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Insect Hymnenopteran Parasitoids of Sugarcane Pest and Role as Biological Control Agents

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Abstract

The present study is short communication of insect parasitoids belongs to order Hymenoptera. Sugarcane crop attract number of insect pests that flourish on it, and cause about 15- 20% yield loss and minimize the productivity, this reduction in yield increase when the insect parasitoids attack on pest. There are some major parasitoids Orders that attack on the number of crops pest, like Dipteran, Lepidopterans, Neuropteran etc. and one of the major Order is Hymenopteran. As the agriculture field is growing day by day, number of methods are invented to deal with these pests, biological control is one of the best methods. In biological control methods, parasitoids are used to kill the insect pest under the controlled conditions and temperature as they infiltrate the physiology of insect pest to ensure their own survival. Biological control help to reduce the use of pesticides and other chemicals that kill that not only kills insect pest but also leaves the harmful effect on the environment. But the use of parasitoids in biological control programs requires careful consideration of factors like host specificity, environmental impact and potential interaction with other organisms. Some of the parasitoids of sugarcane pest are Cotesia flavipes, Trichogramma spp., Telenomus remus, T. chilonis etc. Parasitoids provide food source to other animals thereby supporting food chain. But activities like deforestation, urbanization, changes in temperature and precipitation, presence of invasive species can destroy the habitat of parasitoids, affect parasitoid populations and interactions and can disrupt parasitoid-host relationships and ecosystems.

Keywords: Parasitoids, Hymenopteran, insect pest, sugarcane, Parasitoids

INTRODUCTION

Due to their unique anatomy and physiology, insects are widely distributed on Earth. Their mode of life and growth highly effected by the environmental conditions like food availability, temperature and humidity etc. So Mosquitoes multiply when the environment is favorable for their growth. . But when the conditions are so much favorable insects increase their population and destroyed the crops and house hold. When the population of insect increase in such extent that they can cause the economic lose to the health and crops, then they become pest. Parasite insect lay eggs on the bodies of the insect pests of plants, their emerging larva feed on the tissues of the host and kill them. A parasite is an insect that lives freely as an adult but becomes parasitic and eventually kills its host during its formation phase [22] Insect parasitoids are divided into different categories according to the mode of development on or in host, number of parasitoids developing from single host, association with host, competition among the immature stages of parasitoids, host specificity and stage of host (egg, larvae/ nymph, pupa and adult). The honored microbiologist Van Leeuwenhoek (1701) was the first to understand the parasitism in saw fly that feed on willow. Parasitoids life way is found in all major holometabolous insect (Diptera.

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Coleoptera, Hymnoptera, Lepidoptera, Neuroptera). Since parasites generally have one or more stages of ticks, it is the insects that develop in other arthropods that eventually produce millions of species that are killed before the end of the host's life; At least one genus of Neuroptera, two genera of Lepidoptera, eleven genera of Coleoptera, twenty-one genera of Diptera and sixty-three genera of Hymenoptera are represented. App. 10% all insect species are parasitoids, of these about three quarters are Hymnopteran [7, 8] There are some parasitoids and its species that attack on crops Table 1.

Table 1. Different types of Parasitoids.

S.N.	Type of parasitoids		Reference
1	Braconid Wasps (Braconidae):	Braconid wasps are common agricultural parasitoids that attack a wide range of pest insects, The female wasp lays eggs directly into the host insect's body, and the developing braconid larvae consume the host's internal tissues.	(Tiwari *et al*., 2014)
2	Ichneumonid Wasps (Ichneumonidae):	Ichneumonid wasps are large and diverse parasitoids that target various insect hosts, including caterpillars, beetles, and sawflies. They lay their eggs on or inside the host, and the parasitoid larvae develop within the host,	(Tiwari *et al.*, 2014)
3	Chalcid Wasps (Chalcidoidea):	Chalcid wasps are tiny parasitoids that have a remarkable ability to parasitize a wide range of pest insects, such as scales, whiteflies, and leaf miners. They are often used in greenhouse and horticultural settings for pest control.	(Tiwari *et al*., 2014)
4	Trichogramma Wasps (Trichogrammatid):	Trichogramma wasps are extremely small parasitoids that lay their eggs inside the eggs of various pest insects, including moths and butterflies. The developing Trichogramma larvae consume the contents of the host egg, preventing the pest from hatching.	(Tiwari *et al*., 2014)
5.	Tachinid Flies (Tachinidae):	Tachinid flies are parasitoids that lay their eggs on or near the body of their host, typically caterpillars, beetles, or true bugs. The tachinid fly larvae feed on the host's internal tissues, ultimately leading to its death	(Tiwari *et al.*, 2014)

Parasiotioids are Facultative, Obligative and Transistory parsites. Faculatative spends few stages of its life cycle in one and others on some other species of host. Obligative parasites cannot live away from the host even for a short period. Transistory cause parasitism for limited to definite phase of its life history Table 2 [21].

