Chronic metal contamination shapes the life-history traits of Gammarus fossarum populations in French headwater rivers

Auréline Lalouette*[1], Davide Degli Esposti[1], Clément Colomb[1], Laura Garnero[1], Hervé Queau[1], Rémi Recoura-Massaquant[1], and Arnaud Chaumot[1]

[1]INRAE, UR Riverly, Laboratoire d'écotoxicologie – INRAE, UR RiverLy, 5 rue de la Doua, CS 20244, F-69625 Villeurbanne Cedex, France – France

Abstract

Assessing the effects of multigenerational exposure of aquatic animal populations to chemical contamination is essential for ecological risk assessment. However, beyond rare examples reporting the possible emergence of toxicological tolerances within populations that persist in contaminated environments, conclusive results are even more limited from field studies when it comes to the alteration of life-history traits. Here, we investigate whether long-term exposure to cadmium (Cd) causes changes in life-history traits in *Gammarus fossarum*, a keystone species of European stream ecosystems. We study at a large geographical scale 13 field populations of *G. fossarum* (cryptic lineage B) living in headwater rivers located in natural areas, and exposed to contrasted bioavailable Cd contamination levels due to different geochemichal backgrounds. We achieved a detailed description of the physical habitats and water physicochemical conditions. Metallic bioavailable contamination was assessed using a standardized active biomonitoring procedure (*Gammarus* caging). Based on the field demographic census of the 13 populations, our results demonstrate that chronic Cd contamination significantly influences life-history traits in the *G. fossarum* species, leading to a reduction in all size traits of populations (size at puberty, median adult size, maximum size). In addition, we confirm Cd-tolerance in contaminated populations during exposure tests in the laboratory. Various hypotheses can be then put forward to explain the modification of life-history traits: a direct toxic effect of Cd, a cost of Cd-tolerance, or an adaptive evolution of life-history exposed to toxic pressure.

Keywords: Natural population, Gammarus fossarum, life history traits, adaptation, chronic chemical contamination, cadmium

*Speaker