NEWLY OVERLAPPING RANGES : FIRST RECORDS OF *POTOMIDA LITTORALIS* (CUVIER, 1798) INFESTATION BY THE EUROPEAN BITTERLING *RHODEUS AMARUS* (BLOCH, 1782)

The Bitterling *Rhodeus amarus* (Bloch, 1782) has a peculiar reproduction strategy: females lay their eggs inside freshwater mussels *via* the exhalent aperture using a specific oviduct that develops during reproduction time (which occurs from March to August) and males release sperm in front of the inhalant aperture, fertilisation taking place within the mussel. Bitterlings are host specific. There are known to infest *Anodonta anatina* (Linnaeus, 1758), *A. cygnea* (Linnaeus, 1758), *Unio pictorum* (Linnaeus, 1758) and *U. tumidus* Philipsson, 1788[1,2,3]. More recently, infestation of *U. crassus* Philipsson, 1788 has been recorded (Tatoj *et al*. in press[4]; Lamand com. pers.). All these species commonly occur in the original distribution range of the Bitterling.

However, both mussels and fish are now being introduced in many parts of the world and host/parasite specificity may be challenged. The Chinese pond mussel *Sinanodonta woodiana* (Lea, 1834), systematically close to the European *Anodonta* species, is now widely introduced in Western Europe and comes into contact with the Bitterling. However, no change in species host has been recorded so far. In controlled conditions, the European bitterling would readily oviduct in *S. woodiana* specimens, but most of the eggs are rejected immediately and the remaining ones does not seem to produce viable embryos[3]. The bitterling itself has expanded its range towards western Europe since the 12th century and comes into contact with new potential host species especially since the 18th century, as it has colonized new biogeographic areas[5] (Fig. 1). In France, the recent range extension of the Bitterling allows it to come into contact with two other Unionid species: *U. mancus* Lamarck, 1819 and *Potomida littoralis* (Cuvier, 1798). Both species have their northern and easternmost distribution limits in France and do not occur within the native range of the Bitterling [6,7,8].

Not surprisingly, as *U. mancus* and *U. pictorum* are closely related species, Bitterling embryos have already been observed in *U. mancus* gills (B. Adam com. pers., Ardèche River, 2009). In contrast, *Potomida littoralis* belongs to a distinct tribe, the Gonideinae. During freshwater mussel surveys in the Saône and Allier Rivers in France in July 2016, *Potomida littoralis* specimens were sampled for DNA analyses. Two specimens, one collected in the Allier River near the town of Cournon d'Auvergne (3.210025 E / 45.727304 N) and another one collected in the Saône River near the town of Pontailler (5.419462 E / 47.305896 N) had developed embryos of European Bitterling in their gills (Fig. 2). These two observations in two distinct drainages, one Atlantic, the other Mediterranean, give evidence that the Bitterling

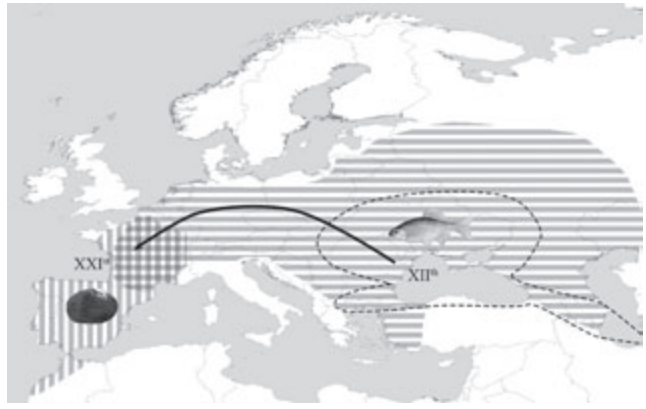

Figure 1 Range expansion of the Bitterling from the 12th century to now. Dotted lines: bitterling native range limits; horizontal pattern: actual range of the Bitterling; vertical pattern: distribution range of *P. littoralis*.

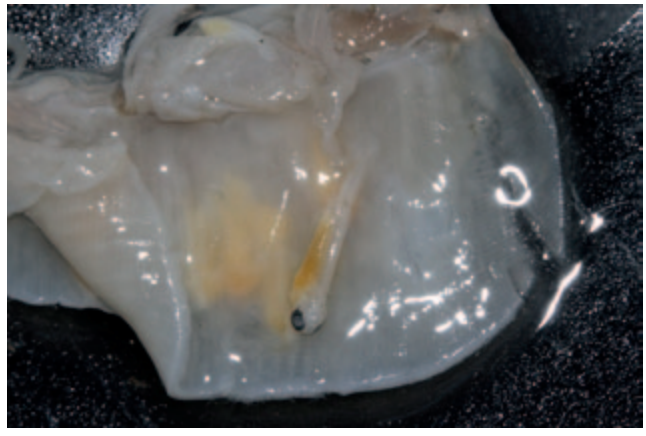

Figure 2 Embryos of European bitterling in *Potomida littoralis*' ctenidium (specimen from Cournon d'Allier preserved in ethanol).

has successfully adapted to a new species after having extended from its native range. Because Bitterling eggs and embryos are known to affect growth rate and produce damages to the ctenidia, thus affecting reproduction[9], this new parasite constitutes a supplementary threat in France for the endangered *P. littoralis*[10].

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