Ecofarming
e-Magazine for Agriculture and Allied Sciences
http://www.rdagriculture.in
e-ISSN: 2583-0791
Ecofarming Vol. 03(03): 265-268, 2023

Floral Resources

Plant Insect Interaction

Conservation Biological Control

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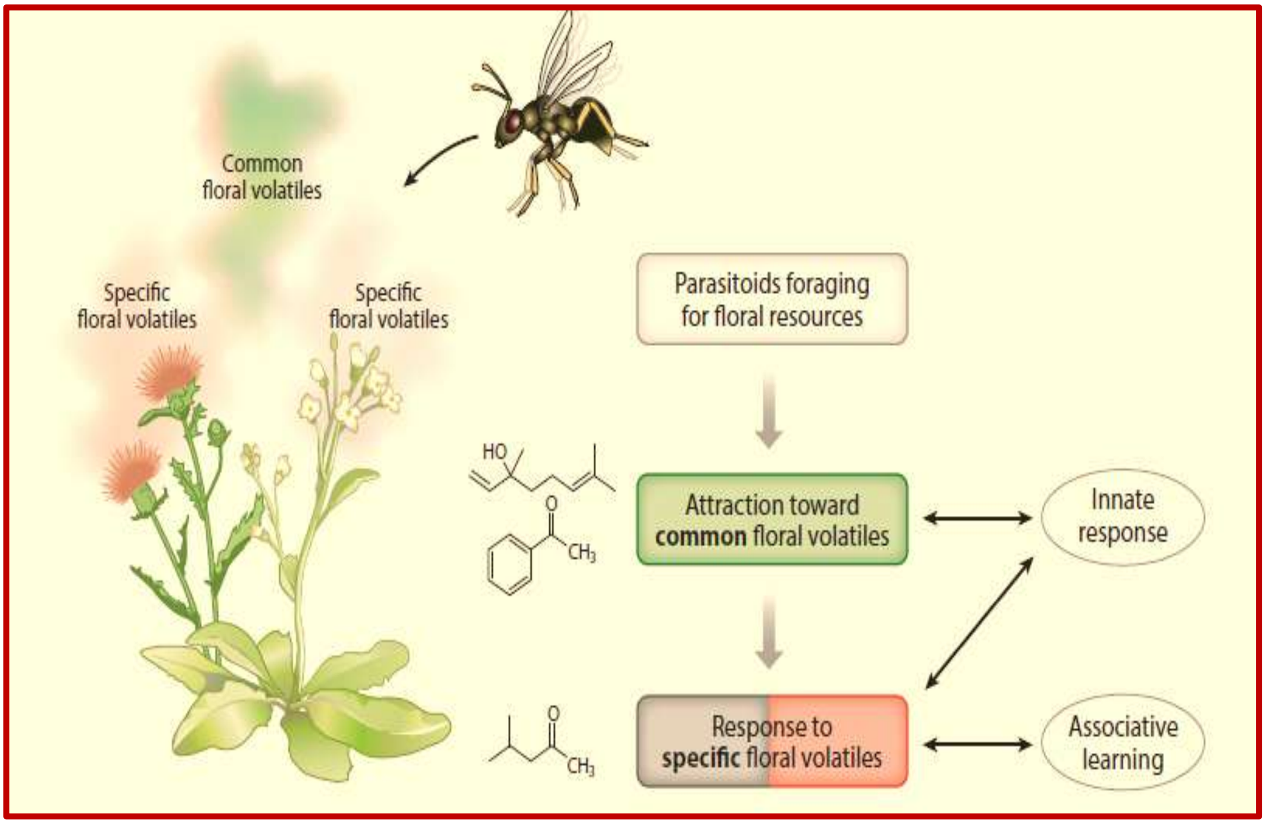
Received: **May, 2023;** ***Revised:*** **May, 2023** ***Accepted:*** **June, 2023**

Introduction

In recent decades, a great deal of research has concentrated on how the interaction between landscape structure and the behaviours of both insect pests and their natural enemies can influence CBC. Conservation biological control (CBC) is a set of tactics and approaches that aim to sustain arthropod natural enemies of insect pests and improve their efficacy in crop habitats through modification of the biotic environment. Natural enemies of arthropods require two major kinds of resources to complete their life cycles in the compositionally complex agroecosystems that comprise several types of crops and/or non-crop plants with variable phenologies: food and a place to live. In simple agricultural environments, these two resources are frequently insufficient, therefore pest control may not be as effective as it may be. Consuming nutrients not obtained from the host, such as nectar from flowers, extrafloral nectaries, and/or hemipteran honeydew, has a positive impact on predator and parasitoid life history parameters. Resources provided by flowers help to attract natural enemies, but they can also be used by pests and hyperparasitoids, which could make the pest situation worse. Finding flowering plants that selectively draw natural enemies would therefore probably increase the effectiveness of biological control. Such plants should be very alluring to parasitoids, attracting them to them frequently and enhancing their fitness.

