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Editorial: Pollinators: a network to life

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Editorial on the Research Topic
Pollinators: a network to life

This Research Topic of Frontiers in Bee Science is the result of the twelfth symposium on pollination of the International Commission of Plant Pollinator Relationships. The Symposium was held at the Kirstenbosch National Botanic Gardens between 16-20 October 2023. There were 54 presentations with five plenaries, and 11 posters. The 72 delegates collectively represented 22 countries. Forty-three of the delegates were African, 21 were students, and there were four South African citizen scientists. Thirty-nine of the delegates were women and fourteen student bursaries were awarded. Below, we present a background to, and an overview of the works presented at the symposium, along with an introduction to the studies in this Research Topic. The book of abstracts is available through the IPCCR website.

Pollination is an evolutionarily complex matter that is responsible for much of the magnificent diversity of floral traits. When self-pollination is limited, pollination needs to involve a vector to achieve pollen transport and deposition between individual plants, i.e. wind, water or animals. Animal vectors service 80% of all angiosperms. Selection causes plants to improve pollination by fine-tuning floral characters to a select group of efficient pollinators. The character traits under selection include flowering phenology and schedules of nectar and pollen production, in addition to morphology, color, and sensory and chemical properties of flowers and floral resources.

However, this is not the whole story: the consumption of floral resources by non-pollinating species is not in the plant's interest. Therefore, in addition to traits that attract effective pollinators, plants have evolved many mechanisms to exclude ineffective floral visitors, or 'freeloaders'. These include protecting floral resources by making them difficult to access or digest, and attracting pollinators without offering a reward, such as simulating the presence of food or a mate. In response, many floral visitors and pollinators have evolved digestive, sensory or morphological traits to overcome such defenses. Thus, flower and pollinator morphology are the outcome of pressures to improve mutualisms as well as those exerted in an arms race.

Pollination is also important in the context of conservation and food production. Pollinators are crucial for the survival of plant diversity, and they are involved in the production of 30% of our food and play a role in the reproduction of over 75% of the world's agricultural crops.

Considering these multifaceted aspects of pollination, along with its complex evolutionary interactions, it is not surprising that the symposium covered a wide range of topics. Understandably pollinator-plant interactions were a theme in nearly all sessions. Ten talks focused on more floral advertisement, and predominantly considered dynamics in color, structure, scent and flowering time. Those with an emphasis on pollinators were more case study oriented or investigated pollen dispersal and pollination syndromes. Adaptive evolutionary changes in floral cues due to pollinator shifts, the most frequently invoked driver of floral divergence, were a recurring subject in many talks. Such shifts can be the result of geographic plant migration, changes in land use or climate, pollution or pesticide use.

In crop pollination, apple, blueberry, pigeon pea, cotton, maize, soybean and avocado were specifically considered, and research included solitary bees, honeybees, and bumblebees. For the latter taxa, which are the most important managed pollinators, the health risks posed by pesticides, and protocols to test for health assessment were presented in detail, as was the involvement of the ICPPR Bee Protection Group.

The importance of maintaining pollinator biodiversity in pollination-dependent crops was repeatedly expressed during the crop pollination sessions and in the presentations addressing climate change and land use. The main strategies to achieve this include maintaining and protecting areas of natural vegetation. However, the cultivation of pollinator-friendly plants and trap nests can also help. It was noted that future research could consider flower morphology when developing new cultivars of blueberry and use genomic information to breed attractive lines.

Presentations on a variety of topics expressed the need for ongoing monitoring of pollinators. The approaches include involving citizen scientists, camera monitoring, pan traps and trap nests. Of particular note were techniques and tools for studying orchid pollination risk assessment. Documentation of pollinator diversity requires taxonomists - an increasingly rare breed. Online tools and educated citizen scientists can help, as can databases of genetic or genomic information for reliably identified species. However, funding for taxonomy is still needed to allow the recognition and description of new species.

Six of the presenters have submitted a paper based on their oral presentation to this Research Topic. In keeping with the theme of the symposium, they cover a wide range of topics.

Four of these papers investigate how different groups of bees can be supported. This is of particular importance in the face of habitat loss and the effects of extreme weather on floral resource availability. Two of these papers focus on the conservation of crop pollinators, and two investigate the conservation of wild bees. Sultana et al. investigated the effects of various cheap supplementary feed mixtures on honey bee colony maintenance and growth under drought conditions. Escobedo-Kenific et al. found that forest reserves help maintain pollinator diversity and pollination services in tropical agricultural highlands, while Kasongo et al. documented flower visitation networks in an agroforestry area in the Democratic Republic of Congo. Finally, Krahner et al. analyzed whether mulched wildflower strips in fallow vineyards have the potential to increase the species richness and abundance of wild bee species.

Two other papers investigate the effects of land use and plant diversity, and composition on the presence and seasonality of bees in urban and agricultural ecosystems. Floral species composition, size, shape and location of habitat patches were found to affect pollinator diversity in urban areas (Walker). However, the study of bees in coffee plantations by Casiá-Ajché et al. showed that the type of habitat, such as forest, grassland, or homestead habitats, affects pollinator species composition and diversity in agroecological regions.

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