

## *Parasitoids and its importance in biological control of pest*

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### **Abstract:**

The temperature has an important impact on the parasitoid's biological traits in a lab setting, suggesting that the effectiveness of a biological control programme may be impacted by this factor. However, the use of additional synthetic insecticides became vital for both the effectiveness of Integrated Pest Management and biological control programmes. However, aside from parasitoid species that reside on the exact same host, parasitoid wasps that are focused on herbivores often do not have the ability to attack other guild mates. In terms of eradicating their carriers, parasitic organisms are the most effective natural enemies in biological insect control. Therefore, it is crucial to correctly identify the hosts and parasitoid subspecies when utilising parasitoids for biological control. Biological control is the effective management of pests and the damage they cause by parasites, diseases, and predators. Effective biological control requires accurate pest identification that separates pests from their natural adversaries.

**Keywords** – Parasitoids, Biological Control, Pathogens, Parasitoid wasp, Vegetablecrop, Stored-product Pests, Natural Enemies.

### **Introduction:**

In agro-ecosystems, parasitoids can be employed as biologically pest control strategies to eliminate pest insects. The most common natural enemies utilised today for traditional biocontrol are parasitoids and the larvae of parasitoids destroy its host to complete their development from egg to adult and only require one host to support them until they reach adulthood. Pests targeted by parasitoids perish more gradually than prey of predators, which are instantly killed or rendered ineffective. Even though some hosts become incapacitated, others could keep eating or perhaps even lay eggs eventually they pass away. Compared to many predators, parasitoids frequently complete their lives more promptly and multiply more rapidly. When creating a

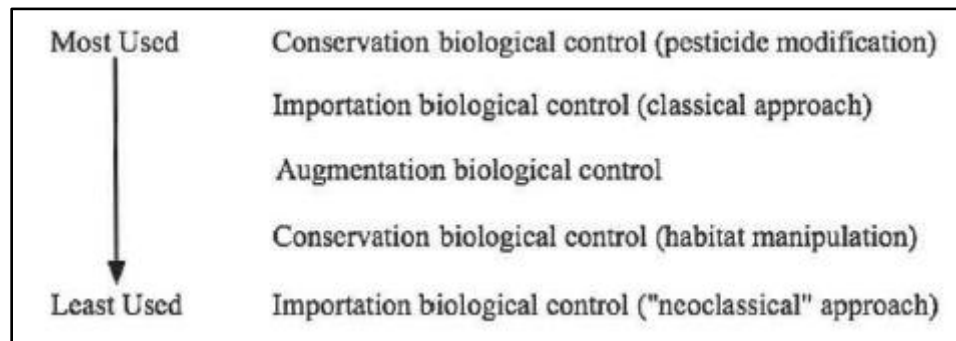
biological control programme that uses this variant of the parasitoid in field settings, this findings must be taken into consideration (Bueno et al., 2009).

Use of biological systems to mitigate the harm that pest infestations may otherwise cause is known as biological controls. "The biological management of all pests, including insects, vertebrates, plant infections, and weeds, is possible, although the methods and substances used differ depending on the type of pest".. To clear up any doubts at the species identification, these parasitoids must first undergo accurate molecular confirmation (Malaus et al., 2010). Despite the fact that interest in pest management strategies used by farmers and biological preservation has grown since then (Van Mele, 2008). As the use of pesticides is increasingly regulated, biological control is becoming more and more recognised as a reliable and cost-effective method of controlling fruit flies (Bokonon-Ganta et al., 2007). Since they consume a narrower variety of predatory species and have shorter life cycles than other invertebrate predators, insects and other arthropods are more frequently used in biological control. This is because their current population can alter in response to modifications in the concentration of their food. Arthropod pests in agricultural and woodland environments are well-known to be controlled by parasitoid wasps, a relatively broad historical group of belonging to the genus insects. One method of biological management is to utilise and protect native natural enemies that are already a component of the ecosystem instead of importing foreign organisms (Zehnder et al., 2007).



