female feeds on this yolk, which increases their longevity and under laboratory conditions. A female parasitizes from 1 to 25 eggs per day and thus, from 10 to 190 during her life. Large females parasitize more eggs than smaller females. The number of eggs laid by the host egg may vary from 1 to 90 or more developing on the host egg. However, in paddy, cotton, tomato and sugarcane in which moth borer eggs are small, generally 1 or 2 parasites develop for egg, a female parasitoid can distinguish already parasitoid eggs, thereby avoiding super parasitism or multiple parasitism under natural conditions. Fecundity varies from 20 – 200 eggs per female according to this species, the host and the longevity of female adult. Host eggs in the early stages of development are more suitable for parasite development. Whereas the older eggs especially those in which the head capsule of larva is visible, are not usually parasitized and if they are, parasite survival is much lower. Venom injected by the female at the time of oviposition is believed to cause pre digestion of eggs contents. During the third instar (3-4 days after host eggs was parasitized). Dark melanin granules are deposited on the inner surface of egg chorion, causing the host egg to turn back. This is an invaluable diagnostic character for distinguishing them from an unparasitized egg.

Larvae then transform to the inactive pupal stage. The adult wasps emerge from the pupae and escape the host egg by chewing a circular hole in the eggshell. The black layer inside the chorion and the exit hole are incidence of parasitism by trichogramma. The egg larval and pupal stages of trichogramma at 28 +20 C are completed in about one day, 3-4 days and 4-5 days, respectively. Thus, the life cycle is completed in 8-10 days which may be prolonged at lower temperatures and hampered at very high temperature. Trichogramma adults emerge from their host eggs in the early morning. Males emerge first and remain at the host egg to mate with emerging females if they are present. The sex ratio is generally 1:1 mated female produces male and female offspring's unmated female produce only males. Females begin egg laying within a few hours of emergence. The adults are short lived (2-5 days).

Trichogramma overwinters as immature forms in host eggs some species enter a state of diapause which allows them to tolerate long periods of sub-freezing temperatures. Other species slow their rate of development and may be active as adults during warm days as early as January and February. The lack of host eggs in the early spring may be a critical factor in determining the number of trichogramma that are later present to move into field crops.



Life Cycle of Trichogramma



Applications of Trichogramma in Pest Management in Various Crops in India :

Trichogramma species has been applied are used in pest management of various crops *viz*., paddy, maize, okra, tomato, brinjal, sugarcane and cotton in India and given as.

Application of Trichogramma in Different Crops:

Species	Stage supplied	Crop	Target pests	Recommended dose (ha)	No. of release (recommended)
Trichogramma chilonis	Parasitized eggs	Sugarcane	Borer pests *H. armigera*	50,000	4-6 release at 10 days interval
		Tomato	D.B.M	50,000	6 release at weakly interval
		Cabbage/ cauliflower	Stem borer Bollworms	50,000	6 release at weakly interval
		Maize	Stem borer	1.5 lakhs	3 release at weakly interval
		Cotton		1.5 lakhs	6 release at weakly interval
		Sorghum		75000	3 release at weakly interval
Trichogramma japonicum	Parasitized eggs	Paddy	Stem borer Top borer	1.5 lakhs	6 release at 10 days interval
		Sugarcane		1.5 lakhs	4-6 release at 10 days interval
Trichogramma acharae	Parasitized eggs	Cotton Okra/ brinjal	Bollworms Fruit borer	1.5 lakhs 50,000	6 release at weakly interval

Trichogramma pretiosum	Parasitized eggs	Tomato	Fruit borer	50,000	6 release at weakly interval
Trichogramma embryophagum	Parasitized eggs	Apple	Codling moth	2000 adults/tree	Release starting from first moth catch and continue at weakly interval
Trichogramma brassicae	Parasitized eggs	Cabbage/ cauliflower	D.B.M Cabbage Butterfly	1 lakh	6 release at weakly interval
Trichogramma evanescens	Parasitized eggs	Maize/ sugarcane	Tissue borer		Targeted for research work
Trichogramma bactrae	Parasitized eggs	Cabbage	D.B.M	2.5 lakhs	5 release at weakly interval

CONCLUSION

Trichogramma are commonly used egg parasitiod in biological control and constitute an important component in IPM practices. The diversity of these egg parasitoids reported across the world and effectively employed for pest control in different crops. Trichogrammatids, notably trichogramma and trichogrammatoidea are mostly used in mass production and the ability to control the pests at egg phase made them an efficient biological control agent. Therefore, conservation of trichogramma through adopting different cropping systems, utilization of semio chemicals and development of tolerance strains to adapt a climatic stress and insecticidal pressure have made them to integrate with other control measures in the management of crop pest.

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