PhD position in Evolutionary Ecology of Plant Defenses
at the Institute of Ecology and Environment in Paris

At the Ecosens department of iEES-Paris we investigate how insects perceive their environment through chemical information and different aspects in the ecology of plant-insect interactions. We employ a diverse range of techniques according to each question, including: olfactometry, wind-tunnel, electrophysiology, analytical chemistry, transcriptomics and bioinformatics. This PhD will focus on studying plant chemical diversity from a broad and integrative perspective and will be part of the doctoral school in biological sciences of Paris-Saclay University, one of the leading research universities in Europe. The aim is to merge the knowledge from different fields in ecology and plant biology to advance our understanding in the evolution of plant defenses with implications for evolutionary theory and agricultural applications. By using a statistical approach to analyze the existing information on chemical pathways and their differential effects on herbivores across the plant phylogeny, the student will uncover how plant chemical diversity evolves and is shaped by herbivores counteradaptation. They will also perform bioassays in transgenerational experiments to explore the insect counteradaptations to plant chemical diversity and their trade-offs.

Supervisors

The student will be supervised by Dr. Carlos Bustos a specialist in plant-insect interactions and biostatistical approaches and Dr. Philippe Lucas an expert in insect physiology. Both are researchers at the Ecosens department of iEES-Paris campus Versailles.

Research objectives

With this project we aim to discover how plant defense diversity has evolved and its consequences to herbivore counteradaptations by combining statistical approaches with experimental work. There are three main questions on this project:

1) How defensive compound diversity is maintained through plant evolution? We will test different hypotheses in the evolution of plant chemical defenses. In particular we will focus on analyzing whether molecular innovations with increased biological activity are more likely to be preserved. This will help to understand how biochemical pathways have been shaped by the interaction with herbivores and their counter adaptations in different plant families covering the plant phylogeny.
2) What makes a biochemical pathway inducible? Here we will analyze different biochemical pathways to know what are the components of the pathways that are necessary for defense induction by herbivores.
3) What are the transgenerational consequences of plant chemical diversity on herbivores? Here we will study how different blends of defensive chemicals affect successive generations and whether they cope better with diverse plant chemicals.

Research profile
-Master's degree in biology (specialty in evolutionary ecology or biostatistics)
-Interest in plant chemistry
-Proficiency in English (both oral and written)
-Experience in these areas desirable:

- Advanced biostatistics (R, Python, etc)
- Plant ecology
- Insect bioassays

-Located in France or neighbor countries (final interview on site)

Position details
This is a fully funded position for 3 years with social benefits. Work will be based at the Ecosens department located at the UMR INRAE Versailles within an international team and access to state-of-the-art facilities.

How to apply
Applications will be accepted until the 11th of April (23h59 the latest) but the successful candidate can be selected before this date, thus early applications are encouraged. The candidate will have to defend the project in June 2025, before a selection panel of the doctoral program at Paris-Saclay University (ABIES doctoral school). If the candidate is selected the PhD will commence in September, 2025.

Please send to the following documents in English to carlos.bustos@inrae.fr
-Motivation letter
-CV with 3 reference contacts
-Academic transcripts