**Fig.1.** the image above shows a parasitoid in action.

Furthermore, in order to perform the quick population control necessary for techniques biological control methods, it is essential to comprehend how parasitoids react to hosts densities (functional response) (Laumann et al., 2008). Production plants that are unwilling to stop development for pest control activities are especially drawn to biological control (Schöller, 2010). We concentrate on invertebrate natural enemies even though a variety of species, such as nematodes, diseases, and arthropod predators and parasitoids, provides biological control functions (Romeis et al., 2008). The Hymenoptera family contains the majority of the parasitoids utilised in biological pest control of insects that attack plants (Araj et al., 2009). Utilizing this tendency greater completely through biological management can assist in controlling pests more successfully and use fewer insecticides (Stansly et al., 2010). Additionally, it discusses the interactions between biological control and other IPM strategies and the possibility for improved integration into IPM programmes (Peshin & Dhawan, 2009).



**Fig.2.**Integration of different biological control methods in IPM on a relative basis

### **Literature review:**

Teja Tscharntke et al 2007 evaluated by A multitrophic viewpoint is also necessary for conserving biological control. Biological conservation control is independent of specific species of natural enemies whose populations are closely correlated with those of their host or predator. For parasitic organisms and predator invertebrates, they offer a variety of crucial resources, including protected areas from disturbances and continuous vegetative cover appropriate for overwintering. Attacks on non-target organisms in biological ecosystems and unintentional adverse indirect effects are two potential consequences of unleashing biological barriers (Tscharntke et al., 2007)(Desneux et al., 2010).

Zeyaur R. Khan et al. 2008 described by in agricultural settings, conservation biological control (CBC) aims to maintain regional natural enemies, while boosting their quantity and activities, notably employing cultural methods. The plan might be a helpful tool for IPM programmes that want to reduce the amount of pesticides used in favour of biological control, particularly CBC. Close to half of all initiatives were identified as ongoing for biological control of plants and insects, indicating that the application of biocontrol agents for the preservation of wilderness areas is currently quite prevalent. One or several of these methods may need to be used with biological management for effective control of invasive weeds. Plants and pest biological control initiatives have distinct backgrounds, with insects biocontrol being used for majority of its first period primarily versus agricultural pests (Khan et al., 2008)(Driesche, 2010).

Linda J. Thomson et al. 2009 demonstrated by “the relative advantages of various types of vegetation are frequently unclear, although non-crop areas can enhance the number of naturally invertebrates competitors on agriculture and help with invertebrates pest control”. A wide range of adversaries, such as parasitoid wasps, insects, caterpillars, and predatory mites, have been shown to be affected by these changes. A multispecies complex of parasitoids, like the one seen above, can enhance pest management. Compared to their herbivorous hosts, parasitoid populations found to be more substantially impacted by internally shifting crop combinations (Thomson & Hoffmann, 2009)(Thies et al., 2008).

David Orr et al. 2009 explained by the The cultivation of non - target organisms continues to be a crucial component in integrated pest control strategies used to combat insect pests all over the world. The connection between biological control and the different components of integrated pest management programmes is then taken into account (Peshin & Dhawan, 2009).

J. Moreau et al. 2010 described by the ability of parasitoids to considerably lower the pest density determines how effective they are at controlling pest populations. “Therefore, knowing the impact of host plant and host selection may help to improve our comprehension of the dynamics of parasitic and pest population growth, which is necessary to create successful biological programmes”. Studying the pest's natural predators and the effects that environment variation have is essential. on the community composition and diversity of parasitoids in order

for this kind of biocontrol agents programme to be effective. In biological control, creating practical criteria for the discharge of real enemies has proven crucial (Moreau et al., 2010).

**Analytical study:**

**There are different types of parasitoids:**

**Primary parasitoid:** An organism that grows on uninfected hosts.

**Hyperparasitoid:** often known as a secondary parasite, is a parasite that arises from another parasite (it is a parasitoid of a parasitoid). The level of hyperparasitism may vary.

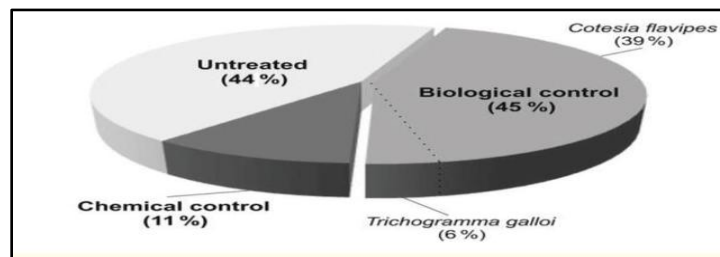
**Endoparasitoids:** A parasite that grows inside its host's body. The endoparasitoids can be gregarious or solitary (when only one larva develops in a single host)

**Ectoparasitoid:** An organism that grows outside of its host's body and there are solitary and social endoparasitoids, like the endoparasitoids.

