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Relict populations of *Hyloniscus transsilvanicus* and *Ligidium germanicum* in the Blahniţa Plain, south-western Romania

(Isopoda, Oniscidea)

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In the Blahniţa Plain of south-western Romania, two terrestrial isopod species, *Hyloniscus transsilvanicus* and *Ligidium germanicum*, are present, considered in the past to be restricted to high altitudes in this country. In this area *H. transsilvanicus* populates swamps and canals situated between 39 and 91 m a.s.l. *L. germanicum* was identified at the bank of a small stream at 45 m a.s.l. The possible explanations of the two species presence at such low altitudes are discussed.

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Introduction

Although there are few zoogeographical data on terrestrial isopods in the literature, their link with the altitude was studied in some regions (e. g. Sfenthourakis 1992, Lopes et al. 2005, Sfenthourakis et al. 2005, 2012). There are only few studies on this aspect in Romania (e. g. Tomescu et al. 2011), but the altitudinal distribution of the terrestrial isopod species is generally known (see in: Radu 1983, 1985; Tomescu et al. 2011). Thus, there are species distributed irrespective of the altitude in the country, but there are also species tied to high altitudes, like *Hyloniscus transsilvanicus* (Verhoeff, 1901) and *Ligidium germanicum* Verhoeff, 1901, present in hilly and mountain areas. *H. transsilvanicus* is considered a Carpathian species (see in: Vilisics et al. 2008), being present in Slovakia, Hungary, Serbia and Romania (Schmalfuss 2003). For a long time this species was recorded only in hilly and mountain areas in Romania (see in: Tomescu et al. 2011), being typical for wet habitats (Radu 1983). Recently it was found in lowland areas in north-western Romania (Ferenţi et al. 2012, 2013a, b). At low altitudes it was also identified in a few spots from the north-eastern Pannonian Plain, in Hungary (e. g. Kontschán 2003, Vilisics & Hornung 2010). Unlike this, *L. germanicum*, a species with central and east European distribution (see in: Schmalfuss 2003), was identified in the past in Romania only in mountain areas (Tomescu et al. 2011). Recently, it was mentioned in north-western Romania at the limit of mountains with neighbouring plain areas (Ferenţi et al. 2013a), but it was not encountered in the plains from Hungary (Vilisics & Hornung 2010). Unexpectedly, taking into account the previous information, we identified both species in plain areas from south-western Romania, this paper discussing upon some possible explanations of their presence and distribution range.

Fig. 1. Distribution of *Hyloniscus transsilvanicus* and *Ligidium germanicum* in the Blahniţa Plain.

Materials and methods

In July 2011 we identified, by chance, a low altitude *H. transsilvanicus* population near the locality Hinova, in south western Romania. After that, in the years 2012 and 2013, we investigated 33 habitats from 12 localities from Blahniţa Plain, south-western Romania, looking for other low altitude populations, trying to verify if our previous record was an exception or a general rule in the region. Thus, we identified other *H. transsilvanicus* populations and a *L. germanicum* population. Isopods were collected by hand or tweezers, from the edge of some wetlands (swamps, canals, streams), under the vegetation from near the water.

Results

In Blahniţa Plain we recorded the species *H. transsilvanicus* at five localities and the species *L. germanicum* (Fig. 1) at one locality. These were situated at altitudes between 39 and 91 m a.s.l. (Table 1). The localites Hinova and Gogoşu are situated in the Danube's floodplain, very close to the river, even at a distance of only 10 m. The other localities are situated inside of the Blahniţa Plain. The closest mountain areas (Mehedinţi Mountains) are more than 45 km away from the most distant point (Gogoşu), where *L. germanicum* was identified. The habitats where the populations of *H. transsilvanicus* have been found are represented by artificial canals and a wide wetland near Hinova (Table 1). The habitat of *L. germanicum* is represented by a stream with rocky substratum, formed on the bank of the Danube, in an oak forest. At least in the case of *H. transsilvanicus*, the populations seems large, as every vegetation lifting from near the water being encountered more than 10 running individuals.

Discussion

The habitats from the Blahniţa Plain are different from other ones from Romania where the two species were generally found. Thus, despite *H. transsilvanicus* has been found in mountains and hilly forests before (see in: Tomescu et al. 2011), here it is found in an open wetland, or artificial canals, formed probably after the draining of the initial swamps. Only in the plains of north-western Romania *H. transsilvanicus* was found in similar habitats (Ferenţi et al. 2012). The isopods' habitats are represented by wet areas, with plenty of grassy vegetation and a few trees and bushes growing right next to the water bodies. Although situated in an unexpected geographic unit and altitude for this species, the habitat of *L. germanicum* from Gogoşu resembles those where the species appears at high altitude (see in: Radu 1983).