Chemical ecology: Floral odour Vs Parasitoids

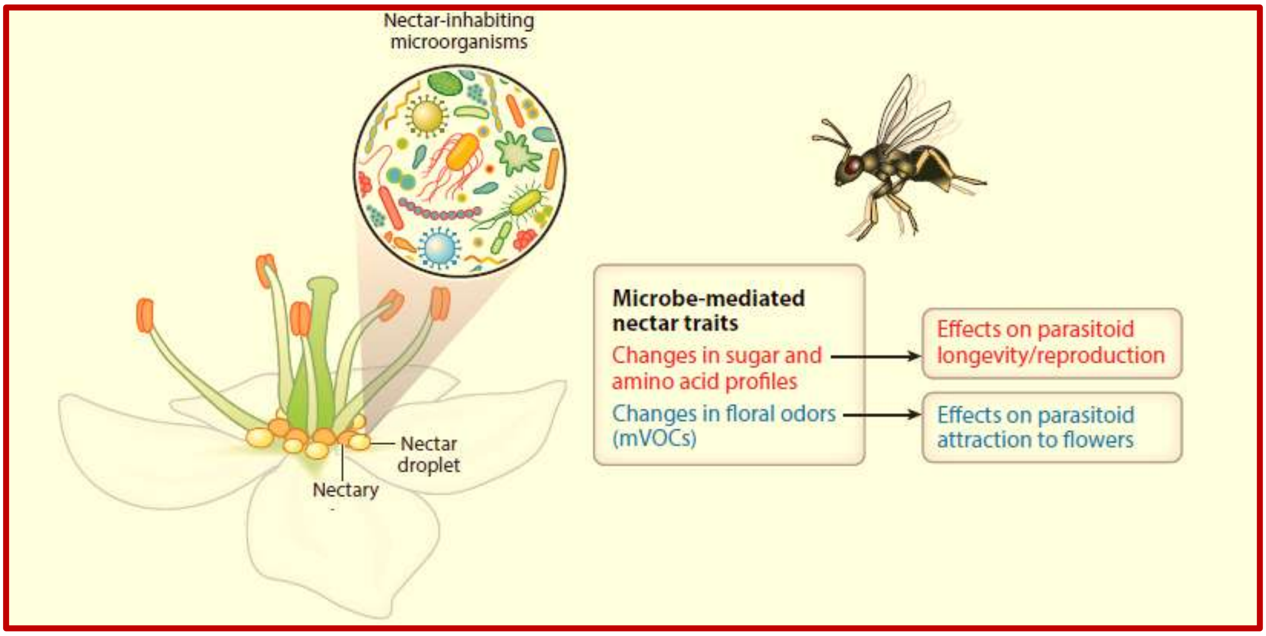
In an unfamiliar habitat, parasitoids should react to common floral volatile chemicals that are shared by several flowering species in order to increase their chances of discovering flowers and, consequently, food. This is because it is doubtful that parasitoids have evolved distinct innate preferences due to the great chemical diversity of volatile molecules emitted by flowers. Instead, it is anticipated that via repeated practice while foraging, parasitoids would hone their capacity to identify appropriate flowers. It has been demonstrated, in particular, that associative learning is a crucial factor influencing parasitoid choices when foraging for nutrition. For example, wasps have been found to be able to correlate a wide variety of volatile molecules with sugar-rich sites. Although floral odours are typically more diverse than those of foliage or fruits, vegetative plant parts such as foliage and fruits also release numerous significant families of odorants, such as terpenoids and volatile compounds found in green leaves (Fig 1). The capacity of naive parasitoids to react to suitable flowers is probably influenced by these various odours. Parasitoids responded to odors emitted by flower such as sweet alyssum, *Lobularia maritima,* oregano, *Origanum vulgare,* buckwheat, *Fagopyrum esculentum*, French marigold, *Tagetes patula*, and sweet basil, *Ocimum basilicum*.



(Fig 1. Response of parasitoids to floral volatile compound; retrieved from Colazza *et al.,* 2023)

Microbes associated with flowers play a supporting role in plant-insect interactions

Almost all animals and plants are colonised by microbes, and since they can influence plant-insect interactions in terrestrial food webs, microorganisms have attracted a lot of interest.



(Fig 2. Mechanisms: Flower-Associated Microbes; retrieved from Colazza *et al.*, 2023)

For instance, bacteria and fungi that promote plant growth can also produce systemic resistance against a variety of predators, including as diseases and herbivores. In contrast, microorganisms connected to herbivorous insects have the ability to control pathways that signal plant defences, pass off insect attack as a pathogen attack, or otherwise evade plant defences. It has been demonstrated more recently that symbionts associated with parasitoids can have cascading effects at the plant-insect interface. As an illustration, parasitoids can introduce symbiotic viruses into caterpillar hosts, which have been demonstrated to change the phenotypic of herbivores and, consequently, the way in which plants react to harm caused by grazing by virally-infected herbivores. The potential ecological impacts on CBC caused by bacteria have rarely been taken into account, despite the fact that microbes are becoming understood as hidden participants in the interaction between plants and insects repercussions for parasitoids and impacts of nectar-inhabiting microbes on flower nectar. Some nectar characteristics are altered by the metabolic activity of the microorganisms that live in it. Sugar profile and concentration, amino acid content that affects parasitoid longevity and reproduction, microbial volatile organic compounds (mVOCs), and parasitoid sensory responses to flowers are all altered in nectar (Fig 2). As a result, it is possible that the effects of blooming plants are modulated by bacteria rather from being solely attributable to the inherent characteristics of plants.

Conclusion

In order to increase the effectiveness of natural enemies of insect pests, flowering resources have been a major component of habitat management in agroecosystems. Our knowledge of the mechanisms by which the deployment of blooming resources results in successful or unsuccessful biological control, however, is still restricted. As a result, efforts to increase insect parasitoids in non-crop settings have yielded inconsistent results. Understanding how insect parasitoids identify flowering resources and which chemical compounds they use can provide fundamental insights for CBC strategy improvement.

Reference

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