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Biodiversity of flower visitors: Enabling and threatening factors for the existence of species – rich communities

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Abstract

Many flower visitors have declining populations or are in danger of being extinct and lack of nectar and pollen supply is thought to be a main factor for threatening. For studying the effects of decreased resource supply for the autochthonous visitor community honeybees were introduced temporarily in a naturally honeybee-free valley. In the vicinity of the beehives nectar supply decreased significantly and also abundance and species number of flower visitors decreased. At times with low nectar supply these effects could be measured till distances of more than 800m from the beehives and they can be expected till more than 1500m. Similar effects can be expected in all cases, where competition between flower visiting insects increases. Examples are alpine meadows after end or change of management or alpine pastures after having been overgrown by shrubs. In these cases flower supply as well as species number of flower visiting insects decrease significantly, as can be shown for bumblebees and butterflies.

Keywords

biodiversity, flower visitors, resource partitioning, nectar supply

Project aims and duration

Aim of the project was to investigate the effects of decreased nectar supply for a subalpine flower visitor community. The project was realized in July and August 2001. Some comparison data is derived from other investigations about flower visitor communities in the Hohe Tauern, conducted by the author between 1994 and 2003.

Area of study

The study was conducted in the Mühlbachtal (Niedernsill, Salzburg, Austria). The area „Lärchach" in the „Fuscher Tal" served as comparison area. Both areas are situated in a South to North extending valley in an altitude between 1650 and 1750 m asl and show a similar vegetation. The nearest beehives were at least 5 km away from the study and comparison sites and were located at least 800 m below. All other flower ecological data, used for comparison purposes, also was obtained in the Fuscher Tal.

Methods

Two honeybee hives were placed in the Mühlbachtal at an elevation of 1650m asl from the end of June to the end of August 2001. In a distance of 10, 30, 90, 270 and 810m from the beehives study sites with an area of 80m² were marked. They were named according to their distance from the beehives as 010m, 030m etc. In the Fuscher Tal three comparison sites (named as site 1, 2, 3) of the same size were marked.

Nectar supply of eleven plant species regularly visited by honeybees and autochthonous insects was measured in the course of the day on both the study and comparison sites – or just beside in the same distance from the honeybee hives. Nectar quantity and concentration was measured every two hours between 9 am and 17 pm CET from ten flowers per species. The obtained data from 200 nectar measurements was analyzed statistically in a matrix of four daytime periods and the five distances from the beehives.

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Every ten days flower supply was counted once and all flower visits were censused every two hours in the same intervals as nectar measurements. Observations of flower visitation were conducted as standardized transect observations (40 m transect length, 2 m breadth of observation) at times without precipitation and temperatures above 12°C. Further methodic details are described in NEUMAYER & PAULUS 1999. For calculation of flower visitor abundance (both per 1000m² and per 1000 flowers or inflorescences) only observations of flower visiting individuals were evaluated.

Results

Nectar sugar supply

Nectar sugar supply of eight of the eleven investigated plant species was significantly lower at the study sites than at the comparison sites. Additionally in two further species it was significantly lower at the sites 010m und 030m than at the sites 270m und 810m (t-tests; *Calluna vulgaris*: p = 0,0072, *Senecio ovatum*: p = 0,0286). Diminution of nectar sugar supply increased in the course of the day and in the vicinity of the honeybee hives.

