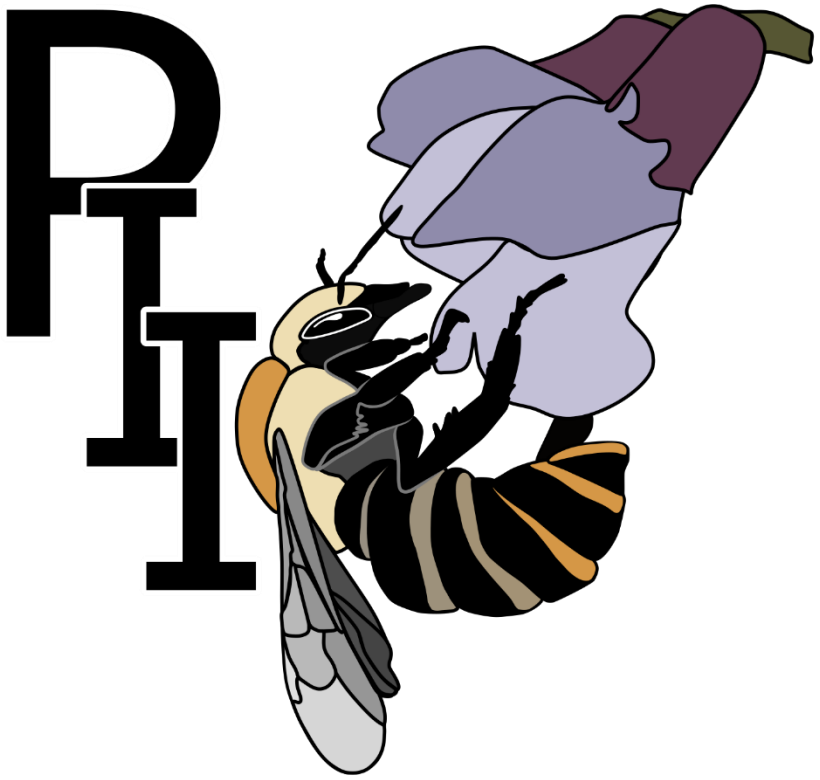
Dear Reader,

Here, we have collected several possible positions in our group, from projects to master thesis. For more information, please do not hesitate to contact the person responsible. Please note that we cannot consider AI-generated emails or applications.

Yours sincerely,

The Team of Plant-Insect-Interactions



Plant-Insect-Interactions

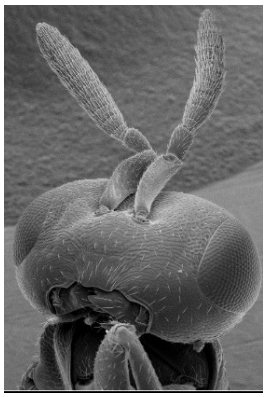
Project-, Bachelor-, or Master Thesis

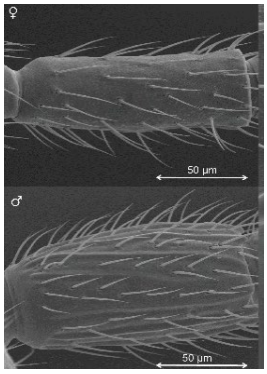
Plant-Insect Interactions – Evolutionary chemical ecology

Winter Semester 2025/26

Scanning electron microscopy to investigate antennal fine structures in parasitic wasps

Background:





The parasitoid jewel wasp genus *Nasonia*, encompassing four species, has become one of the **best-investigated** insect model systems to study **pheromone**-based **sexual communication** and **species recognition** behavior. However, although the **signaling part** of this communication system has been intensively investigated, the underlying **chemoreceptive mechanisms** are far less understood. In collaboration with Dr. Michael at the TUM School of Life Sciences Zoology Department, this project will investigate the chemoreceptive **fine-structures** ("sensilla") on the insects' antennae and assess **sex**- as well as **species-specific** differentiation in their **morphology**, **distributions** and **types**. This will allow for **valuable conclusions** on the **evolution of chemoreception** and how signaling molecules can be **differentially perceived** and **processed** according to sex and species in parasitoid wasps.

Methodological approach:

JSM-IT100 InTouchScope scanning electron microscope (magnifications from x5 to x300.000) will be used to analyze the insects' antennal fine structures.

Research question:

Are differences in the chemoreceptive fine-structures consistently and unambiguously quantifiable between the four *Nasonia* species and the respective sexes?

