BIOLOGICAL CONTROL - DEFINITION – HISTORY - CLASSICAL EXAMPLES - FACTORS GOVERNING BIOLOGICAL CONTROL

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B. Parasitoid: It is a special kind of parasite which often about the same size as its host, kills its host and requires only one host (prey) for development into a free-living adult.

Characteristics of insect parasitoids:

- Host searching capacity
- Host specificity
- Universal adoptability
- Dispersal ability
- Amenability to mass culture
- Ability to withstand competition
- Ability to out number the pest
- Survival capacity

Predator

V/S

Parasitoids

Predators	Parasitoids
1. Bigger than the prey	1. Smaller than its host
2. Very active	2. Usually sluggish once the host in secured
3. Organ of locomotives, sense organ and mouth parts are well developed.	3. Organ of locomotives, sense organ and mouth parts not well developed
4. Habitat is independent of its prey.	4. Habitat in same that of its host.
5. Life cycle in longer than the host.	5. Life cycle shorter than the host
6. A single predator may attack several host in in its life period	6. It usually completes development in a single host.

Types of parasitoids

1. **Based on the developmental site in the host**

a. Ectoparasitoid : An insect parasite which develops externally on its arthropod host.

(eg). *Bracon brevicornis* on coconut black headed caterpillars.

b. Endoparasitoid : An insect parasitoid which develops within the body of its arthropod host. (eg) *Eriborius trochanteratus* on coconut black headed caterpillar.

B. brevicornis **on larva of** ***Opisina arenosella***

2. Based on the stages of the host attacked

Order: Hymenoptera (90% of parasitoid coming under this order)

Stage	Family	Species	Hosts
Egg parasitoid	Trichogrammatidae	*Trichogramma chilonis*	Eggs of sugarcane internode borer, cotton bollworm, rice leaf folder
		T. japonicum	Eggs of rice stem borer
	Scelonidae	*Telenomus rowani*	Eggs or rice stem borer
		Telenomus remus	Eggs of tobacco caterpillar

Trichogramma sp.

Telenomus remus

Contd…..

Stage	Family	Species	Hosts
Egg-larval parasitoid	Braconidae	*Chelonus blackburni*	Eggs of cotton spotted bollworm
	Encyrtidae	*Copidosoma koehleri*	Potato tuber moth

Chelonus blackburni

Copidosoma koehleri parasitizing eggs and larvae of PTM

Contd…..

Stage	Family	Species	Hosts
Larval parasitoid	Bethylidae	*Goniozus nephantidis*	Late larval CBHC
	Platygastridae	*Platygastor oryzae*	Larvae of rice gall midge
	Ichneumonidae	*Campoletis chloridae*	Larval Spodoptera or Helicoverpa
		Erioborus trochanteratus	Larval CBHC

Campoletis chlorideae

Goniozus nephantidis

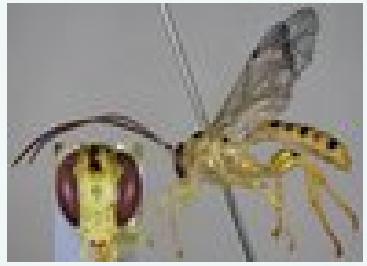
Platygastor oryzae

	Family	Species	Hosts
Larval parasitoid	Braconidae	*Bracon brevicornis*	Larvae of coconut black headed caterpillar
		Bracon hebetor	Larvae of coconut black headed caterpillar
		Chelonus blackburni	Egg-larval, Ha, Sl, Aa
		Cotesia plutellae	Larvae of diamondback moth
Larval – Pupal parasitoid	Ichneumonidae	*Isotima javensis*	Pre – pupal parasite of top shoot borer of sugarcane.
Pupal parasitoid	Ichneumonidae	*Xanthopimpla punctata*	Larval, Lepidopteran