Table 2. Type of parasite on the bases of phase of life.

Egg parasites	Pests of crops	Pupal parasites	Adult pests
The larvae lay their eggs on or in their colony, where they grow to maturity and then emerge from the host. For example, a female Trichogramma lays 90–100 eggs in a patient (Rao, 2011).	To complete their development, parasites lay eggs on or in their host larvae or grow outside them. They reach maturity and emerge as adults to feed, mate and complete their life cycle (Ghimire, 2014; Saleh et al., 2020).	According to Ghimire (2014), pupal parasites are organisms that lay eggs on or inside the pupal cocoon.	Larvae, which hatch from eggs laid by adult parasites, eat adults in order to survive. Adult parasitoids lay their eggs on or in adult hosts. In nature, these viruses are very rare (Ghimire, 2014).

Types of parasitoids are also based on the mode of development in host.Foolishly, Trichogramma sp. During reproduction, it develops its larvae on or in the growth-stop host. Parsitiod *Bracon brevicornis* is ectoparasitiod, lay eggs outside the host's body. Some parasitoids are endoparsitoids, lay their eggs within the host's body eg. *Chelonus blackburni* and *Ericborus trochanteratus.* Some insect parasitoids are solitary and gregarious like parasitoid. *Chelonus blackburni* completes its one

progeny alone in or on a single host. *Trichogramma evanescens* show super parasitism, attacked on the host more than once by single species.

Depending on the developmental stage of their infestation host, parasites can be classified into four groups: adult, pupal, larva, and egg [14-16].

ROLE OF PARASITIODS IN BIOLOGICAL CONTROL

Number of parasitoids speciecs play important role in biological control Efforts to improve biological control. There are different methods are used to release the parasiotoids on the insect pest. Trichogramma spp. In sugarcane, borer eggs do not appear to increase the parasitization rate of other eggs [20] Several methods have been developed to release T. chilonis for biological control of sugarcane internode borer Chilo sacchariphagus indicus (Capur) [2].

Two species of Trichogramma—T. pretiosum and T. galloi—as well as the braconid C. flavipes are among the biocontrol species currently marketed in Brazil [17]. In the Biocontrol control programs , egg , larva and pupa of parasitoids are used to minimize the attack of sugarcane borers.in previous studies approximately sixteen species of parasitoids attack on the different life stage of sugarcane borer [9]. Larval parasites such as Trichogramma spp. and Cotesias spp. and pests [10-13].

Pandey [3] studied integrated control of *Scirpophaga excerptalis* on sugarcane at Seorahi, Uttar Pradesh, India. Control methods include releasing of the *Trichogramma spp.* against the sugarcane borer. Various studies evaluated that egg parasitoid *Trichogramma chilonis* is used for the control of the sugarcane pest *Chilo auricilius* in farmers' fields in Punjab India.

Mann and Doomra [4-6] investigate tha biological control using the egg parasitoid *T. chilonis* to control Sugarcane shoot borer, *Chilo infuscatellus*.

The wasp *Cotesia flavipes* parasitoid play very important role to destroy sugarcane borer, and in the egg stage the main parasitoid is the *Trichogramma galloi*, and both used in biological control in Brazil [18, 19]. In order to use the wasp parsitiods against the insect pest, The wasps are reared in laboratories and are released on plantations infested with borers Table 3.

Table 3. List of some parasitoids of sugarcane pest.

S.N.	Parasitoids	Host	Parasitoid type
1.	*Trichogramma minutum*	*Chilo infuscatellus*, *Proceras indicus*, *Corcyra cephalonica* (Mealworm moth)	Egg Stage
2.	*Perisierola nephantidis*	*Nephantis serinopa* (Black headed caterpillar)	Egg Stage
3.	*Xanthopimpla punctata*	*Scirpophaga nivella* (Sugarcane top borer)	Pupal stage
4.	*Isotima javensis*	*Scirpophaga excerptalis* (Sugarcane white top borer)	Prepupal stage
5.	*Campoletis chlorideae*	*Heliothis armigera*	Larval stage
6.	*Trichogramma chilonis*	*Chilo infuscatellus* (Suagrcane shoot borer)	Egg stage
7.	*Encarsia haptiensis*	*Trialeurodes vaporariorum* (White fly)	Nymph and Adult Stage

CONCLUSION AND FUTURE PROSPECTS

Parasitoids are harmful in nature but have significant future prospects in various fields. Parasitoids helps in controlling pest populations, provide insights into ecosystem dynamics and conservation biology, have potential medical applications, can also be used to control invasive species, also play a significant role in restoring degraded ecosystems by controlling pest population and in recovery of native species. For that purpose, the government and private agencies need to take strong initiatives.

There is more need of research in order to increase the crop yield and to create balance in the ecosystem.

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