Time frame:

This project can be started year-round, start date flexible, project time can be adjusted according to the type of thesis, internship, "Forschungspraktikum" etc.

Requirements:

Self-sufficient, reliable and precise work ethic in the lab. Experience with handling insects and conducting morphometric and/or (electron) microscopic analyses would be beneficial.

Plant-Insect-Interactions

Contact:

Plant Insect Interactions, Evolutionary chemical ecology, TUM, Jan Buellesbach (jan.buellesbach@tum.de)

Project-, Bachelor-, or Master Thesis

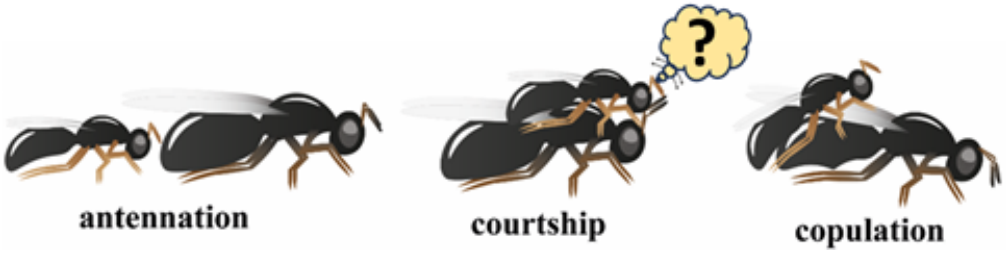
Plant-Insect Interactions – Evolutionary chemical ecology

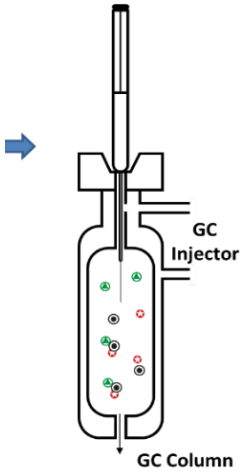
Winter Semester 2025/26

Characterization of a mouthpart aphrodisiac in parasitic wasps

Background:

The parasitoid jewel wasp **species complex** *Nasonia* is an excellent model system for studying **sexual communication**. Males of this genus mount the female wasps and perform a series of **characteristic headnods** for **courtship**, which usually triggers **female receptivity** and is followed by copulation. However, when the males have their **mouthparts glued**, female receptivity cannot be achieved. It has been hypothesized for decades that a **volatile male aphrodisiac/pheromone** is required to trigger female receptivity, though it has thus far eluded **detection** and **chemical identification**. With newly developed **sensitive detection methods** such as SPME on-fiver derivatization, we now have the unique opportunity to solve this almost 50 year old **chemical conundrum** and finally reveal this mysterious **signaling molecul**e playing such a vital role in **parasitoid reproduction**.





Thermal Desorption

Methodological approach:

SPME on-fiber derivatization to compare the headspace between control and male mouthpart sealed couples and detect minute differences in short highly volatile molecules, behavioral female receptivity assays with the identified candidate compounds.

Research question:

What pheromonal molecular structure triggers receptivity in female parasitoid wasps?

Time frame:

This project can be started year-round, start date flexible, project time can be adjusted according to the type of thesis, internship, “Forschungspraktikum” etc.

Requirements:

Self-sufficient, reliable and precise work ethic in the lab. Experience with handling insects and conducting behavioral experiments is desirable. Experience with analytical chemistry not required as this will be taught in the project, but some experience with data analysis through statistical programs such as R would be beneficial.

Plant-Insect-Interactions

Contact:

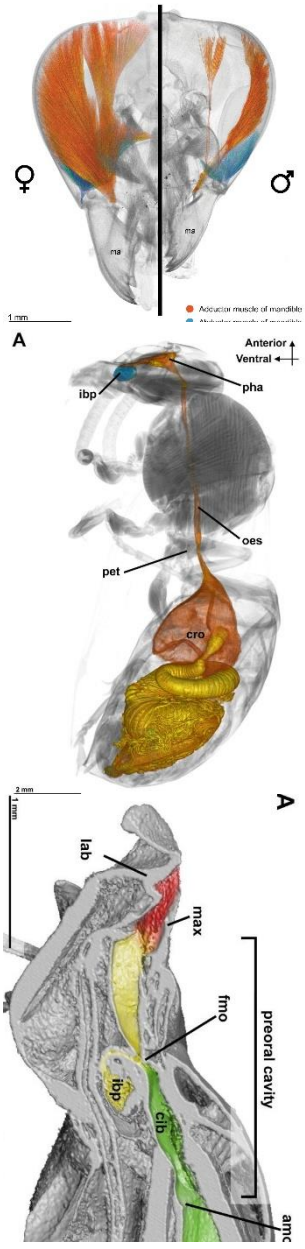
Plant Insect Interactions, Evolutionary chemical ecology, TUM, Jan Buellesbach (jan.buellesbach@tum.de)

