Short communication

First record of eyeless specimens of *Gammarus roeselii* Gervais 1835 (Amphioda, Gammaridae) in a small stream of the sub-lacustrine Ticino River basin (Lombardy, Northern Italy)

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Abstract - In this short communication, we report the unusual presence of blind specimens of the non-native *Gammarus roeselii* Gervais 1835 (Amphioda, Gammaridae) in the sub-lacustrine Ticino River basin (Po River floodplain, Northern Italy). Considering that *G. roeselii* is present in almost all small semi-natural tributaries of the Ticino River, it is important to carry out further research on this well-established exotic species to verify its genetic variability.

Key words: non-native species, blind specimens, stygoxenes, gammarids.

In both the *pulex*- and the *balcanicus*-groups, dorsal carinae are completely absent, but on the contrary, the members of the *Gammarus roeselii*-group can be distinguished from those of the other two groups by the presence of dorsoposterior process (spines) on a number of metasome segments. Most populations in western Europe have four dorsal processes, while in south-eastern Europe, most of them only have three (Fig. 1).

These spines can be considered as a morphological antipredatory adaptation, like in many other organisms, such as fish (Hoogland *et al*., 1956), gastropods (West & Cohen, 1996) and other crustaceans (Tollrian, 1995).

The present communication is about the amphipod *Gammarus roeselii* Gervais 1835, which has a long invasion history in Eastern and Central Europe, where it is now considered as a well-established exotic species.

Fig. 1 - The non-native amphipod *Gammarus roeselii* Gervais 1835 (from Paganelli *et al*., 2015).
**G. roeselii** reaches a higher density in small streams with moderate water currents and abundance of plants by using such biotopes as refuge (Mayer *et al.*, 2012). Moreover, it is more eurybiont and it can survive in lower oxygen concentrations and higher temperatures than the native species *Echinogammarus stammeri* (Karaman, 1931), which prefers fresh running water (Karaman, 1993; Kley *et al.*, 2009).

Up to 2005, in Italy its presence had only been reported for the Sile River basin (North-Eastern Italy); subsequently, it was discovered in the sub-lacustrine Ticino River basin (Po River floodplain, Northern Italy), despite the lack of a direct connection between these two basins. In this area, it lives in sympatry with dense populations of *Niphargus fossarum* - groups, but no blind species have been reported in the *roeselii*-group.

Effectively, according to their affinity to subterranean environments, organisms can be classified as one of three types: i) stygoxenes, defined as accidental or occasional presence in subterranean waters *(e.g. the amphipod Gammarus fossarum* Koch, 1836), ii) stygophiles which inhabit both surface and subterranean aquatic environments, but are not necessarily restricted to either, and iii) stygobites, which are obligate or strictly subterranean animals where they complete their entire life *(e.g. amphipods belonging to the genus Niphargus)*.

The first two types of organisms may live in caves for part of their lives, but do not complete their life cycle in these environments, while the third type usually appears to be highly modified for subterranean life with lack of eyes and pigment, and generally has a gracile appearance, largely due to long appendages and antennae.

In particular, the reduction or the absence of eyes is very common in organisms which inhabit subterranean or aphotic habitats (Karaman & Pinkster, 1977) but, in superficial waters, records of eyeless amphipods are very rare: according to Özbek & Belgin (2010), eyeless *Gammarus* species distributed in European freshwaters belong to the *Gammarus pulex*- and *Gammarus balcanicus*-groups, but no blind species have been reported in the *roeselii*-group.

Overall, the four eyeless specimens collected in the Venara Stream did not show any other specific morphological adaptations to a subterranean life and this suggests that the absence of eyes should only be considered as a genetic mutation, without an evolutionary significance. Moreover, the Venara Stream does not show any particular environmental features which may suggest a genetic adaptation to survive here; this stream has all the typical ecological characteristics of a small stream of the Po River Plain such as a moderately water current, sandy-gravelly bottom and presence of aquatic plants.

However, Gammarids usually live near the bottom of the stream, hidden under stones or aquatic plants, eating leaf debris. Considering their habitat and the fact that the blind specimens collected had quite a large body, the lack of eyes does not seem to represent a handicap for their survival in the wild.

Finally, our discovery also suggests that *Gammarus roeselii* could be classified as stygoxene organisms.

Taking into account the fact that the non-native species *Gammarus roeselii* is present in almost all semi-natural streams of the intricate irrigation system of the lower course of the Ticino River, it is important to carry out further research on this well-established exotic species to verify its genetic variability as reported by Grabowski *et al.* (2017) in other countries.

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**Fig. 2** - Eyeless specimens collected in the Venara Stream, one of the small right bank tributaries of the Ticino River.
REFERENCES
Özbek M. & Belgin Ç.E., 2010 – *Gammarus kesanensis* sp. nov., a new blind amphipod species from Turkey (Amphipoda, Gammaridae), with a key to eyeless *Gammarus* species of Europe. *Zootaxa*, 2399: 51-60.