**Multiple parasitism:** Multi predation is the condition where more than one variety of parasitoid wasps resides on or is established on a single host. Often, only one person makes it through while others pass away. More than one species can occasionally develop to maturity in the egg, as is the case with *Trichogramma* species (parasitoids of lepidoptera eggs).

**Superparasitism:** In this situation, a host may become home to several members of a parasitic species. "A dominant person may survive when superparasitism with solitary endoparasites occurs due to mutual destruction of the physiological suppression of larvae or surplus eggs". But occasionally, the host passes away before the extra is used, and everyone dies.

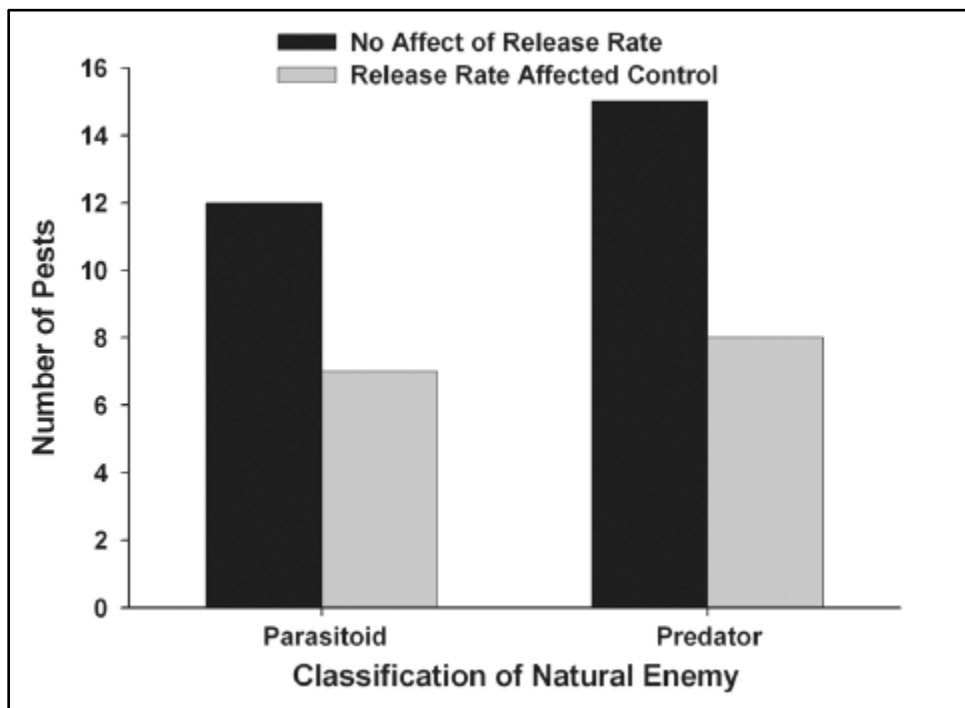
**Heteromes:** The male and female parasitoids are parasites of various hosts.



**Fig.3.**Use of Parasitoids as Biological control

**Impact of release rate when predators were used for biological control:**

In a few cases, the way and when a biological control agent was applied had more of an impact on the controlling of a pest than the particle's optimized formulation. "The capacity of a biological pesticide to develop in the field, which is required for long-term management of a pest, is mostly impacted by the application technique". It was frequently best to utilise biological control in combination with pesticides at lower release rates. In integrated pest management systems, biological control is frequently seen as a possible substitute for or addition to insecticides (Crowder, 2007). Carnivorous lifestyles are typically used to identify biological control organisms. However, because they frequently consume meals produced from plants, the overwhelming amount of parasitoids and predators are really "omnivores" (Wäckers et al., 2008).



**Fig.4.**A natural enemy used for augmenting biological control may be a predator or a parasitoid, depending on the number of pests affected by the release rate.

**Conclusion:**

Energy efficiency and energy biological control entails modifying the environment or employing management strategies that promote the presence and activities of natural predators. A continuous, risk-free method of pest management, biological control (biocontrol) makes use of natural enemies found in agro - ecosystems such diseases, parasitic beetles, or predators. Sustainable biological control for subsistence tree crop producers in the equator remained under-examined within this framework of a change in thinking toward smallholder involvement and a rising environmental knowledge. The creation of prospective biological control models can benefit from assessing the ability to perform everyday activities of parasitoids utilised in biological control and connecting these to populations decrease.

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