

SYRPINTINE

Syrphidae plant interactions introducing next-generation sequencing techniques

DURATION
 15/12/2014 - 15/03/2017

BUDGET
 149.326 €

PROJECT DESCRIPTION

General framework and objectives

Hover flies (Diptera, Syrphidae) represent one of the major plant pollinator insect guilds. A case in point is the genus *Eristalinus*. However, little is known of their pollination biology and a major reason for this is that their taxonomy is poorly known. Yet, a reliable species identification is fundamental to study plant-pollinator interactions. Unfortunately, many hover flies cannot be identified unambiguously on morphological grounds. Modern DNA sequencing techniques (so called Next-Generation Sequencing or NGS techniques) are increasingly used to improve the taxonomy of insects.

Once the taxonomy of *Eristalinus* is improved, pollen recovered from the gut may be used to understand the diets of the different species. Morphological identification of pollen is time-consuming but NGS techniques may allow the identification of plants using short DNA fragments (DNA-barcodes), from pollen collected from the stomach, or other body parts, of the hover flies.

In this project, we will apply several NGS techniques to improve the taxonomy of *Eristalinus* and to evaluate how these techniques allow to characterize the diet of the different hover fly species. Specifically, the aims of the project are:

- To establish morphological and NGS protocols to identify Afrotropical species of the hover fly genus *Eristalinus*.
- To develop morphological and NGS protocols to identify plant species from leafs and pollen in S Benin.
- To characterize the diet composition of the different *Eristalinus* species in S Benin.

Methodologies

General

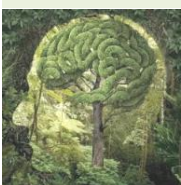
Hover flies and plant material will be collected during field excursions. All specimens, and pictures of them, will be retained as voucher specimens at various museums as recommended by the International Barcode of Life community (iBOL; <http://ibol.org>). Hover flies and plants will be preliminary identified using morphological identification keys and parts will be used for the molecular analyses to construct DNA barcode reference databases. Pollen collected from flowers will be used to create a palynological reference database. Plant pollen on hover flies will be removed with a small brush and the stomach of the hover flies will be dissected. From these pollen scanning electron microscope pictures will be taken and DNA will be extracted for molecular analyses and comparison with the palynological and DNA barcode reference database. There will be three Work Packages (WP) in the project.

WP1: The use of RAD-Seq to identify and delimitate Afrotropical species of the hover fly genus Eristalinus.

Restriction-site-associated DNA sequencing (RAD-seq) allows to genotype thousands of genome-wide single-nucleotide polymorphisms. So far, this technique has not been applied to hover flies. The data will be subjected to phylogenetic analyses that will allow to optimize the taxonomy of the genus *Eristalinus* and to re-evaluate the morphological characters that currently are used for their identification. The results of these studies will be used in an integrative taxonomic approach to improve the taxonomy of the genus.

WP2: The development of a target amplicon sequencing (TAS) protocol to identify plant species from fresh leaf and fresh pollen material.

Target amplicon sequencing (TAS) allows the simultaneous sequencing of different fragments. For each plant species, a selected number of individuals will be sequenced for *rbcl*, *matK*, ITS. This will allow to test to what extent DNA-barcoding can be used to identify flowering plant species from Southern Benin. Scanning electron microscopy will be used to characterize the morphology of the pollen. The results obtained from the DNA-barcode analyses will be compared to those from the palynological study to test whether the morphological examination of pollen is sufficient to identify the plant species.



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WP3: The testing of the TAS-protocol to identify plant species from pollen collected from hover flies of the genus Eristalinus.

Eristalinus specimens will be identified using the methodologies described under WP1. Pollen collected from external body parts and their stomach will be identified using the palynological reference database constructed as outlined in WP2. In addition pollen collected from the syrphids will be identified using the TAS-protocol developed in WP2. This will allow to reconstruct the diet of the different *Eristalinus* species.

Impact on the Research on Scientific Research, Community, and Policy

The project will be a first step in the understanding of plant-pollinator communities in southern Benin. Benin is predominantly an agricultural country and about 55% of the economically active population was engaged in the agricultural sector in 2000, which accounted for 38% of GDP that year. Small, independent farmers produce 90% of the agricultural products and as such agricultural activities are interspersed with (semi) natural habitat. The conservation of pollinator services by insects is thus of major importance for seed and food production in this area.

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