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Waiting for the train that never came: establishing a new *Podarcis muralis* (Laurenti, 1768) railway population in Romania

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Abstract. Nowadays, man-made structures have become surrogate habitats for various species. Among them, lizards are often capable of using railways. In the autumn of 2024, we identified a new *Podarcis muralis* railway population on a railway abandoned for 11 years in southwestern Romania, near Voislova locality. On a 100-meter transect, we observed 13 *P. muralis* and 3 *Lacerta viridis*. Most wall lizards were subadults, indicating a breeding population on the railway. Probably, the lizards were introduced from the nearby marble quarry in Ruşchiţa, where the species is present. Although *P. muralis* was mentioned in the mountains surrounding Voislova, the habitats near the railway are not favorable to it.

Keywords: distribution, lizard, human-modified landscape, quarry, transportation infrastructure.

Introduction

Lizards are known to use different types of artificial or human-modified habitats, as ancient ruins in modern cities (Simbula *et al.*, 2019), town cemeteries (Heltai *et al.*, 2015), remains of fortification (Strijbosch *et al.*, 1980), ports (Iftime, 2005; Santos *et al.*, 2019), road embankments (Gherghel *et al.*, 2009), highway guardrails (Livo, 2025), artificial ditches in agricultural areas (Covaciu-Marcov *et al.,* 2009a), etc. Among artificial habitats, railways play an important role for

lizards, which in many cases populate such structures (e.g., Sá-Sousa, 1995, Graitson, 2006; Covaciu-Marcov *et al.,* 2006; 2009b; Livo, 2025), sometimes even expanding their range along them (Gherghel *et al*., 2009). Abandoned railways have become well-represented elements in the landscape in some regions, thus their possible uses are analyzed nowadays (e.g., Sarmento, 2002; di Ruocco *et al.,* 2017). It appears that abandoned railways could even become green corridors, connecting protected areas with the outskirts of urban areas (see García-Mayor *et al.,* 2020). Recently, abandoned railways have been shown to be important for biodiversity, as they contribute to the maintenance and conservation of certain populations by providing habitats and resources (e.g., Leaney, 1983; Higginson and Dover, 2021; Pop *et al.,* 2021a, b; Dylewski *et al.,* 2022, 2025). Lizards were frequently mentioned on different railways (e.g., Graitson, 2006; Janssen *et al.,* 2025; Kovačević and Tvrtković, 2025), which could even serve as dispersal routes (e.g., Krämer *et al.,* 2025). *Podarcis muralis* (Laurenti, 1768) is a lizard species typically associated with rocky areas, both natural and human-made, in Romania (Fuhn and Vancea, 1961; Covaciu-Marcov *et al.,* 2009b). At its range limit, it is even considered to spread using railways (e.g., Covaciu-Marcov *et al.,* 2006; Gherghel *et al.,* 2009; Dudek, 2014; Gherghel and Tedrow, 2019), as human activities have created useful habitats and colonization routes in regions naturally devoid of suitable habitats (Wirga and Majtyka, 2015). *P. muralis* was frequently mentioned on railways (e.g., Graitson, 2006; Strugariu *et al*., 2008; Dudek, 2014; Niedrist *et al*., 2020; Williams *et al.,* 2021; Petreanu, 2023), as railways are considered major dispersal routes (Schulte *et al.,* 2013). Even where the species is introduced, the wall lizards are advancing through railways (Heden and Heden, 1999). In Romania, this species is primarily found in the southwestern sectors of the Carpathian Mountains (e.g., Cogălniceanu *et al.,* 2013). It is a xero-thermophilic species, present in rocky habitats (Fuhn and Vancea, 1961), although railway *P. muralis* populations were sometimes mentioned in the country in areas outside their ecological preference (Covaciu-Marcov *et al.,* 2005, 2006; Strugariu *et al.,* 2008). Given that railways are usually perceived through their negative impact manifested by fauna road mortality, even in the case of reptiles (e.g., Pop *et al.,* 2021c, 2023; Banerjee *et al.,* 2023; Bhardwaj *et al.,* 2025), this fact indicates a positive facet, confirming that in some cases railways (both active and disused) could have even a conservative value for reptiles (Graitson, 2006). In this context, this note presents information about a new *P. muralis* population on an abandoned railway in south-western Romania, and a possible explanation of the probable causes of its origin.

