Evolution Biologique et Ecologie

Olivier HARDY

Maître de Recherches FRS-FNRS

Localisation: Solbosch, bâtiment U, UC4.250
Avenue F.D. Roosevelt 50, B-1050 Brussels
Tel: +32 (0)2 650.65.85 - fax: +32 (0)2 650.24.45
Email: ohardy@ulb.ac.be
Webpage: http://ebe.ulb.ac.be/ebe/Hardy.html
Équipe : Génétique des populations et diversité des communautés végétales tropicales

Thèmes de recherche

Les recherches menées dans l'équipe s'intéressent aux processus impliqués dans la dynamique de la biodiversité, avec un intérêt particulier pour la biodiversité végétale des forêts pluviales africaines. Ces recherches relèvent principalement de la génétique des populations, la phylogéographie, la phylogénie et l'écologie des communautés.

Sujets de mémoire (in English)

Detailed subjects must be discussed with Olivier Hardy and his PhD students or postdocs; here are general topics, all related to the evolution, ecology and/or genetics of African plants.

1. Modelling the demographic history of African rainforest trees to understand the origin of their phylogeographical patterns. This subject consists in using a modelling tool (PhyloGeoSim) to simulate phylogeographic datasets under different scenarios describing the Central African rainforest cover changes during the Quaternary, and to confront these simulations with the phylogeographical patterns observed in African tree species. It requires a student comfortable with modelling approaches, statistical analyses and concepts in evolution. New genetic data could also be acquired if necessary. Documentation: Dellicour et al. 2014 (doi.org/10.1093/molbev/msu277), Hardy et al. 2013 (doi.org/10.1016/j.crte.2013.05.001), Dauby et al. 2014 (doi.org/10.1111/mec.12724), Demenou et al. 2018 (doi.org/10.1038/s41437-017-0035-0).

2. Understanding the regeneration cycle of African trees (seed and pollen dispersal, inbreeding depression, determinant of reproductive success) for their sustainable management. This subject aims to characterize the reproduction of African tree species using genetic markers. Genotyping adult trees and progeny sampled in large plots using microsatellite markers allows to conduct parentage analyses and deduce how far seed and pollen disperse, which traits determine the reproductive success of trees and whether selfing or inbreeding depression occur. Ultimately, the goal is to assess whether current forest exploitation practices could be improved to avoid overexploiting timber species. This subject requires laboratory work, possibly combined with a field mission in Central Africa to collect samples or conduct observations on pollinators or seed dispersers. Documentation: Monthe et al. 2017 (doi.org/10.1111/mec.14241), Duminil et al. 2015, 2016 (doi.org/10.1016/j.foreco.2016.08.003, doi.org/10.1038/hdy.2015.101).

3. Species delimitation and patterns of diversification in the African flora. Many subjects are available on particular taxa from the African flora. They typically involve sampling in

herbarium collections (possibly in the field for some plant models), possibly investigate morphological variation, and perform DNA sequencing or microsatellite genotyping on tens to hundreds of samples to improve species delimitation, establish phylogenetic relationships, estimate the timing of diversification and/or investigate the evolution of species traits or niches. Documentation: Ikabanga et al. 2017 (doi.org/10.11646/phytotaxa.321.2.2), Tosso et al. 2018 (doi.org/10.1016/j.ympev.2017.11.026), Daïnou et al. 2017 (doi.org/10.1007/s11295-017-1174-4).

4. Floristic diversity patterns in Western Central Africa: data analyses to better understand the biogeographic history of the forest and define conservation priorities for Gabon. The forests of western Central Africa host the highest floristic diversity across tropical Africa. Recently assembled plant databases covering this region allow studying the spatial patterns of diversity and endemism. This subject aims to characterize the most important territories for conservation and to test hypotheses related to the biogeographic history of Central Africa, notably in relation to Quaternary climate changes. This subject, in collaboration with Nicolas Texier and Tariq Stévart, will involve big data statistical analyses, possibly combined with complementary works to validate or complete the database by examining herbarium specimens. Documentation: Droissart et al. 2018 (doi.org/10.1111/jbi.13190), Sosef et al. 2017 (doi.org/10.1186/s12915-017-0356-8)

>4. Additional subjects are possible in the domains of DNA (meta)barcoding or invasive plants.

Quelques publications représentatives

Droissart V, Dauby G, Hardy OJ, Deblauwe V, Harris DJ, Janssens S, Mackinder BA, Overgaard A-B, Sonké B, Sosef MSM, Stévart T, Svenning J-C, Wieringa JJ, Couvreur TLP (2018) Beyond trees: biogeographical regionalization of tropical Africa. *Journal of Biogeography* 45:1153–1167. doi: 10.1111/jbi.13190

Demenou B, Doucet J-L, Hardy OJ (2018) History of the fragmentation of the African rain forest in the Dahomey Gap: insight from the demographic history of *Terminalia superba*. *Heredity* 120:547–561. doi: 10.1038/s41437-017-0035-0

Tosso F, Hardy OJ, Doucet J-L, Daïnou K, Kaymak E, Migliore J (2018). Evolution in the Amphi-Atlantic tropical genus *Guibourtia* (Fabaceae, Detarioideae), combining NGS phylogeny and morphology. *Molecular Phylogenetics and Evolution* 120: 83–93. doi:10.1016/j.ympev.2017.11.026

Piñeiro R, Dauby G, Kaymak E, Hardy OJ (2017) Pleistocene population expansions of shade-tolerant trees indicate fragmentation of the African rainforest during the Ice Ages. *Proc. R. Soc. B* 284:20171800. doi:10.1098/rspb.2017.1800

Ikabanga DU, Stévart T, Koffi GK, Monthe FK, Nzigou Doubindou EC, Dauby G, Souza A, M'batchi1 B, Hardy OJ (2017) Combining morphology and population genetic analysis uncover species delimitation in the widespread African tree genus *Santiria* (Burseraceae). *Phytotaxa* 321: 166–180. doi:10.11646/phytotaxa.321.2.2

Monthe FK, Hardy OJ, Doucet JL, Loo J, Duminil J (2017) Extensive seed and pollen dispersal and assortative mating in the rain forest tree *Entandrophragma cylindricum* (Meliaceae) inferred from indirect and direct analyses. *Molecular Ecology* 26: 5279–5291. doi:10.1111/mec.14241

Vleminckx J, Doucet J-L, Morin-Rivat J, Biwolé A, Bauman D, Hardy OJ, Fayolle A, Gillet J-F, Daïnou K, Gorel A, Drouet T (2017) The influence of spatially structured soil properties on tree community assemblages at a landscape scale in the tropical forests of southern Cameroon. *Journal of Ecology* 105(2):354–366. doi: 10.1111/1365-2745.12707