Orchid research

For more than 20 years, intensive research has been conducted on flower scents at the Munich Botanical Garden. In nature, they play an important role in the communication between flowers and their pollinators. With the help of flower scents, pollinators find the flowers they are looking for. In this context, visual orientation usually has only a secondary function, for example a white flower color for nocturnal hawkmoths.

Ingenious reward system

In tropical Latin America, a special pollination system has evolved in which flower scents serve as a reward for the pollinator. These flowers are characterized by a rich production of fragrance: The perfumes spread on the surface of the flowers are eagerly collected by magnificent bees of the bee group Euglossini, which exist only in Central and South America. While almost only female bees are involved in the pollination process, the floral scents are picked up exclusively by males. The scents collected are central to the bees' reproductive biology. Scent-affording flowers, so-called "perfume flowers," have evolved in a wide variety of plant families.

Perfume flowers

Besides the orchids with about 800 species of this type, the families of the nightshade family, the Gesneria family, the spurge family as well as the Arum family are to be mentioned here. In contrast, there are almost 190 species of magnificent bees.

The different species of the magnificent bee males have species-specific preferences for the scent components they seek on the flowers. The "perfumed flowers" have taken

advantage of this behavior, attracting only one or very few bee species at a time to their flowers with equally species-specific scent compositions. In this way, a highly efficient pollination system develops, which finds its expression in extremely short-lived flowers. In contrast, the orchids that are preferably cultivated as houseplants, for example *Phalaenopsis* species with flowering times of often more than a month, are a consequence of ineffective pollination. A superlative of effective pollination, on the other hand, is the genus Coryanthes. With more than 100 grams, it has the heaviest flowers among the orchids. In nature, their flowers last only one morning in good weather. Immediately after opening, they are assiduously visited and pollinated by magnificent male bees.

Unique collection & research

A unique collection of these perfumed flowers has been assembled at the Munich Botanical Garden and is the subject of extensive research. The species, which are very rare in nature and, moreover, only bloom for a short time, can only be studied in a targeted manner in a botanical garden. Difficult access and the short flowering period in their natural environment – up to three days in the garden – would otherwise quickly limit such research. In the greenhouses, flowering can be waited for in order to collect the flower scent. To do this, the flowers that are still on the plant are hung in a jar. This is loosely covered, so the ambient air can be extracted. The scented air is passed through a kind of filter, in which the scent molecules remain. The procedure takes about two hours, after which the filter is rinsed with solvent, whereupon the fragrances collect in the solvent. Finally, this solution is separated by means of a gas chromatograph and the fragrances contained are identified.

The identification of many of the components contained in floral fragrances is a great challenge that cannot be

accomplished in the Botanical Garden alone. Around 1995, cooperation with the research laboratories of the perfume industry, which have the relevant skills and knowledge as well as sensitive analytical equipment, presented itself. This resulted in a mutual benefit: Botanical science was interested in elucidating fragrance compositions, and perfumers in ideas for new creations. Thus a long-standing cooperation between the Munich Botanical Garden and Dr. Roman Kaiser of Givaudan (Dübendorf, Switzerland) was born.