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Adaptation and host seeking behaviour of predatory and parasitic groups of insects

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The adult stage of entomophagous insects would be of considerable imoprtance if it merely furnished the morphological basis for the taxonomy of the groups. But the adult stage does much more than this, for the behaviour of the mature female is commonly the major determinant of the efficiency of the sp as a controlling agent of its host. This is so because it is the adult female via finds and selects the host on which, or in which, her progeny will develop. She only exhibits discrimination in her choice of hosts but, if efficient, she has the ability to find such hosts when they are scarce. These two characteristics of the female are tremendously important in biological control.

Thus, as an initial basis for biological control we start with something more the fact that some arthropods are obligatorily entomophagous, for we note that are restricted in this feeding habit to a relatively few species. In the predaceous species, unlike the parasites, the larval stage is forced to find several prey individuals and accordingly the searching behaviour of the larva as well as that of the adult is important in any analysis of predator-prey population dynamics.

Adaptation of predatory and parasitic groups of insects: Some lists of predatory and parasitic groups of insects are as follows :

Predators: A predator is an organism that attacks, kills, and feeds on several to many other individuals (its prey) in its lifetime.

Insect parasites (parasitoids): Larval stages of insect parasites feed on or inside of other insects, killing their hosts. Adults are free-living wasps or flies.

Adaptation and behaviour: Coccinellids in temperate regions enter diapause during the winter, so they often are among the first insects to appear in the spring. Some species (e.g., *Hippodamia convergens*) gather into groups and move to higher elevated land, such as a mountain, to enter diapause. Most coccinellids overwinter as adults, aggregating on the south sides of large objects such as trees or houses during the winter months, dispersing in response to increasing day length in the spring.

Factors that affect adaptation: Organisms can conform to and cope with a highly predictable environment relatively easily, even when it changes in a regular way, as long as the changes are not too extreme. Adaptation to an unpredictable environment is usually more difficult; adapting to extremely erratic environments may even prove impossible. Many organisms have evolved dormant stages that allow them to survive unfavorable periods, both predictable and unpredictable. Brine shrimp in deserts and annual plants everywhere are good examples. Brine shrimp eggs survive for years in the salty crust of dry desert lakes; when a rare desert rain fills one of these lakes, the eggs hatch, the shrimp grow rapidly to adults, and they produce many eggs. Some plant seeds known to be many centuries old are still viable and have been germinated.

Very small undirected changes in the physical environment can sometimes improve the level of adaptation between an organism and its environment, but large changes are almost always detrimental. Changes in the environment that reduce overall adaptation are collectively termed the “deterioration of environment.” Such changes cause directional selection resulting in accommodation to the new environment, or adaptation. Changes in biotic

Common name	Scientific name
Assassin bugs	Reduviidae family
Brown lacewings	*Hemerobius* spp.
Convergent lady beetle	*Hippodamia convergens*
Damsel bugs	*Nabis* spp.
Green lacewings	*Chrysopa* spp., *Chrysoperla* spp.
Mantids	Mantidae family
Mealybug destroyer	*Cryptolaemus montrouzieri*
Minute pirate bugs	*Orius* spp., *Anthocoris* spp.
Multicolored Asian lady beetle	*Harmonia axyridis*
Praying mantids	Mantidae family
Predaceous ground beetles	Carabidae family
Predaceous midge, aphid midge	*Aphidoletes aphidimyza*
Sevenspotted lady beetle	*Coccinella septempunctata*
Sixspotted thrips	*Scolothrips sexmaculatus*
Spiders	Araneae order
Syrphid flies	Syrphidae family
Twicestabbed lady beetle	*Chilocorus orbus*
Vedalia beetle	*Rodolia cardinalis*

environments (such as the hunting efficiency of an organism's predator) are usually directed and typically reduce the level of adaptation.

Every individual is simultaneously a member of a population, a species, and a community; therefore, it must be adapted to cope with each and must be considered in that context. An individual's fitness-its ability to perpetuate itself as measured by its reproductive success-is greatly influenced by its status within its own population. An individual might be a resident or a vagrant, mated or unmated, or high or low in a pecking order, all factors that strongly affect its fitness. Any given individual's fitness is also influenced by various interspecific associations of its species and especially by the particular community in which it finds itself embedded.

Host seeking behaviour of predatory and parasitoid group of insects:

Defination:

Predator: An organism that feeds on its prey one prey to compete its life cycle.

Parasitoid: Insect parasite of an arthropod which is parasitic in immature stages and adults are free living.

Behaviour in host selection: Host habitat location, Host location, Host acceptance and Host suitability

Host habitat location: Process of finding a likely habitat that will include appropriate prey. Parasites and predators initially and fundamentally seek a certain environment, and they do this irrespective of the presence of hosts. Two important types of cues :Attractant stimuli, Arrestant stimuli

Attractant stimuli : Induce a change in forager behaviour that results in orientation to areas that either contain host or are likely to contain host.

Arrestant stimuli: Act by eliciting a reduction in distance or area covered per unit time by forager within such areas, Example: Larvae of the green lacewing *Chrysoperla carnea* feed primarily on aphids, many of which occur on cotton plants. *Caryophyllene* is a volatile chemical released from cotton that attracts *C. carnea* adults.

-Egg parasitoids respond to odours of adult hosts such as moth scales, marking pheromones.

Host location: The process of actually finding suitable prey within the appropriate habitat. The most commonly reported senses used in detecting the host are tactile and olfactory (for parasitoids) Ex. Adultlacewings orient to the honeydew excretion of aphids because such sites likely have suitable prey for their offspring.

-Inferring behaviour from morphology: A predator or parasitoid may locate its prey is to pay close attention to insect morphology. Ex. Pipunculid flies

-Kairomones:

-Contact chemicals

-Chemicals released by one insect that induces a response in another insect which is advantageous to recipient

Ex. Potato tuber moth.

Host acceptance : Parasite/ predator actually finds or contacts a suitable host/ prey, it still may not attack if the proper stimuli are lacking. This step is truly host selection and is clearly a matter of innate behaviour of a parasitic / predacious species.

Hosts may be rejected because they are:

- Too young or old
- Wrong size
- Diseased or Unhealthy
- Already parasitized (by the same or another species)

-Have been used for host feeding

-Do not exhibit the correct reactions when investigated by the parasitoid.

Host suitability: Even though a parasite / predator has found the potential host / prey in its habitat and selected it for attack, the host/parasite or prey/predator relationship may still not succeed if the potential host individual is immune or otherwise unsuitable. Nutritional and physical characteristics of the prey are involved. Ex. Diseased prey may be acceptable to a generalist predator but be rejected by a specialist.

Common name	Scientific name
Anaphes species	*Anaphes iole, Anaphes nitens* and other *Anaphes* spp.
Aphidius species	*Aphidius* spp.
Bracon cushmani, grape leaffolder parasite	*Bracon cushmani*
Citrus mealybug parasite	*Leptomastix dactylopii*
Cottony cushion scale parasite	*Cryptochaetum iceryae*
Elm leaf beetle parasite	*Erynniopsis antennata*
Encarsia formosa, whitefly parasite	*Encarsia formosa*
Hyposoter exiguae, caterpillar parasite	*Hyposoter exiguae*
Lysiphlebus testaceipes, aphid parasite	*Lysiphlebus testaceipes*
Tachinid flies	Tachinidae family
Trichogramma spp., egg parasites	*Trichogramma* spp.
Trioxys pallidus, walnut aphid parasite	*Trioxys pallidus*

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