In three of the five habitats with *H. transsilvanicus*, *H. riparius* was also present, a congener species which is more widespread in Romania (Radu 1983). In contrast, besides *L. germanicum* its congener species, *L. hypnorum*, was not found, although they were encountered in the same habitat in other parts of Romania (e.g. Ferenţi et al. 2013a). Thus, though in other regions a competition between the two species of genus *Ligidium* was reported (e.g. Spelda 2011). this is not the case of Blahniţa Plain. At least in the case of genus *Hyloniscus*, the cohabitation of the two species probably indicates that competition is not a primordial determinant for their distribution. In this case, probably we cannot talk about a descent of the

Table 1. Location and habitat type of the low altitude populations of *H. transsilvanicus* and *L. germanicum*.

Species	Locality	Geographic coordinates	Altitude	Habitat type
H. transsilvanicus	Hinova	44°32'07.67" N / 22°45'54.64" E	39 m	Swamp
H. transsilvanicus	Jiana	44°25'05.03" N / 22°42'57.10" E	78 m	Canal
H. transsilvanicus	Burila Mică	44°23'37.72" N / 22°35'51.89" E	84 m	Canal
H. transsilvanicus	Bistreţu	44°27'24.02" N / 22°37'31.49" E	91 m	Canal
H. transsilvanicus, *L. germanicum*	Gogoşu (Iron Gates II)	44°23'54.42" N / 22°32'14.19" E	45 m	Small stream

mountain species to the low altitudes into the area of the other species, but *H. transsilvanicus*' persistence in the humid areas. Thus, the more widespread *H. riparius* was the one which probably has extended its distribution range over the relict *H. transsilvanicus* populations.

Explaining the presence of two species tied to high areas, like *H. transsilvanicus* and *L. germanicum* in the Blahniţa Plain, a region with sub-Mediterranean climate influences (Mândruţ 2006), might seem difficult. The presence of the low altitude populations from the north-eastern Pannonian Plain was explained with the colder and humid climate there (Vilisics & Hornung 2010), something out of the question in the Blahniţa Plain. Also, in other low altitude areas relict habitats for species related to high altitudes were identified, but in more northern areas than in our case (Köppel et al. 1994). In north-western Romania the low altitude populations were considered as a consequence of the past of that region, where other mountain species are present (see in: Ferenţi et al. 2012). We consider that a similar explanation is plausible in our case. The recent migration of the two species from mountain areas toward Blahniţa Plain seems impossible due to the present climatic conditions and the aspect of the region and the habitats. The populations of the two species from the Blahniţa Plain seem to be restricted to some small habitats, representing remnants of some wide wetlands, presently surrounded by anthropogenic modified area. Thus, it is unlikely that these species are widespread in the low areas from south-western Romania and not indicated here before because of the lack of studies, they are probably absent from most of the plain areas of southern Romania. Despite the fact that there have been studies in respect of isopods from south-western Romania during the last years, these have only mountain and hilly areas on focus, where indeed the species has been identified (e. g. Ilie et al. 2002, Nitzu et al. 2010, Tomescu et al. 2011). To our knowledge, studies on isopods from the lowlands of south-western Romania were not undertaken before. However, there are data from the plain areas near Bucharest and from Dobrudja, but there the species has not been found (Giurgincă & Ćurčić 2003, Giurgincă 2006). Thus, we concur that the presence of the low altitude population is not a general phenomenon, but determined by the particularities of south-western Romania. In this region and especially in the Danube's Gorge, despite the sub-Mediterranean climate influences (Mândruţ 2006), some plants and animals are present at very low altitudes (e. g. Paşcovschi 1956, Trilar & Gogala 2008, Covaciu-Marcov et al. 2009). It is considered that, at least, the region of Danube Gorge was covered in the last glacial period by cold climate forests (see in: Schmitt 2009). Although *H. transsilvanicus*' habitat from Hinova isn't afforested, at a few km from it, on Starmina Hill, there are some of the lowest beech forests from Romania (Paşcovschi 1967). Thus, the presence of these species at low altitudes is probably a consequence of the history of the region and needs to be explained through their survival here in the last glacial maximum. This explanation seems plausible, recent studies confirming that the Carpathian basin was an important glacial refuge (e. g. Babik et al. 2005, Hofman et al. 2007, Varga 2010, Fijarczyk et al. 2011, Zielinski et al. 2013). Thus, the presence of *L. germanicum* and *H. transsilvanicus* low altitude populations from atypical habitat can be considered as another proof of the special past of the biodiversity from south-western Romania, and also of the biogeographical importance of terrestrial isopods.

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