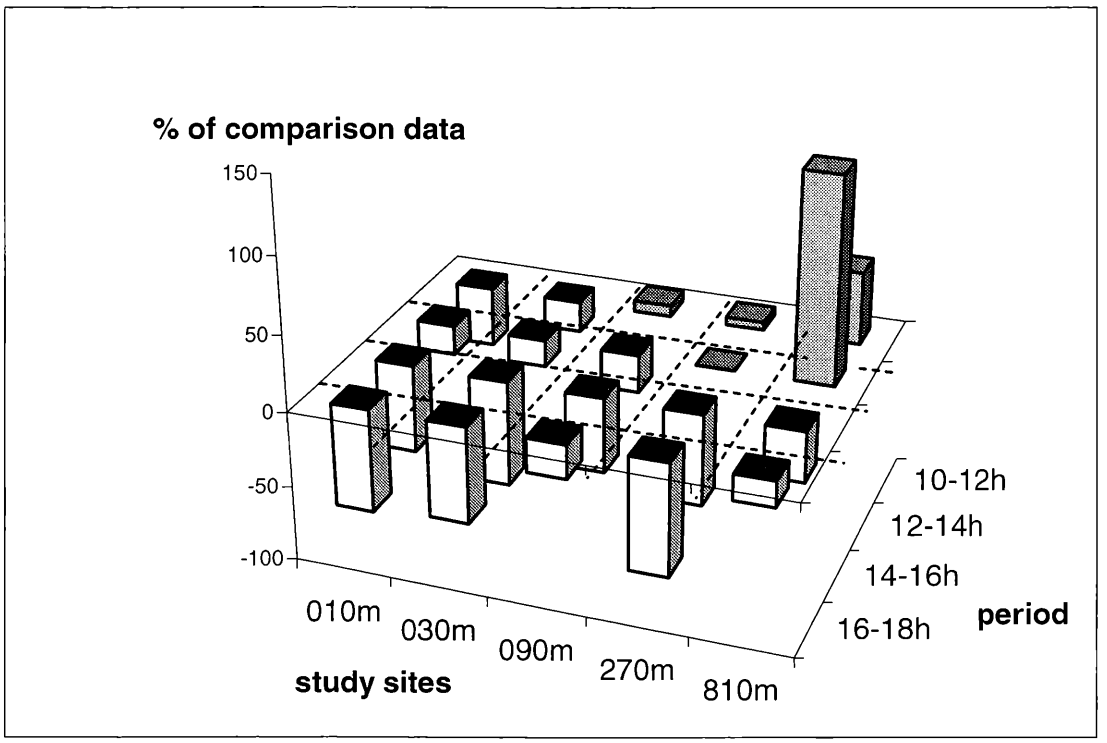

Fig. 1: Mean decrease of nectar supply of the investigated plant species in the course of the day and in different distance from the honeybee hives.
Nectar sugar supplies of the single plant species at the study sites were related to the comparison data from the Fuscher Tal, that were taken as 100%.

Flower visits

Until the 20th of July no differences of flower visitor abundance between study sites and comparison sites could be detected. From the 20th of July onwards flower visitor abundance at the study sites 010m and 030m was significantly lower than at the sites 270m and 810m (t-test, p = 0,0354). Between 12 and 4pm these differences increased (fig 2). Whereas this was a short distance effect, the decrease of flower visitor abundance was found at all study sites in the period between 1st and 20th of August. Also the number of flower visiting species of bees, hoverflies, butterflies and day-active moths (Apoidea, Syrphidae, Lepidoptera) was evidently lower in the vicinity of the honeybee hives (t-test: p = 0,0513). Flower visitor abundance showed a significantly positive correlation with species number (r = 0,9119;***).

