

# Master Thesis

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## Complementarity and redundancy of different pollinators on cucumber (*Cucumis sativus* L.) in Sulawesi (Indonesia)



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## Abstract

Seventy-five percent of the main global crops depend on animal pollination and are visited by a variety of flower visitors. It is therefore important to understand the behavioural interactions of different pollinating species on crop flowers and how the inter-specific interactions change pollination services. Different adaptations of pollinator species to the environment define niche differentiation. This also includes the complementary use of resources and can reduce the spatio-temporal variation of flower visitation. Species complementarity can also contribute to higher and more stable pollination services. In addition, redundancy of species reduces spatio-temporal variation due to a higher diversity of different service providers and stabilizes the pollination service against environmental changes.

In this study I examined functional traits of a flower-visitor community of cucumber (*Cucumis sativus*) in Indonesia. I specifically assessed the following hypotheses: flower-visiting species (1) have a complementary use of different flower heights, (2) have a temporal redundant development of their abundances (time of day) and (3) show a spatial complementary use of floral resources (flower visits on male vs. female flowers).

To address the hypotheses I observed flower visiting species visitors on three different flower heights, in three time levels from 8 am to 2 pm on male and female flowers of *C. sativus*. Open flowers were observed for 5 min and all flower visitors were noted. The plot directly was adjacent to tropical forest to guaranty a high flower-visitor diversity and abundance.

I found that the flower-visitor community was dominated by two social bee species: *Apis cerana* (67 %) and *Trigona* spp. (23 %). These two species showed a temporal redundancy with the highest abundances in the morning, decreasing over the day. This decrease of the main flower-visitors resulted in a significant decay of flower visits later in the day.

A spatial complementarity of the floral resource use was found with *Trigona* spp. preferring the male flowers and *A. cerana* the female flowers.

My study demonstrates that spatio-temporal redundancy and spatial complementarity of floral resource use occurs between flower visiting bee species but the extent of these interactions does not guaranty a spatio-temporal stable flower visitation over the whole day. The results show the importance of a diverse flower-visitor community for a stable visitation rate on crop flowers and in this way for crop pollination.

**Keywords: inter-specific interactions, wild bees, stingless bees, honeybees, crop pollination services**