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=== SHORT COMMUNICATION ===

Preliminary data on terrestrial isopods from some railways in Dobruja, eastern Romania

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Abstract. In July 2020 we analyzed the terrestrial isopod assemblages from different (mostly abandoned) railway constructions in Dobruja, eastern Romania. We identified 10 terrestrial isopod species, of which the most abundant and frequent were *Porcellionides pruinosus* (Brandt, 1833) and *Armadillidium vulgare* Latreille, 1804. We identified species that, in Romania, are present only in Dobruja: *Leptotrichus pilosus* Dollfus, 1905 and *Trachelipus squamuliger* (Verhoeff, 1907). Most of the species are common, generalist or synanthropic, connected to dry and open habitats. In abandoned railway-stations the number of species/samples was low (at most two), but at the base of a stone railway bridge in Babadag forest six species were found.

Key words: transportation network, habitats, artificial structures.

Introduction

Dobruja is a region from eastern Romania with a warmer and drier climate than other areas in the country (e.g. Mândruț, 2006; Croitoru *et al.,* 2013; Prăvălie and Bandoc, 2015). However, in Dobruja, there are numerous isopod species (Radu, 1983; 1985; Giurginca and Ćurčić, 2003; Tomescu and Teodor, 2018) compared with other regions in the country (Radu, 1983; 1985), even if their distribution is determined by humidity (Hornung, 2011).

Nevertheless, previous studies focused mainly on natural habitats (Giurginca and Ćurčić, 2003; Tomescu and Teodor, 2018), including caves (Tăbăcaru and Boghean, 1989; Gruia *et al.,* 1994; Gruia and Giurginca, 1998). However, it is known that isopods can use disturbed habitats, as they are present in large number in urban areas (Vilisics and Hornung, 2009; Ferenţi *et al.,* 2015; Giurginca *et al.,* 2017; Laza *et al.,* 2017; Pop *et al.,* 2019), but also on highways edges (Vona-Túri *et al.,* 2016; 2017; 2018; 2019). Thus, considering the rich terrestrial isopod fauna of Dobruja (Radu, 1983; 1985; Giurginca and Ćurčić, 2003; Tomescu and Teodor, 2018), we supposed that some of these species are present in artificial habitats too, like transportation network infrastructure. For this, we chose the railways, which have a dual relation with the fauna: on one hand they favor certain animals, like herpetofauna, isopods, spiders or pollinators (e.g. Covaciu-Marcov *et al.,* 2006; 2017; Wrzesień *et al.,* 2016; Graitson *et al.,* 2020), but on the other hand they cause the mortality of some animals, both vertebrates (e.g. Budzik and Budzik, 2014; Heske, 2015; Dornas *et al.,* 2019; Joshi and Puri, 2019) and invertebrates (Pop *et al.,* 2020). In Dobruja many railway stations were abandoned in the last years (C.F.R., 1993; C.F.R., 2019). Thus, our objective was to collect preliminary data about the terrestrial isopod fauna from Dobruja which populates different railway constructions.

Material and methods

The field work was realized at the end of July 2020. We investigated two secondary railway lines, which cross Dobruja on the north-south direction, diverging from the main line at Medgidia, namely Medgidia - Tulcea line and Medgidia - Negru Vodă line (C.F.R., 2019). The Tulcea line has a low number of passenger trains (maximum of six trains / day (C.F.R., 2019) and freight trains. On the Negru Vodă line passenger trains were suspended (C.F.R., 2019). We searched for terrestrial isopods around various constructions along these lines, especially in railway stations abandoned in the last years (C.F.R., 1993; C.F.R., 2019). We collected terrestrial isopods from five disused railway stations and from abandoned constructions belonging to two functional stations. Also, we collected isopods at the base of a stone railway bridge in Babadag forest. Under the bridge there is a tunnel with a road that leads to a stone quarry. The isopods were collected under the debris from the abandoned stations, or under the stones that fell at the base of the bridge. In each locality, the sampling took approximately 20 minutes, as in other cases (Ferenţi and Covaciu-Marcov, 2016; Pop *et al.,* 2019). The isopods were determined in the laboratory.