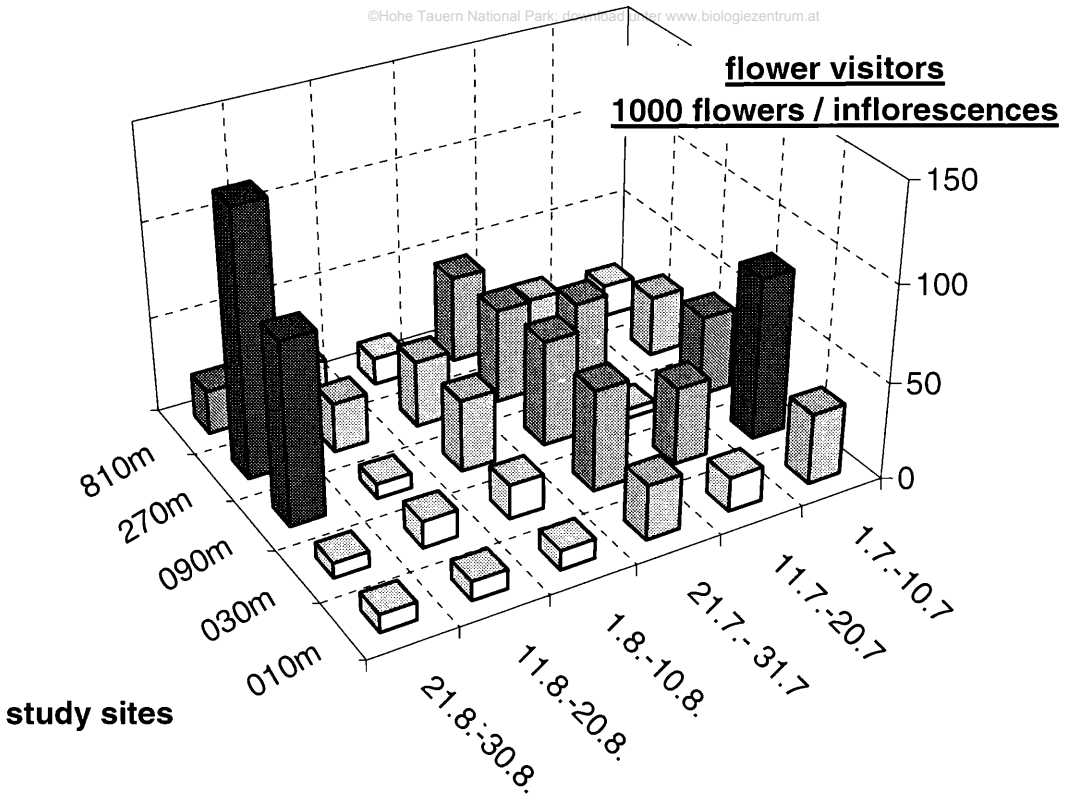

Fig. 2: Flower visits/1000 flowers or inflorescences between 12 and 4pm at the study sites in the course of the season.
Column color: white: 0-20 visits, light grey: 20-40 visits; dark grey: 40-60 visits; black: > 60 visits.

Discussion

Different strategies for the optimization of resource exploitation allow many species of flower visitors to coexist, although strict specializations are rare. Considering the fact, that the currencies in the trade between insect pollinated plants and flower visitors are – with few exceptions – only nectar and pollen, the importance of resource supply on the "common flower market" is obvious.

The introduced honeybees were able to reduce resource supply: In ten of the investigated eleven honeybee-visited plant species, they reduced nectar sugar supply significantly at least at distinct times of the day in the vicinity of the hives. This effect increased in the course of the day and with proximity to the hives (fig 2). Similar, although probably rather smaller effects can be expected to pollen supply (compare NEUMAYER & PAULUS 1999), but could not be considered in this study.

Also the autochthonous flower visitor community was affected increasingly by the honeybees during the course of the season: In the middle of August, when flower supply decreases rapidly, frequently it comes to a bottleneck situation in nectar and pollen supply (NEUMAYER & PAULUS 1999). Just at this time the decrease of flower visitor abundance reached all study sites and also the species number of visitors showed a minimum (unpublished data).

It is of importance for nature conservation, how far negative effects for other flower visitors can be expected from honeybee hives. Taking into account the mean flight distances of honeybee foragers, in times with low flower supply one can expect a significant decrease of nectar sugar supply and autochthonous flower visitor abundance up to distances of more than 1500m from the hive. Especially flower visitors with a small action area around the nest site as many wild bees are potentially threatened by honeybees.

Similar effects can be expected when flower supply decreases. For instance this is the case, when communities of tall herbs – that have a peak of flowering in August, when overall flower supply decreases, are destroyed. Other frequent examples with high relevance for conservation are alpine meadows, changing into pastures after giving up of mowing, or pastures becoming overgrown by shrubs. Indeed species number and abundance of bumblebees and butterflies decrease from alpine meadows over alpine pastures to shrub communities (NEUMAYER & PAULUS 1999 and unpublished data). Traditional management of alpine meadows enables a large, highly diverse and long lasting flower supply, that can by far not be reached by any other biotope type in mountain areas. So this anthropogenic biotope must be a main target for conservation.

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References

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