Bachelorarbeit, Projekte

Plant Insect Interactions |

Wintersemester 2025

Bee Plant Pollution
Advances in Morphological Modeling



Background:

Recent advances in Artificial intelligence (AI) based methodologies are also rapidly manifesting in traditional biological research fields like Morphology. For many decades, analyzing three-dimensional morphological structures required labor intensive serial sectioning, concordant time-consuming image processing, and manually guided visual reconstruction. With more modern, specialized micro-computed tomography (CT) machines it has now become possible to not only efficiently automate these tasks, but also perform them non-invasively, allowing for multiple analyses of the same individual sample. However, work on the resulting CT Data leading to efficient 3D reconstructions is still time as well as labor intensive. Emerging AI-based machine learning methods have the potential to significantly optimize these processes, leading to faster and possibly more accurate results.

Methodological approach:

Assessment of already existing micro-CT Data stacks of a selection of insects with several methods including more traditional and modern AI based approaches. Comparison of the achieved results and evaluation of each methods efficiency, validity and accuracy

Research question:

Is the use of AI based micro-CT data analysis faster / more accurate / more efficient than traditional morphometric approaches?

Time frame:

This project can be started year-round, start date flexible.

Requirements:

Self-sufficient, reliable and precise work ethic. Affinity for digital work and novel software would be beneficial. A basic knowledge of Insect morphology would be useful as well. Experience with data analysis through statistical programs such as R desirable.

Plant-Insect-Interactions

Contact:

Plant Insect Interactions, TUM:
Kenneth Kuba (Kenneth.kuba@tum.de)

Master's Thesis (WiSe2025)

Plant Insect Interactions

The ecology of bats and bat-flower interactions in Curaçao

Background: Within the context of the EU-funded Butterfly Project, our group will conduct bat sampling in the Caribbean island of Curaçao in 2026, with the goal of collecting data on the interactions between bats and flowering plants on the island. Our project aims at expanding the database of plant-pollinator interactions in the EU, which also includes overseas territories such as the Dutch Caribbean.

Objectives: For this purpose, a field campaign will be conducted between March and June 2026. The campaign will include nocturnal fieldwork, netting, the processing and identification of bats *in situ*, and the collection of pollen samples. We are seeking a motivated Master's student interested in tropical ecology, plant-pollinator interactions, hands-on fieldwork, and bat biology and ecology to join us for fieldwork and data collection, which can be developed into a Master's thesis within our group. Although the project's focus is on flower-visiting bats, captures will potentially also include bats from other guilds, which also opens up the possibility of not restricting the thesis to flower-visiting bats.

Tasks:

- Setting up research plots and transects on the island, and performing nocturnal fieldwork in Curaçao, from March to June 2026.
- Capture, identification, and trait measurements of bats.
- Potentially, work in the laboratory in Freising, depending on the data desired for the thesis.
- Processing and analysis of ecological data derived from fieldwork (bat population, community, and interaction data).

Timeframe

- Start: early 2026, ideally two months before the trip to allow for preparations.
- End of fieldwork is late May or early June. End of the project and thesis submission is flexible.
- In the field station in Curaçao, ca. 40-60 h/week, flexible. Ca. 30 hours/week at Freising afterwards (flexible).
- The project may start before thesis registration if desired.

Master's Thesis (WiSe2025)

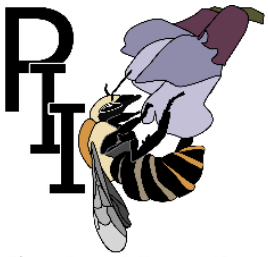
Plant Insect Interactions

We offer

- A unique opportunity to gain experience with fieldwork and ecological research in a Neotropical environment.
- An excellent research location with infrastructure to support researchers.
- Travel logistics and equipment, but funding for the trip may only be partially covered. Applying for external funding (e.g., TUM international grants) is highly encouraged to cover accommodation costs in the station.
- A vibrant and international working environment in our group at the TUM for writing your thesis.