On the railways from Dobruja we collected 113 terrestrial isopod individuals, who belonged to 10 species (*Hyloniscus riparius* (Koch, 1838), *Haplophthalmus danicus* Budde-Lundt 1879, *Porcellium collicola* (Verhoeff, 1907),

Leptotrichus pilosus Dollfus, 1905, *Trachelipus nodulosus* (Koch, 1838), *Trachelipus squamuliger* (Verhoeff, 1907), *Porcellionides pruinosus* (Brandt, 1833), *Cylisticus convexus* (De Geer 1778), *Armadillidium vulgare* Latreille, 1804, and one *Armadillidium* species that could not be determined, as we collected only one juvenile). The species number / locality was reduced; in the case of the abandoned stations, we registered one, at most two species / locality. In the case of the stone bridge from Babadag forest, we identified six terrestrial isopod species. The percentage abundance differed between localities. The highest percentage abundance was registered by *P. pruinosus*, followed by *A. vulgare* (Tab. 1). *A. vulgare* also registered the highest frequency of occurrence.

Table 1. Percentage abundance and frequency of occurrence of terrestrial isopods in the studied railway constructions in Dobruja (1. – Istria, 2. Ciocârlia, 3. – Nazarcea, 4. – Târgușor Dobrogea, 5. – Ceamurlia de Jos, 6. – Zebil, 7. – Mihail Kogălniceanu, 8. – Babadag forests: S – station, B – Bridge, P% – Total percentage abundance, f% – Total frequency of occurrence)

Locality	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**P%**	**f%**
Type	S	S	S	S	S	S	S	B		
H. riparius	-	-	-	-	-	-	-	4.42	4.42	12.5
H. danicus	-	-	-	-	-	-	-	0.88	0.88	12.5
P. collicola	-	-	-	-	-	-	-	0.88	0.88	12.5
L. pilosus	-	-	-	6.19	-	-	-	-	6.19	12.5
T. nodulosus	-	-	-	-	-	-	-	2.65	2.65	12.5
T. squamuliger	-	-	-	-	-	-	-	8.84	8.84	12.5
P. pruinosus	8.84	-	-	3.53	21.2	3.53	-	-	37.1	50
C. convexus	-	-	-	-	-	-	0.88	2.65	3.53	25
A. vulgare	3.53	-	0.88	-	1.76	12.3	15.9	-	34.5	62.5
A. sp.	-	0.88	-	-	-	-	-	-	0.88	12.5
Species number	2	1	1	2	2	2	2	6		
P%	12.3	0.88	0.88	9.73	23	15.9	16.8	20.3		

Discussions

The number of terrestrial isopod species identified on the railways from Dobruja is reduced compared with the one recorded in the region's natural habitats, where more than 40 species are present (Giurginca and Ćurčić, 2003, Tomescu and Teodor, 2018). Nevertheless, the species number identified on the railways in Dobruja is close to the one registered in some towns in Romania (Ferenţi *et al.,* 2015; Laza *et al.,* 2017). Thus, as railways are artificial habitats, the species richness is close to the one registered in other artificial areas with more diverse habitats, like towns (Ferenţi *et al.,* 2015; Laza *et al.,* 2017). This could be a consequence of the high isopod diversity in Dobruja

(Giurginca and Ćurčić, 2003), some of the local species colonizing railways. Compared to abandoned railway tunnels (Covaciu-Marcov *et al.,* 2017) the number of isopods species identified on the railways in Dobruja was smaller, but the number of tunnels was higher compared with the number of railway constructions from Dobruja. At the same time, tunnels were situated in different (usually mountain) areas and the study was made in different periods (Covaciu-Marcov *et al.,* 2017).

The low number of isopod species registered on the railways does not necessary reflect the assemblages' poverty, but could be a consequence of the study period, as temperature and humidity also influences isopods near highways (Vona-Túri *et al.,* 2019). The study was made in summer, in the warmest and driest region of Romania (Mândruț, 2006; Croitoru *et al.,* 2013; Prăvălie and Bandoc, 2015), and terrestrial isopods are related to humidity (e.g. Warburg *et al.,* 1984; Hornung *et al.,* 2011). Previously in one of the investigated railway-stations the feeding of two frog species was studied in the spring (Covaciu-Marcov *et al.,* 2012) and those frogs consumed more isopod species than we identified now. Probably in the spring more species are active, but in the middle of the summer only the most drought-resistant ones were present. Probably in other seasons, the number of isopod species would have been higher than in many towns.

Compared with the isopods identified near highways (Vona-Túri *et al.,* 2017; 2019), the number of species registered near the railways from Dobruja was smaller. However, it is difficult to make such comparison, because we have fewer samples, from a smaller area, while near highways more road-areas were investigated, from a larger area, and at different distances from the roads (Vona-Túri *et al.,* 2017). Because the isopods near highways were sampled with pitfall traps, the individual number was huge (Vona-Túri *et al.,* 2017; 2019), and this reduced the species diversity compared with the railways from Dobruja, in the case of roads, the lowest species richness was near forests (Vona-Túri *et al.,* 2017), but in Dobruja in such habitats it was the highest. This could be a consequence of the species different ecological demands. Also, it could be caused by the differences between roads and railways, as roads generally have a more intense traffic, are wider and more polluted than railways (see in: Borda-de-Água *et al.,* 2017). In the same time, on roads the maximum species richness was registered at 40 meters from the roads (Vona-Túri *et al.,* 2017), but in Dobruja the isopods were collected at only few meters from the line.

