A chromosomal inversion in seaweed flies forms parallel latitudinal clines of frequency: An adaptation to thermal conditions?

Léa Nicolas*[1], Sylvain Glémin[1], Claire Mérot[1], Emma Berdan[2], and Pierre De Wit[3]

[1]UMR 6553 Ecosystèmes, biodiversité, évolution [Rennes] – Université de Rennes, Observatoire des Sciences de l'Univers de Rennes – France

[2]Bioinformatics Core, Harvard T.H. Chan School of Public Health [Boston] – États-Unis

[3]Department of Biological and Environmental Sciences, University of Gothenburg [Gothenburg] – Suède

Résumé

Chromosomal inversions which form blocks of linked genes are increasingly recognized for their role in intra-specific diversity and local adaptation. However, the mechanisms that control the spatio-temporal dynamics of these polymorphic supergenes and the evolution of their sequence remain poorly described.
The seaweed fly *Coelopa frigida* is a diptera distributed along the northern coasts of the Atlantic Ocean. Its genome includes several large polymorphic inversions, one of which showing a latitudinal gradient of frequencies along the American East Coast. This distribution suggests putative divergent selection on the haplotypes along the thermal gradients.

After confirming the presence of the inversion in European populations, we demonstrated the validity of a molecular marker to genotype the inversion in America and Europe. Subsequently, we demonstrated that the frequency of the inversion forms two parallel latitudinal clines between America and Europe, providing a strong argument in favor of adaptation to parallel environmental gradient.

By an experimental approach, we aimed to test the direct link between the inversion and phenotypes associated with the thermal stress response. First, traits involved in cold resistance (supercooling point, chill coma recovery time) were measured in populations sampled at different latitudes. Second, life history traits (development time, viability, fecundity, longevity) were measured at different thermal conditions to test the role of the inversion on fitness variation.
The results provide an empirical case of parallel distribution of an inversion polymorphism, supporting the prediction that this type of genetic architecture is possibly important in repeated adaptation along environmental gradients.

Mots-Clés: Chromosomal inversions, Local adaptation, Parallelism, Thermal gradient, Diptera

*Intervenant