C. blackburni

Isotima javensis

Bracon brevicornis



X. punctata

Pupal parasitoid	Eulopidae	*Trichospilus pupivora*	CBHC
		Tetrastichus israeli	Pre-pupal, Pupal, CBHC
	Chalcididae	*Brachymeria nephantidis*	Pupal, CBHC
	Epiricanidae	*Epiricania melanoleuca*	Nymphal, Pp
Nymphal and adult parasitoid	Aphelinidae	*Aphelinus mali*	Nymphal, Aphids
		Encarsia formosa	Nymphal, WF, MB, SC
		Encarsia favoscutellum	Nymphal, WF, MB, SC

Trichospilus pupivora

Tetrastichus israeli

B. nephantidis

Aphelinus mali

Order: Diptera (10% of parasitoid coming under this order)

Larval parasitoid	Tachanidae	*Eucelatoria bryani*	Larval, Lepidopteran
		Sturmiopsis inferens	Larvae of sugarcane early shoot borer
		Spoggosia bezziana	Larvae of coconut black headed caterpillar
Larval ï pupal parasitoid		*Eucelatoria bryani*	Larvae of H.armigera

Sturmiopsis inferens

3. Based on host specificity

a. Monophagous parasitoid : Highly host specific attacking a single host species.

E.g. *Parasierola nephantidis* (Goniozus) (Bethylidoe) on *Opisina arenosella*(coconut black headed caterpillars).

b. Oligophagous parasitoid (Stenophagous): Attacking a group of related host species.

c. Polyphagous parasitoid: Attack a wide variety of host species.

(eg) *Trichogramma Spp*. (Trichogrammatidae) on eggs of many Lepidopteran species.

Parasierola nephantidis

4. Based on the host

a. Primary parasitoid: A parasitoid parasitizing a pest. It is beneficial

(eg) *Trichogramma sp*.

b. Seconday parasitoids: A parasitoid attacking another parasitoid. It is harmful

(eg.) *Opisina arenosella* (pest) *Bracon brevicornis*(Primary parasitoid) ï

Pleurotropis sp. (secondary parasitoid).

c. Tertiary parasitoid: A parasitoid attacking secondary parasitoid. It is beneficial.

(eg) *Trichospilus coerulescens*

All parasitoids whose hosts are parasitoids are called as hyperparasitoids (Parasitoids of Parasitoids).

***Bracon brevicornis* on BHC**

5. Based on the number of parasitoids developing from a single host insect

a.Solitary parasitoid:

One progeny alone is capable of completing its development in or on its host

(eg) *Eriborus trochanteratus*.

b. Gregarious parasitoid:

Several progeny are capable of completing its development in or on a single host. *(eg) Bracon breviconis.*

A further extension of gregaiousness is Polyembryony in which several individuals develop from a single egg. (eg) Platygaster.

Gregarious parasitisation

Kinds of insect parasitism

Simple parasitism: It is applied when there is a single attack of the parasitoid in the host, irrespective of the number of eggs laid.

Eg: *Goniozus nephantidis* on *Opisina arenocslla*.

Goniozus nephantidis

Super parasitism: When may individuals of the same species of the parasitoid attack a single host it is called super parasitism.

Eg: *Telenomus remus*

Telenomus remus

Multiparasitism: It means attack of different species of parasitoid on a single host. It is not beneficial for biocontrol.

Field applications.....

Species	Host/s	Quantity
Trichogramma chilonis	ESB/INB/OLE	1.50-2.50 Lakh/ha
Trichogramma japonicum	YSB/Sl/TSB/OLE	1.50-2.50 Lakh/ha
Trichogramma brasiliensis	Ha/OLP	1.50-2.50 Lakh/ha
Goniozus nephanidis	CBCP	15-20/plant
Bracon brevicornis	CBCP/OLP	25000-50000/ha, 10-15/plant
Bracon bebetor	GLM/OLP	25000-50000/ha, 10-15/plant
Chelonus blackburni	Ha/Aa/Sl/OLP	25000-50000/ha, 10-15/plant
Cotesia plutellae	DBM/OLP	25000-50000/ha, 10-15/plant
Trichospilus pupivora	CBCP/OLP	10-15/plant
Tetrastichus israeli	CBCP/OLP	10-15/plant
Brachymeria nephantidis	CBCP/OLP	10-15/plant
Sturmiopsis inferens	ESB/INB/TSB/OLE	250-500 /ha