*General Article*_____ *Chapter –22*

Insect-Plant Interactions: The Role of Phytochemicals

*Neha Pandey, *Kiran Bharti, and Neelam Diwan*

Abstract

Plant-insect interactions are mediated by phytochemicals. Primary and secondary plant metabolites have an impact on insect herbivores and pollinators. In nature, insect herbivory is ultimately controlled by forces influenced by plant phytochemicals, such as the production of toxic phytochemicals that inhibit, toxify, or even kill herbivores that have consumed plant tissues, or the production of information-rich chemical cues that attract herbivore enemies or that modify insect susceptibility to pathogens. Different phytochemicals play varied roles in insect-plant interactions and their role should be understood in detail.

KEYWORDS: Insects, Phytochemicals, Plants, Herbivory

[1]Abu Dhabi Waste Management Center, Tadweer, United Arab Emirates.
[2]KLDAV PG College, Roorkee– 247667, Uttarakhand, India.
[3]GBPUAT, Pantnagar, Udham Singh Nagar, Uttarakhand, India.
Email-Id: dr.kiranbharti.botany@gmail.com

Introduction

Phytochemicals are naturally occurring compounds found in plants that play a significant role in insect plant interactions.Plants' ability to tolerate herbivores is based on both direct and indirect chemical defence. Plants can discourage herbivores by employing poisonous phytochemicals, on the other hand they can attract herbivore predators by emitting volatile organic compounds into the atmosphere. Insects, being majorly associated with plants have evolved mechanisms to cope or perceive the presence of these compounds.This article aims to provide an overview of the current knowledge on the interactions between phytochemicals and insects, focusing on their effects on insect biology, behaviour, and ecology.

Phytochemicals as Insecticides

Phytochemicals have been extensively studied for their potential use as insecticides. These compounds can act through various modes of action, including interference with insect feeding, growth, reproduction, and behaviour.

One of the most studied phytochemicals is azadirachtin, a compound found in the neem tree (Azadirachta indica). Azadirachtin has been shown to have potent insecticidal properties against a wide range of insect pests, including aphids, whiteflies, and caterpillars (Schmutterer, 1995). The mode of action of azadirachtin involves disruption of insect molting and feeding, as well as interference with hormone signalling pathways (Isman, 2006).

Other Phytochemicals with insecticidal properties include pyrethrins, rotenone, and sabadilla alkaloids. Pyrethrins are natural insecticides extracted from chrysanthemum flowers (Tanada and Kaya, 1993), and are commonly used in household insecticides due to their low toxicity to humans and pets. Rotenone, a compound found in the roots and stems of plants in the Leguminosae family, has been used as an insecticide for centuries (Liu et al., 2015). Sabadilla alkaloids, derived from the seeds of Schoenocaulon officinale, have also been shown to have insecticidal properties (Isman, 2006).

Phytochemicals and Insect Behaviour

Phytochemicals can also affect insect behaviour, influencing feeding, oviposition, and mating preferences. For example, some phytochemicals can act as feeding deterrents, reducing the likelihood of insect herbivory. These compounds can either be present in plant tissues or can be induced by herbivory, resulting in a phenomenon called induced plant resistance (Kessler and Baldwin, 2002).

Phytochemicals can also affect oviposition preferences of insects, leading to host plant selection. For instance, the presence of certain phytochemicals can attract or repel female insects from laying their eggs on a particular plant species (Bernays and Chapman, 1994). The phytonutrient limonene, which is found in citrus fruits, has been shown to attract fruit flies, while repelling other insect species (Liu et al., 2003).

Phytochemicals and Insect Development

Phytochemicals can also have significant effects on insect development, growth, and reproduction. Some phytochemicals can act as growth regulators, interfering with the

molting process and leading to abnormal development and growth (Gunning and Eastwood, 2000). Other compounds can interfere with insect reproduction, by acting as antifeedants, oviposition deterrents, or reproductive inhibitors (Isman, 2006).

Conclusion

Phytochemicals have significant effects on insects, including their potential as insecticides and their influence on insect behaviour and development. While these compounds have been studied primarily in the context of plant-insect interactions, their non-toxic nature to humans and potential as alternatives to synthetic insecticides make them an attractive option for pest management. Much work has been done, however, further research is needed to fully understand the mechanisms of phytonutrient-insect interactions and to develop effective and sustainable pest management strategies.

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