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Role of Tritrophic Interactions in Pest Management

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SUMMARY

The physical, morphological, physiological and chemical characteristics of plants interact with the parasitoids and predators of insects by influencing their host seeking ability and affecting the efficacy with which they locate and utilize hosts. Trichomes are usually implicated in the second trophic level by increasing pest mortality. Indeed, trichomes affect natural enemies either by direct contact or indirectly by positively affecting the phytophagous prey insect.

INTRODUCTION

Interactions among host plants, insects and their natural enemies (parasitoids and predators) is called Tritrophic interaction. There are two type of tritrophic interaction, intrinsic defense and extrinsic defense. Intrinsic defense, it mean when the plant alone produce defense through physical means or through production of chemicals or both it is called intrinsic defense. Extrinsic defense, it mean when the natural enemies of insect pests benefit the host plants by reducing the pest abundance is called extrinsic defense. The physical, morphological, physiological and chemical characteristics of plants interact with the parasitoids and predators of insects by influencing their host seeking ability and affecting the efficacy with which they locate and utilize hosts. Plants provide nutrition to the natural enemies in the form of pollen and nectar. Insects such as aphids and whiteflies which secrete honey dew attract ants which also keep herbivores away.

The resistant varieties play an important role in;

1.Increasing the searching behaviour of natural enemy.
2.Decreasing the vigour of the herbivorous insect so that it is easily attacked.
3.Delays the development of the insect so that it is more exposed to natural enemy.

Floral volatiles benefit plants by attracting pollinators and benefit insects by serving as nutrition and mate location sign posts. Floral scents attract or arrest potential predators and parasitoids of herbivores. Many such natural enemies are carnivorous only as larvae; as adults they require nutrition from flowers. Sugar rich extra floral nectaries and protein and lipid laden food bodies are thought to attract natural enemies. It has been noticed that wild cherry and catalpa trees time extrafloral nectar production to coincide with susceptible periods of herbivores. Plant pollen and nectar increase the life spans and fecundities of many parasitoids and predators, fostering greater herbivores mortality.

Chemical Factors

Toxins present in plants are taken up by herbivores and these provide defense against their natural enemies. Examples; Monarch butterfly sequesters cardiac glycosides from milk weed plants so that it becomes distasteful to predatory birds. Aphid, Brevicoryne brassicae uses sinigrin as cues to find host plant but its parasitoid, Diaeretiella rapae uses allyl isothiocyanate to find host habitat and then host. Volatile compounde released by the molases grasse when intercropped with maize stimulates the parasitization of Chilo partellus by Apanteles sesamiae on maize.

Physical Factors;

Leaf toughness slow the larval development of Pierid butterfly and thus exposing them to natural enemies for longer period. High rate of parasitization is recorded to moderately resistant varieties of pigeonpea which have fine epidermal hairs. The searching behaviour of Trioxys indicus (parasitoid of aphids) is influenced by pubescence of host plants.

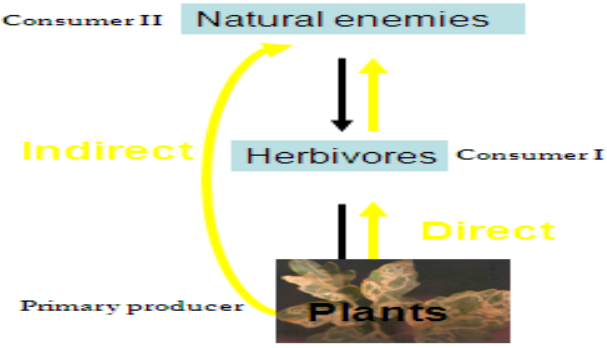
Mechanical Defenses;

Plants have many external structural defenses that discourage herbivory. Depending on the herbivore's physical characteristics (i.e. size and defensive armor), plant structural defenses on stems and leaves can deter, injure, or kill the grazer. Some defensive compounds are produced internally but are released onto the plant's surface; for example, resins, lignins, silica, and wax cover the epidermis ofterrestrial plants and alter the texture of the plant tissue. A plant's leaves and stem may be covered with sharp prickles, spines, thorns, or trichomes-hairs on the leaf often with barbs, sometimes containing irritants or poisons.

Tri-trophic interactions:

As well-known, plants recruit natural enemies to protect them from herbivores through herbivore-induced plant volatiles when plants are damaged by the herbivores (De Moraes et al., 1998; Arimura et al., 2005).

Natural enemies have to utilize different inforchemicals to locate the appropriate host plants and host prey in their whole life span (Vinson, 1976).



Conclusions:

Beside the beneficial impact of their volatile chemicals on infesting pests (Ecole et al. 2001), trichome-based natural resistance of tomato plants offers a potential approach to reduce pesticide use (McKinney 1938). Trichomes are usually implicated in the second trophic level by increasing pest mortality, as demonstrated within numerous host plant models including tomatoes and potatoes. For example, the glandular trichomes of the wild potato species, Solanum berthaultii Hawkes, deter oviposition and affect other important performance parameters of the potato tuber moth, Phthorimaea operculella Zeller (Lepidoptera,Gelechiidae) (Malakar and Tingey 2000). Plant surfaces covered densely with trichomes are not suitable for both hoverfly female and larva foraging. Broad beans, V. faba, have been largely used in the study of the oviposition behavior of hoverflies, demonstrating its suitability for aphidophagous predator (hover fly) within pest management strategies. The attachment and locomotion of the predatory larvae of E. balteatus is compromised on solanaceous plants densely covered with glandual trichomes, particularly on L. esculentum cultivars. Therewith, larval mobility and subsequent aphid accessibility are decreased.

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