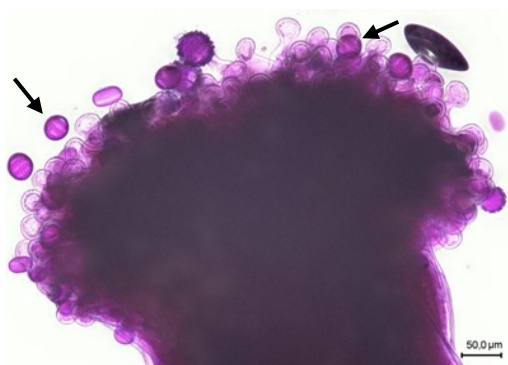


# CONTRASTING POLLINATION EFFICIENCY AND EFFECTIVENESS AMONG FLOWER VISITORS OF *MALVA SYLVESTRIS*, *BORAGO OFFICINALIS*, AND *ONOBRYCHIS VICIIFOLIA*

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Flower visitation is a commonly used parameter to describe pollination performances. However, not all flower visitors transfer pollen, and species differ in the amount of conspecific pollen transferred to stigmas. Quantifying pollination performances of flower visitors is thus needed for identifying appropriate pollinators for agricultural systems, interpreting patterns of specialisation and generalisation, and predicting ecological and economic consequences of pollinator loss or invasions.

We analysed conspecific pollen deposition on stigmas to determine the efficiencies of flower visitors to the plant species *Malva sylvestris*, *Borago officinalis*, and *Onobrychis viciifolia*. We used visitation frequencies of flower visitors to the studied plants to scale up single-visit pollen deposition to pollinator effectiveness (pollen deposition per hour).



Stigma of *Borago officinalis* with conspecific pollen grains (arrows).



*Bombus lapidarius* visiting one of the studied plant species, *Borago officinalis*.

Not all visiting bees were pollinators of the studied plants. Pollinators differed in their pollen deposition rate per single visit and bumblebees tended to be most efficient.

The most frequent flower visitors were also the most effective ones, namely *Apis mellifera* for *M. sylvestris* and *B. officinalis* and the *Bombus lapidarius* complex for *O. viciifolia*. For non-dominant pollinator groups, however, visitation frequencies contributed disproportionately to pollinator effectiveness. Hence, our findings emphasise the need to connect stigmatic pollen deposition with visitation frequencies for a meaningful estimation of pollination performances of flower visitors.