Your profile

- Currently enrolled as a Master's student.
- Previous experience with fieldwork. Having performed nocturnal fieldwork is a plus.
- Ideally, some experience with ecology, zoology, bat research, or plant-pollinator interactions.
- Suitability for working in tropical conditions: interest in tropical nature, **yellow fever vaccine**, physical fitness, resistance, and problem-solving mind.
- Having a **rabies vaccination** to handle wild mammals will be necessary.
- Interested in learning and using community-wide statistical analysis. Experience with R is desired but not necessary.
- Flexible working hours. Availability for intense and extended fieldwork (ca. 3 months)
- Good command of English.
- An international driver's license is a plus, although not necessary.



Contact:

Plant Insect Interactions, TUM:
Ugo Diniz (ugo.diniz@tum.de)

Project, Bachelor- or Master Thesis

Plant Insect Interactions

Winter Semester 2025/26

Arthropod diversity on different flowering field types

Background:

Flowering fields are a popular scheme for ecological reassessment of agricultural land. Many studies report about their ecological use compared to other agricultural structures. However, little is known about the comparison between different arrangement methods. The project BlüDiv is comparing five different flowering field types with focus on the optimization of plant and insect diversity.

Methodological approach:

This summer we collected arthropod samples from pitfall traps. These samples will be identified in the lab via morphological traits (on order, family or species level, depending on the task).

Tasks:

The focus for the internship / thesis will be on one specific group within the trap samples (e.g. species identification of ground beetles or family identification of spiders) or a broad overview (counting and presorting on order level).

Time frame:

Earliest in November, approx. 6 weeks for internship; can maybe extended to a bachelor thesis

Requirements:

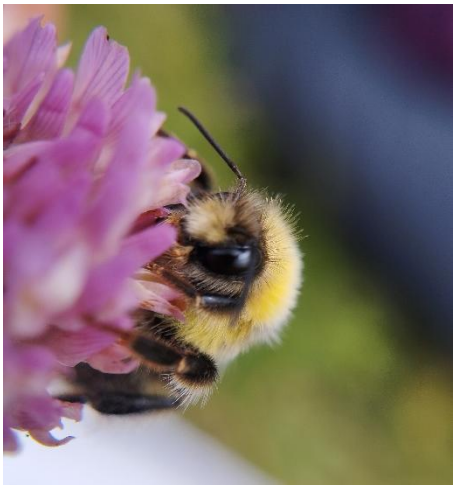
Self-sufficient, clean and reliable work in the lab, no statistical knowledge required, knowledge of a specific arthropod group (e.g. ground beetles) is beneficial but not necessary

Plant-Insect-Interactions

Contact:

Plant Insect Interactions, TUM,
Restoration Ecology, TUM:
Franziska Mück (franziska.mueck@tum.de)

Internships and master theses in the professorship for Plant-Insect Interactions



Our group studies the interactions between plants and insects. For one of our current projects – IntraFlor, we are looking for enthusiastic students who would like to look at the effects of varying **land use intensity on floral reward quality.** This leads to two separate projects, one on pollen sterol extraction and another on pollen grain size measurement. Of course, you can also add on to the topic, depending on your interests, we can decide together what suits you.

Start: Flexible

Your tasks include the following:

For sterol extraction project (thesis):

- Sterol extraction from pollen
- Analysing chromatograms
- Statistical analysis

For pollen grain measurements (internship):

- Using microscopy and ImageJ for pollen grain measurements
- Statistical analysis
- (if time permits – correlating size with pollen nutrient composition and other floral traits)

Your profile:

- Interest in botanical research
- Experience in lab work, or microscopy
- You should have experience or be willing to learn R

If interested, contact me by email. We can arrange a meeting to discuss your options in detail. We can also include plant pollinator interactions by including pollinator data.

The project dates are flexible. You are welcome to discuss your project duration with me.

Contact: vidisha.bansal@tum.de
Technical University of Munich – Plant-Insect-Interactions

Bachelor-, Masterarbeit

Plant Insect Interactions

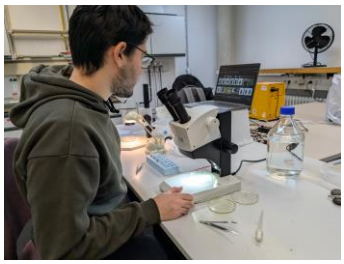
Wintersemester 2025

Land use effects on invertebrate diversity and food webs

Background: Biodiversity is shaped by organismal differences in the consumption, utilization and allocation of nutrients as well as the environment they are immersed in. In this project we aim to determine the impact of grazing and mowing in the diversity of organisms in grasslands and forests, focusing on invertebrates, largely insects and spiders. Many of these groups have never been addressed before and their status is not known, which makes it an exciting project to work on.

