

# Diversity, foraging behaviour, and diel pattern of bees visiting flowers of *Aechmea nudicaulis* (Bromeliaceae) on Santa Catarina Island, southern Brazil

Simone Grohme<sup>1</sup>, Anne Zillikens<sup>1,2</sup>, Josefina Steiner<sup>2</sup>

<sup>1</sup>Zoological Institute, Univ. of Tübingen, Germany

<sup>2</sup>Dept. of Embryology, Federal Univ. of Santa Catarina, Florianópolis, Brazil

simone.grohme@uni-tuebingen.de

anne.zillikens@uni-tuebingen.de

steiner@mbox1.ufsc.br



Universidade Federal de Santa Catarina, Brazil



## Introduction

*Aechmea nudicaulis* is a terrestrially and epiphytically growing bromeliad. Tubular, yellow flowers and red bracts are signs of an ornithophilous pollination syndrome. However, bees and other insects can also be observed at the flowers. Therefore, we aimed to systematically record the spectrum of flower visitors and to document behavior and resource use.

## Materials and Methods

- examined bromeliad species: *Aechmea nudicaulis* (n=93)
- period: November 2005 through November 2007 (35 days)
- observations: between 5:00 - 17:00h (352.5 hours)
- habitat types: secondary forest and restinga
- recording flower visitors and their behaviour at the inflorescences



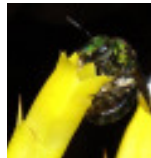
*Euglossa annectans*



*Trigona spinipes*



*Xylocopa artifex*



Augochlorine bee



*Aechmea nudicaulis*



*Bombus brasiliensis*



*Xylocopa brasilianorum*



Augochlorine bee

## Results

### Diversity of flower visitors and pollination efficiency

Among 29 recorded visitor taxa, bees were the most diverse group with 10 species: *Euglossa annectans*, *Bombus brasiliensis*, *Bombus morio*, *Xylocopa brasilianorum*, *X. artifex*, *Trigona spinipes*, *Ceratina* sp., *Augochlora esox*, *Augochlora* sp. and *Plebeia droryana* (34.5% of all taxa) (Fig. 1). Moreover, they accounted for an even higher proportion (78.3%) of all individual flower visits (Fig. 2).

Butterflies were the second diverse group (9 taxa), collecting only nectar.

Pollination experiments revealed that, besides hummingbirds (Trochilidae), the *Bombus*, *Xylocopa* and *Ceratina* species also pollinate flowers of *Aechmea nudicaulis*.

### Diel pattern & foraging behaviour

76,15% of the bee visits occurred between 6:00 - 11:00h (Fig. 3), the main period of pollen collection was 6:00 – 8:00h (Fig. 4). Thereafter pollen was not available any more but nectar was collected until 17:00h. Bees with long tongues such as *Euglossa annectans* and *Bombus brasiliensis* were able to collect nectar in addition to pollen while small bees like *Plebeia droryana* and augochlorine sweat bees could not reach the nectar at the bases of the narrow flower tube; they collected pollen only.

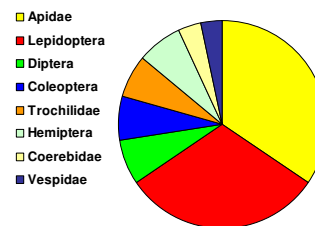


Fig. 1: Spectrum of flower visitors of *Aechmea nudicaulis* (n=29 taxa)

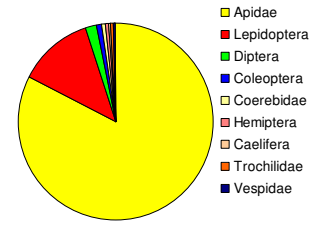


Fig. 2: Individual flower visits of different taxa on flowers of *Aechmea nudicaulis* (n=1361 visits recorded)

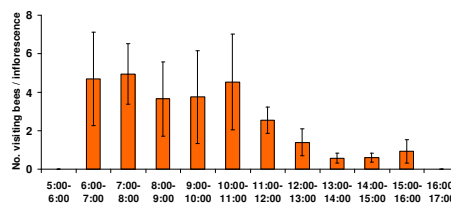


Fig. 3: Temporal pattern of bees visiting *Aechmea nudicaulis* flowers

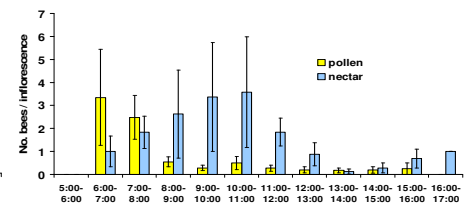


Fig. 4: Temporal pattern of foraging behaviour of bees on *Aechmea nudicaulis* flowers

## Conclusions

Our data reveals that, besides birds, the flowers of *Aechmea nudicaulis* attract a huge variety of insect flower visitors. Butterflies visited flowers of this bromeliad to collect floral nectar. Although the ornithophilous syndrome suggests hummingbirds as the main pollinators, the flowers provide rich food resources for various bee species. Some of them can also be considered as pollinators. This underpins the importance of bromeliads for tropical ecosystems, especially concerning bee-plant interactions.

### Acknowledgements:

We thank Maike Hering de Queiroz and Aldaleia Sprada Tavares for granting access to the study sites and Volker Schmid for help in the field. S. G. and A. Z. acknowledge financial support by BMBF (project No. 01LB0205) and CNPq within the Brazilian-German Program "Mata Atlântica".

