Editorial

Practices to Conserve Pollinators and Natural Enemies in Agro-Ecosystems

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Introduction

Intensive agriculture has put great pressure on populations of beneficial arthropods such as natural enemies and pollinators, especially through adverse effects of pesticide use and the impact on resources in the agricultural landscape, i.e., the reduction of suitable habitats for foraging and nesting sites. The main associated consequences include the decline of biological diversity and delivery of the ecosystem services of biological control and pollination; as a subsequent result, the sustainability of agro-ecosystems is undermined [1–9].

Sustainable agronomic practices such as management of field margins and mid-field strips with selected flower plants, cover crops, banker plants, uncultivated areas (set aside), headlands, and hedges can create suitable habitats that provide food and shelter to pollinators and to natural enemies of insect pests in disturbed agro-ecosystems [9–21].

The successful establishment of such habitats requires a good understanding of the food-web theory with respect to functional plant–arthropod diversity, regulation of herbivore populations by manipulation of bottom-up and top-down effects, and crop pollination. Multiple criteria should be considered regarding the selection of plant species for the semi-natural habitats, such as their soil/climatic requirements, growth habits, flowering periods, nectar and pollen production, and flower structure; their potential to become weeds and threaten crop productivity and native flora biodiversity; and finally the tri-trophic interactions between the plants, pests, and target beneficials.

The spread and possible dominance of a single or only a few plant species would have a direct impact on the desired insect communities in respect to functional biodiversity. Indeed, a narrow plant species selection could support conservation of a certain pollinator group or species in the target area [12,13,22]. In the study by Carvell et al. (2007) [22] a legume-based pollen and nectar flower mix targeted to enhance bumble bee populations in the U.K. could quickly provide a highly attractive forage resource for bumble bees, including rare long-tongued species, whereas a diverse mixture of native wild flowers could attract more of the shorter-tongued Bombus spp. and provide greater continuity of forage resources, especially early in the season. In the case of natural enemies, it is widely recognized that increasing biodiversity per se is no guarantee of pest suppression [23]. In general, the key to effective biological control may be tactics that enhance the relative abundance of the most effective natural enemies within the community of natural enemies [24]. Communities are usually characterized as having one or a few species which are relatively abundant (numerically dominant), while the majority of the members of the assemblage are relatively scarce. Moreno et al. (2010) [25] suggested that the success of management strategies by conservation biological control may be dependent on the identification of both highly abundant and scarce natural enemies to determine which assemblage is likely to work best. Nevertheless, the established plant species could possibly attract herbivorous pest species for the crop, higher-order predators/hyperparasitoids, or plant diseases [26].

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Specificity on flower species as well as interactions between pollinator species at food searching, especially between managed honey bees and wild bees, are also aspects to be looked at in their habitat creation. Specificity on one or a few particular plant species is an attribute recognized in many insect pollinators when visiting a given foraging bout because floral consistency reduces handling time [27–30]. However, the fidelity between the pollinator species and plant species from one year to the next can be affected by many parameters such as the degree of specialization of the pollinator species (oligolectic or polylec...
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