Ecole Doctorale - 104

Sciences de la Matière, du Rayonnement et de l'Environnement

EDSMRE

ESTABLISHMENT : Univ. Lille, Faculty of Sciences and Technologies

Laboratory(ies) of affiliation : UMR CNRS 8198 – Evo-Eco-Paleo, Univ. Lille/ UMR CNRS 8576 – UGSF, Univ. Lille

Scientific field, Speciality: Molecular and Cellular Aspects of Biology, Biology of the environment, organisms, populations, ecology

Thesis director: Touzet, Pascal, Professor, pascal.touzet@univ-lille.fr

Co-director: Cenci, Ugo, Associate-Professor, ugo.cenci@univ-lille.fr

Co-supervisor (non HDR): Chabi, Malika, Post-doc, malika.chabi@univ-lille.fr

Affiliate programme(s): CDP PIE

Plannedfunding: Obtained (100%)

Title of the thesis : Hybrid breakdown in Silene nutans: which plastid protein complexes are involved?

THESIS SUBJECT

Recent studies in evolutionary genomics have revealed the **central role of cyto-nuclear interactions in the emergence of new species** (Postel & Touzet 2020). Because plastid protein complexes have a dual origin (nuclear and plastid), mutations in one genome trigger selection in the other genome to maintain co-adaptation and functional plastids. The coevolution between plastid and nuclear genes involved in the same functional complexes generates strong patterns and could lead to hybrid breakdown between sister lineages as we demonstrated in the species complex *Silene nutans (*Postel et al. 2022). Silene nutans is composed of 4 genetic lineages. The hybrids between these lineages exhibit chlorosis leading to juvenile mortality pointing out to plastid-nuclear incompatibilities. Concordantly, the genomic analysis of both organellar genomes revealed a large number of specific mutations in plastid genes contrarily to the mitogenome (Postel et al. 2022, 2023).

The objective of the proposed PhD project is to identify which plastid protein complexes are functionally impaired in the inter-lineage hybrids. This will be conducted via an **interdisciplinary approach**, from in vivo fluorescence imaging (e.g. Johnson et al. 2009), biochemical methods (electrophoresis, native gels of proteomes from isolated plastids), mass spectrometry for the identification of plastid complexes, to the *in silico* prediction of the potential structural and functional impact of the observed modifications, all results being interpreted in the framework of evolutionary biology. This PhD project is part of the Cross Disciplinary Project PIE (Protein-Interaction-Evolution) (aiming to combine complementary approaches gathering plant physiologists, evolutionary biologists, structural biologists and biocomputer scientists to assess the role of protein-protein interaction in biological transitions.

References:

Johnson X et al (2009) A new setup for in vivo fluorescence imaging of photosynthetic activity. Photosynth Res 102 : 85-93.

Postel Z, Touzet P (2020) Cytonuclear Genetic Incompatibilities in Plant Speciation. Plants 9, 487

Postel et al (2022) Reproductive isolation among lineages of Silene nutans (Caryophyllaceae): a potential involvement of plastid-nuclear incompatibilities. Molecular Phylogenetics and Evolution 169, 107436

Postel et al (2023) The decoupled evolution of the organellar genomes of Silene nutans leads to distinct roles in the speciation process. New Phytol. doi: 10.1111/nph.18966

Expected date of recruitment: 01/10/2025

Contacts: pascal.touzet@univ-lille.fr; ugo.cenci@univ-lille.fr

Evo-Eco-Paléo

ugsf Unité de Glycobiologie Structurale et Fonctionnelle

Cross Disciplinary Projects Lille