Methodological approach: The laboratory work consists on sorting samples of pitfall traps, window traps, swipe netting and targeted collection were collected in Spring-Summer 2024, by their taxonomy using microscope and taxonomical keys. After entering the count of each organism into an excel file we will be doing statistical analyses with R Software, in order to understand species distribution and abundances in a landscape context (landscape heterogeneity, land use, urbanization).

Research question: What is the effect of land use on the diversity and composition of invertebrate communities? Other related questions of your interest would be considered, as this large dataset will be valuable for addressing multiple questions on ecosystem services and landscape ecology.



Time frame: Starting now! The samples are there and they are waiting for you. You can start anytime.

Requirements: Musts: Motivation and responsibility. Willingness to work in the lab with sometimes dirty samples. Attention to detail. Love for nature and insects. **Advantageous:** Basics of R Software. Background in ecology. **We provide:** This is an unpaid thesis for TUM/LMU students. We provide training in different areas (e.g., taxonomical identification, statistics, communication), team work, a great working environment and possibility to be part of publications.

Plant-Insect-Interactions

Contact with a CV, motivation letter and, if you have, references:

Plant Insect Interactions, TUM:
Dr. Alejandra Parreno (alejandra.parreno@tum.de)

Bachelor-, Masterarbeit

Plant Insect Interactions

Wintersemester 2025

Effect of warmer temperatures during overwintering on the physiology of wild bees

Background: Climate change affects insects, special when leading to warmer winters and earlier springs. Little is known however on the mechanisms of those effects, including those on the physiology of organisms. Wild bees are already threatened by a number of global change drivers and changes on their overwintering patterns could be detrimental to their development and success in spring.

Methodological approach: We want to look for differences in fat consumption between wild bees of different species that have overwintered in a gradient of temperatures. We do that with chemical essays and statistical analyses. The bees are already there after an experiment with different temperatures last year, so the thesis would be based on lab work (e.g., GC-MS) and analytical work.

Research question: What is the effect warmer overwintering temperatures on the physiology of wild bees? Other related questions of your interest would be considered, as this large dataset will be valuable for addressing multiple questions on ecosystem services and landscape ecology.

Time frame: Starting now! The samples are there and they are waiting for you. You can start anytime from November 2024 onwards.

Requirements: Musts: Motivation and responsibility. Willingness to work in the lab with chemicals and following protocols. Attention to detail. **Advantageous:** Basics of R Software. Background in chemistry. **We provide:** This is an unpaid thesis for TUM/LMU students. We provide training in different areas (e.g., chemical lab, statistics), team work, a great working environment and possibility to be part of publications.

Plant-Insect-Interactions

Contact with a CV, motivation letter and, if you have, references:

Plant Insect Interactions, TUM:
Dr. Alejandra Parreno (alejandra.parreno@tum.de)

Bachelorarbeit

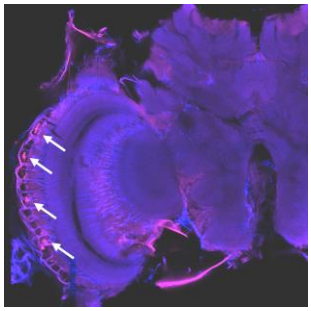
Plant Insect Interactions |

Wintersemester 2025 & Sommersemester 2026

Bee Plant Pollution
Effects of Plastic Particles on Bee Cognition

Background:

Micro plastics are constantly released in the air, and therefore can sediment on various surfaces like plants and flowers. As pollinators primarily depend on the floral resources, a pollution of these resources has possibly detrimental effects. First Hazard experiments concluded that plastic particles have negative effects on health and cognition of Honey bees. However, various plastic materials show different effects on Insects. Therefore, extensive results are lacking to estimate effects of Micro plastics overall.



Methodological approach:

In an easy to learn experimental setup we will test various combinations of micro plastics and their effect on the learning ability of bumblebees and possible further species, depending on the season.

Research question:

What is the effect of different micro plastics on the Cognitive abilities of Bumblebees.

Time frame:

Flexible, duration adjusted on the degree between 6 weeks up to 6 months.

Requirements:

Independent working is required. Preferably some knowledge on Insect handling. Basics of R would be good.

Plant-Insect-Interactions

Contact:

Plant-Insect Interactions, TUM:
Kenneth Kuba (Kenneth.kuba@tum.de)