An integrative study of host response to parasite: from molecular bases to phenotypic alterations

Eglantine Mathieu-Bégné*†[1,2,3], Olivier Rey[3], Julien Cucherousset[1], Lionel Méjean[1], Guillaume Mitta[3], Géraldine Loot[1], and Simon Blanchet[2]

[1]Evolution et Diversité Biologique (EDB) – Université Paul Sabatier (UPS) - Toulouse III, CNRS : UMR5174, École Nationale de Formation Agronomique - ENFA – Université Toulouse III Paul SabatierBâtiment 4R1118, route de Narbonne 31062 Toulouse cedex 9, France

[2]Station d'Ecologie Théorique et Expérimentale du CNRS à Moulis (SETE) – CNRS : UMR5321 – 2 route du CNRS, F-09200 Moulis, France

[3]Interaction Hôtes-Parasites-Environnements (IHPE) – Université de Perpignan : UMR5244 – 58 Avenue Paul Alduy, F-66860, Perpignan, France

Abstract

Ecological interactions can be analyzed at different levels of biological organization, from molecular to ecosystem levels. However, studies generally focus on one or a few levels of organization at a time, hence limiting our ability to generate integrative predictions. Here we aimed at measuring the responses of a host to an ectoparasite, from the molecular level to the population level using a set of complementary approaches. We used the rostrum dace (*Leuciscus burdigalensis*, a freshwater fish species) and its ectoparasitic copepod *Tracheliastes polycolpus* as model species, and we tested whether -and how- this parasite generates cascading effects from molecules to populations. Specifically we tested whether *T. polycolpus* altered the whole gene expression (in three different tissues), the competitive ability, the functional responses and the trophic niche of *L. burdigalensis*. We showed that parasitized host -compared to healthy ones- over-expressed genes related to immune processes at the expense of genes related to metabolism, suggesting an energetic trade-off imposed by the parasite. We further showed that parasitized hosts were poorer competitors (i.e. they had a lower access to feeding resources) compared to healthy hosts, although the functional response of host was not affected. Finally, the parasite modified the trophic niche of its host, which suggests potential impacts of the parasite at biological levels higher than the population. We concluded that *T. polycolpus* has a strong effect at the molecular level (with a costly immune response expressed in parasitized hosts) that generated cascading effects on other biological levels, notably those concerning interactions with the prey community of the host. By using complementary tools, this study is one of the first at demonstrating how a parasite can affect the host biology at multiple biological scales, which illustrates the usefulness of integrative studies for dissecting the complexity of ecological interactions.

*Speaker

†Corresponding author: eglantine.mb@gmail.com