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HOST SEARCHING BEHAVIOUR OF PARASITOIDS AND PREDATORS

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INTRODUCTION

An insect parasite of an arthropod; parasitic only in its immature stages, destroying its host in the process of its development, and free living as an adult. Or An insect whose larvae live as parasites which eventually kill their hosts are known as parasitoid. Ex.: *Cotesia glomerata, Aphidius colemani, Braconid wasps.* Predator is a free-living organism that feeds on their prey, devouring them completely and rapidly. Or A predator is an insect that eats other insects. Ex.: Preying Mantid, Lady bird beetle, green lace wing. A host is an organism that is being attacked by a parasite or a parasitoid. The sequence of steps in host selection includes habitat location, host location, host acceptance, and host use. Insects use several sensory cues in host selection including visual, olfactory, gustatory, and tactile stimuli as well as humidity and light intensity. These cues stimulate receptors, generating sensory input and finally behavioural responses. A large number of sensory receptors of different modalities receive stimulation at each step in the host selection process. This information must be processed and integrated by the central nervous system, interpreted as a positive or negative signal and a decision made as to whether to make a certain behavioural response (Bernays and Chapman, 1994).

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: 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: Caterpillar chews on a corn leaf, leaving traces of saliva that contains volicitin. Volicitin and leaf damage cause the plant to synthesize and release volatile chemicals. The released chemicals attract female parasitic wasps. The wasps lay their eggs on the caterpillar, which will provide food for their larvae (Fig. 1) (Khan *et al.,* 2010)

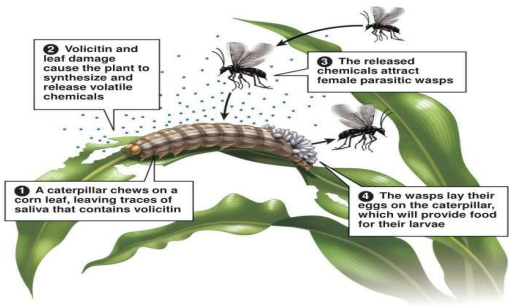

Fig.1 : Host habitat finding behaviour of parasitic wasp

HOST LOCATION:

The process of finding suitable prey within the appropriate habitat. The most reported senses used in detecting the host are tactile and olfactory (for parasitoids). (1) Inferring behaviour from morphology (2) Kairomones

Example: Salehi and Keller (2002) reported that host location behavior of *Apanteles subandinus* Blanchard and *Orgilus lepidus* Muesebeck, two endoparasitoids of potato tuber moth (PTM), *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae). Females of both species discriminate between the volatiles of a mechanically damaged plant and those of PTM larvae-damaged plant. The combination of odours originating from plant host on which the host is feeding play a crucial role in the foraging behaviour of these parasitoids. Developmental experience during larval stages and experience of adults to host plant influence their foraging for host.

HOST ACCEPTANCE:

Parasite/ predator 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 parasitoids.

Example: Ananthakrishnan *et al.* (1991) reported that several kairomones like hexatriacontane, pentacosane, heptadecane, docosane and 2, 6, l0-dodecatrienal-3, 7, 11-trimethyl are extracted from active moth scale of *Heliothis armigera* Hubner (its natural host) and *Corcyra cephalonica* Stainton (a laboratory host) tend to influence the parasitic potential by *Trichogramma chilonis* Ishii.

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.

Example: Hislop *et al.,* (1981) found that the searching behaviour of two acarine predators, *Amblyseius fallacis* and *Phytoseiulus macropilis*, for prey, *Tetranychus urticae*, is affected by the following stimuli: (1) prey silk and associated feces, whose combined physical and chemical properties elicit reduction in the rate of predator movements and longer halts; (2) kairomone extracted from prey silk and associated feces, which, upon contact, elicits frequent predator return to prey-inhabited locales; and (3) predator-emitted marking pheromone, which elicits shorter duration of search in presearched prey locales.

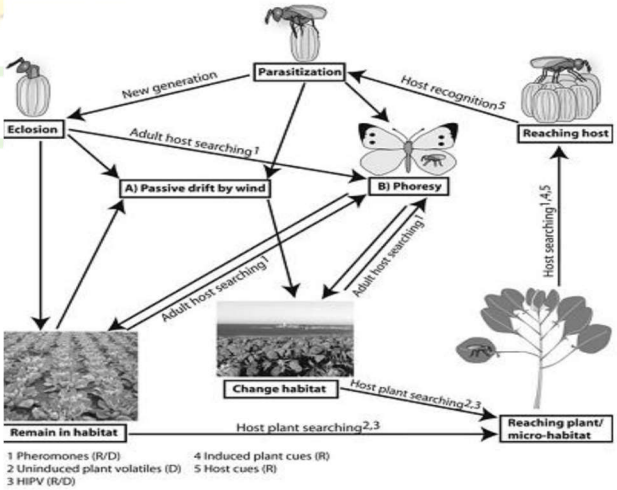

Fig.2: General host location behaviour

The general host location behaviour of egg parasitoids and the possible info chemicals involved are shown based on a virtual system. After eclosion, an egg parasitoid can choose to remain in the same habitat an search for a host plant or to change to anew habitat. To reach habitats, the wasp has 2 possibilities: A) by chance and drift passively with the wind or B) by searching adult hosts for transportation (phoresy). Egg parasitoids are demonstrated to depend more heavily on the adult host stage than other parasitoids do by utilising cues from the adult host, either to directly locate the host plant and lay herbivorous eggs or to accomplish phoresy. In addition to host pheromones, herbivore-induced plant volatiles (caused by egg deposition or feeding) appear to have an impact on the host foraging behaviour of egg parasitoids that has been previously underappreciated. The parasitoids response to all types of info chemicals shown may be innate or learned (see text for more details). R=reliable cue, D=detectable cue, HIPV=herbivore induced plant volatiles. (Takemoto *et al*., 2016)

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