Materials and methods

The field activity took place on 22 September 2024. The studied region is located in the Bistra River corridor (Fig. 1), in the northwestern part of Caraș-Severin County, at the boundary between the Western Carpathians (Poiana Ruscă Mountains) and the Southern Carpathians (Țarcu Mountains), near the Iron Gate of Transylvania pass (Mândruț, 2006). The region was traversed by a secondary normal gauge railway, which even had a segment with rack (Turnock, 2006). The railway, which connected Caransebeș and Subcetate (C.F.R., 1987; Turnock, 2006), has been without traffic since 2013 (C.F.R., 2012). The analyzed railway segment is situated approximately 1 km east of Voislova locality. The marble quarry in Rușchița is located approximately 19 km from the locality (Todor and Surd, 2013).

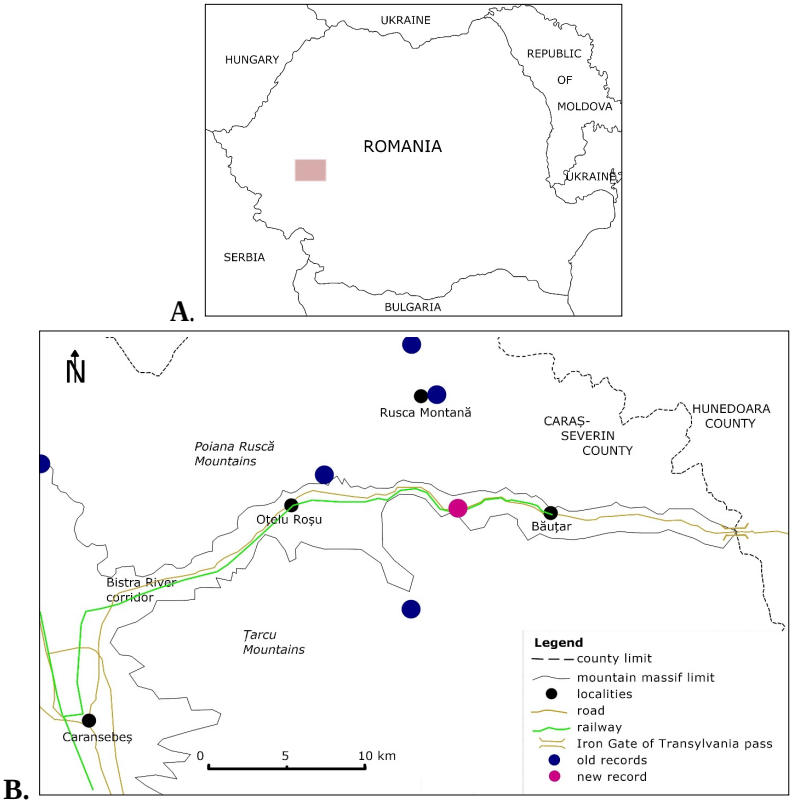

Figure 1. (A) The studied region location in Romania; (B) Detailed map of the Bistra River corridor with the new railway record of *P. muralis* (pink dot) and old records (blue dots, non-railway records according to Bogdan *et al.*, 2011, Iftime and Iftime 2013).

Results

We observed 13 *P. muralis* individuals (Fig. 2) (four adults, nine juveniles and subadults) on the abandoned railway from Voislova (45°31'05''N / 22°28'27''E). The location is situated at an altitude of 341 meters. On the railway, we also observed three juvenile *Lacerta viridis* individuals. The lizards were directly observed, without being captured. They were photographed whenever possible. We spent 30 minutes on the railway and made a 100-meter transect. The wall lizards were very active, running away when we approached and hiding under the tracks or under the railway ballast. This observation was made at 4 pm on a warm, late-autumn day. The railway is partially overgrown with vegetation, particularly by shrubs and trees from neighbouring areas; however, there are also open segments where the railway ballast is exposed (Fig. 3).

Figure 2. *Podarcis muralis* on the abandoned railway from Voislova, Romania.

Figure 3. The abandoned railway from Voislova, Romania.

The location is situated east of Voislova, between this locality and Marga. Surrounding the railways are human-modified areas, including pastures, orchards, and agricultural fields, as well as areas with shrubs and trees interspersed between them.

