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The importance of native flora in orchards

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Abstract

South Tyrolian apple production is a connected monoculture with potential to stabilize biodiversity by creating floral areas. This flowering surrounding is important for insects which secure pollination service as well as attend pest control. Due to anthropogenic changes and missing habitats, the pollinating species suffer from homogenisation what causes pollen limitation. Therefore, a flowering surrounding of orchards is imperative. Even if seeds of non-native species are lower in price and higher in availability, those plants show a lack of adaptation and could even become invasive alien species. For these reasons, autochthonous forb species with ecotypes from the respective region should always be preferred in terms of maintenance of functional biodiversity.

Keywords: wildflowers, functional biodiversity, agroecosystem, apple, wild pollinators

Thematic background

Apple production is one of the most important economical drivers in the North of Italy. On a surface of more than 18.000 connected hectares almost one million tons of apples are produced every year in South Tyrol, thereof about 10% is organic. Concerning the agricultural structure, one farm cultivates on average two to three hectares (Südtiroler Apfelkonsortium). This fact leads to a great potential of measures in the semi-natural part of the agroecosystem: the interrow and the margin area. Native flower stripes with genetic ecotypes referring to the region of sowing, could help to delay biodiversity loss and the decrease of insect abundance as well as their homogenisation in species recently described as “Insect Decline Syndrome” (Rabitsch & Zulka, 2024). Nevertheless, for the agricultural practitioners there is not always comprehension to bring back insect diversity in orchards for fear of pests, among other reasons. In the words of Moonen and Bàrberi (2008), “The presumed need to maximise biodiversity to increase ecosystem functioning is contradicted by the fact that often few dominant species already guarantee ecosystem functioning.”

Functional biodiversity

Malus domestica Borkh. is part of the Rosaceae family which is characterised by dependency on pollinators because of self-incompatibility. A good pollination service by insects is likely to increase the fruit quality, e.g., the seed set as well as the weight and the width of the fruit. Globally seen, apple pollination is mainly done by *Hymenoptera* and *Diptera*, but also *Lepidoptera*, *Hemiptera* and *Coleoptera* can be found on apple blossom. In a worldwide review, Pardo & Borges (2020) showed that honeybees (family *Apidae*) are more abundant in apple orchards than wild bees which are mainly part of the families *Andrena*, *Bombus*, *Halictus, Lasioglossum* and *Osmia*, all belonging to the order *Hymenoptera*. Besides, syrphids (genera like *Dasysyrphus*, *Episyrphus*, *Eristalis*, *Eupeodes*, *Helophilus*, *Platycheirus*, *Rhyngia* and *Syrphus* – all *Diptera*) are of a certain significance to apple pollination as well as pest control because the larvae feed on aphids.

Different to dominant managed honeybees, whose hives can be brought to the next bee pasture, adults of wild bees and syrphids, which forage locally on pollen and

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nectar, are dependent on flowering surrounding of the orchard for their entire life cycle. In a global study, Leclercq *et al.* (2023) showed that wild insect diversity is affected by multiple impacts: (1) oligolectic genera suffer from a lack of flowers they are specialised on what is bound to lead to homogenisation or filter on species richness, (2) the exposition to pesticides before or after apple blooming has a negative impact on reproduction rates due to lower flower visitation and less pollen collection, (3) widely spread managed and/or domesticated bees and their global dominance in apple orchards are competitive in wild insects' ever-decreasing nectar and pollen resources and spillover of pathogens is possible. These factors drive the homogenisation of pollinating species abundance – especially for wild bees – and lead to the vulnerability of this natural service.

Pollination is not only important for cultivated plants, but also for wild species. Those are jeopardized in two ways: land-use increase by anthropogenic change and the massive decline in insect populations due to climate change and poverty of habitat and food. This situation causes a pollen limitation because of volatile visitation of pollinators. Bennett *et al*. (2020) wrote: "Plants only pollinated by one pollinator taxon have higher PL [pollen limitation] than those pollinated by few or many pollinator taxa". As a consequence, we find ourselves in a genetical depletion on the co-evolved mutualism between flowering plants and their pollinators.

Native vs. non-native

This decrease of transmitted information is urged by putting seeds of foreign origin and/or cultivated selections into circulation (Mainz & Wieden, 2018). One of the main reasons could be the need to increase the feed value of forage plants in areas of dairy farming due to the lower price and the easy availability of seeds of foreign provenance. Schmidt *et al.* (2020) mentioned costs of 70€ per hectare for a low-diversity standard seed mixture compared to 600€ per hectare for a high-diversity native plant mixture. The higher price for the autochthone seed mixture is explicable by the time-consuming and labour-intensive propagation. But, in long-term comparison the price can be balanced: the seeds of the native wildflowers establish and persist better. As well, they develop a higher cover, higher abundance and higher diversity compared to non-native forbs because of the lack of adaption to the abiotic and ecological conditions.

In the case of South Tyrol, there is no possibility to buy wildflower seeds with local ecotypes. Users are forced to acquire seeds of wildflowers from neighbour regions or countries. Those seed mixtures are called autochthonous or native, too, but their genetics are adapted to the respective region and environment.

Mainz & Wieden (2018) explained the consequences: "Many of the so-called wildflower mixtures contain ecotypes from around the world or even completely foreign species and therefore conceals risks, for example, of displacing indigenous species and smuggling in invasive neophytes." One floral example of an easy establishment into wild (in a casual, unstable way) by flower seed mixtures is bright reddish-purple *Malva sylvestris ssp. mauritiana*, which is crossing with the autochthone, light coloured *M. sylvestris* (Mainz & Wieden, 2018). It is important to know that only invasive alien species (IAS) endanger in an ecological and economical way. Main risks are the suppression of native species or human health hazards (Salchegger *et al.*, 2023). *Solidago canadensis* is an example of an IAS with tremendous negative effect on plant diversity. It spreads by itself at the edges of orchards or at banks of irrigation channels. Moroń *et al.* (2009) showed "that wild bee (the most important pollinator group) abundance and diversity is negatively affected by goldenrod." It is suspected that *S. canadensis* could pollute pollen or that wild pollinators could only discern native plants

as food plants. But despite this, the strongest impact is the inhibition of germination of autochthone forbs because of shadowing (Moroń *et al.*, 2009).

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