Most of the terrestrial isopod species from the railways in Dobruja are common, generalist species, a fact which was also mentioned in the case of roads (Vona-Túri *et al.,* 2016; 2017; 2018). The most common species (*P. pruinosus* and *A. vulgare*) are synanthropic species, frequently mentioned in artificial, or at least partially modified habitats (e.g. Vilisics and Hornung, 2009; Laza *et al.,* 2017; Bodog *et al.,* 2018) even on the roads' edges (Vona-Túri *et al.,* 2018).

Both are considered species with Mediterranean affinities (e.g. Cochard *et al.,* 2010), thus their presence and high abundance in Dobruja and on the railways, should not be surprising. However, we also registered rare species with a limited distribution in Romania. This is the case of *T. squamuliger*, a species recently recorded for the first time in Romania, only in a few localities in Dobruja (Tomescu *et al.,* 2015, Tomescu and Teodor, 2018). *T. squamuliger* is rare also on railways, as it was encountered only on the bridge from Babadag forest. This is the fifth distribution record of this species in Romania, representing a connection between its previous distribution localities in northern and southern Dobruja (Tomescu *et al.,* 2015). At the same time, is seems to clarify at least partially its ecology (Tomescu *et al.,* 2015), indicating that in Dobruja it is probably related with forests. At Babadag it was encountered in an oak and hornbeam forest, at the base of a stone bridge, in a relatively humid habitat with humid soil and fallen leaves. Another rare species, present in Romania only in Dobruja is *L. pilosus* (Radu, 1985; Giurginca and Ćurčić, 2003; Schmalfuss, 2003). It was recorded only in central Dobruja, in the ruins of the abandoned water tower from Târguşor Dobrogea station, in an open and arid region, which seems to be characteristic for this species (Radu, 1985). *L. pilosus* is rare also in Dobruja, as it seams missing in the Danube Delta (Tomescu and Teodor, 2018). Also, in the case of this species the new locality seems to be a connection between the previously known ones (Radu, 1985; Giurginca and Ćurčić, 2003).

The terrestrial isopod fauna from the abandoned railway stations is poor, comprising numerous individuals from few species. As an exception, the stone bridge from Babadag forest shelters numerous species. Those species have different ecological demands compared with the ones from the railway stations, as species like *H. riparius*, *P. collicola* or *H. danicus*, are considered related to wet areas (e.g. Radu, 1983; 1985). This different fauna is a consequence of different neighboring areas, as the habitats from Babadag is the only one surrounded by forests. This fact confirms the importance of forests for the native terrestrial isopods in Romania (e.g. Ferenţi *et al.,* 2013; Ferenţi and Covaciu-Marcov, 2016), as the species identified in this habitat are generally native, many related with humid habitats. At the same time, it seems to indicate that also in the case of railways the neighboring areas are important for isopods, fact already mentioned in the case of towns (e.g. Herle *et al.,* 2016; Bodog *et al.,* 2018). Thus, a railway structure from natural areas will have a richer and more diverse terrestrial isopod fauna compared with an affected dry and open area. Terrestrial isopod assemblages vary according to the neighboring habitats characteristics on roads too (Vona-Túri *et al.,* 2017). As it is situated in a forest, the stone bridge from Babadag was colonized by the richer isopod fauna from the forest. Probably, in this way, the stone bridge is similar with the entrance of a tunnel (see in: Covaciu-Marcov *et al.,* 2017). Nevertheless, in this habitat we also recorded

species like *T. nodulosus*, which is related to dry and grassy areas (Farkas, 2010; Tomescu *et al.,* 2015). Moreover, *T. nodulosus* missed from the other localities, although it was common on the highway edges in Hungary (Vona-Túri *et al.,* 2019). Even if it is common in other regions from Romania, *T. nodulosus* seems rare in Dobruja (Tomescu *et al.,* 2015). This seems surprising since nowadays most of this region is covered with open grassy habitats, as forests were not a majority in the region even in the past (see in: Feurdean *et al.,* 2021). Probably, the climate in Dobruja, with hot and dry summers is too much for this species, which at least in summers needs more humidity, thus it remains active only in forests.

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