Discussion

Most *P. muralis* individuals were juveniles and subadults, indicating that a sustainable, reproductive population exists on the abandoned railway from Voislova, as observed in other populations (Jablonski *et al.,* 2025). The railway has been disused for approximately 11 years (C.F.R., 2012), but the wall lizard has also been observed on functional railways (Covaciu-Marcov *et al.,* 2006, 2009b; Niedrist *et al.,* 2020), as well as other lizard species (e.g., Graitson, 2006; Remacle, 2018; Janssen *et al.,* 2025). *P. muralis* is known for its ability to use transportation networks (e.g., Covaciu-Marcov *et al.,* 2006; Graitson, 2006; Gherghel *et al.,* 2009; Dudek, 2014; Petreanu, 2023), but also other artificial habitats with stones, even outside its normal distribution range (e.g., Iftime *et al.,* 2008; Sas-Kovács and Sas-Kovács, 2014; Jablonski *et al.,* 2025). In Romania, the wall lizards were previously identified in human-modified habitats in mountain regions with favourable habitats and distribution records in natural habitats (Covaciu-Marcov *et al.,* 2006, 2009b; Gherghel *et al.,* 2009). Nevertheless, the species was also observed in artificial habitats in plain areas, thus outside the region with favourable habitats (Covaciu-Marcov et al., 2005, 2006; Sas-Kovács and Sas-Kovács, 2014; Ile and Dumbravă, 2020). The record from Voislova is added to other railway populations of this species in Romania (Covaciu-Marcov *et al.,* 2006, 2009b; Gherghel *et al.,* 2009).

The habitats surrounding the railway at Voislova (pastures, orchards, grassy areas, and agricultural cultures to a lesser extent) are not favorable to this species, which in Romania is typically associated with rocky areas, both natural and human-made (Fuhn and Vancea, 1961; Covaciu-Marcov *et al.,* 2009b). Eventually, areas with shrubs and trees situated between agricultural cultures could be favorable for *Lacerta viridis*, a species associated with such habitats (e.g., Fuhn and Vancea, 1961; Sevianu *et al.,* 2022), and which was also observed on the railway, albeit in a smaller number of individuals. Nevertheless, *L. viridis* was not recorded in the neighboring region in the most recent review of Romanian herpetofauna, as it was mentioned only in one location on the other side of the pass and in three older locations in the western parts of the Poiana Ruscă Mountains (Cogălniceanu *et al.,* 2013). Records of *P. muralis* were even scarce, as in the region, there are only four old distribution records in the Poiana Ruscă Mountains (Cogălniceanu *et al.,* 2013). Nevertheless, the two species were previously mentioned in different locations from the Poiana Ruscă Mountains (Bogdan *et al.,* 2011) and Țarcu Mountains (Iftime and Iftime 2013). *L. viridis* was mentioned even at Voislova, and *P. muralis* at about 10 km from the railway population at Voislova, as it is the second most common species in the western sector of the Poiana Ruscă Mountains (Bogdan *et al.,* 2011).

Although the region, in a broad sense, has favorable habitats and wall lizard populations (Bogdan *et al.,* 2011, Iftime and Iftime 2013), the area neighboring the railway did not have favorable habitats, so *P. muralis* could not colonize the railway from its neighboring areas. Thus, this raises the question regarding the range expansion of the railway *P. muralis* population at Voislova. The introduction of this species, as a consequence of railway maintenance works and railway ballast, has been repeatedly indicated in the case of wall lizard railway populations (e.g., Covaciu-Marcov *et al.,* 2006; Gherghel *et al.,* 2009; Dudek, 2014). Nevertheless, at Voislova, another explanation seems more plausible, as a large marble quarry is located in the region (approximately 19 km away) (Todor and Surd, 2013), and *P. muralis* has been mentioned in that locality (Bogdan *et al.,* 2011). Moreover, in the immediate vicinity of the railway, there is a marble warehouse and processing facility. Furthermore, until the late 1970s, a narrow-gauge railway existed between Ruşchiţa and Voislova, used to transport marble to Voislova (Todor and Surd, 2013). Probably through this narrow-gauge railway, *P. muralis* has spread directly or indirectly along the line between Ruşchiţa and Voislova, and from Voislova railway station, it has expanded along the normal-gauge railway. Thus, this would be an introduction related to transportation networks from nearby populations, but this could be verified only with genetic tools, as in other cases (e.g., Oskyrko *et al.,* 2020; Jablonski *et al.,* 2025; Naumov *et al.,* 2025) or by studying the species presence on the line at a wider scale. Nevertheless, the wall lizard was also introduced in other ways, such as through freight transport (Kowalik *et al.,* 2025), building materials (Sas-Kovács and Sas-Kovács, 2014; Ile and Dumbravă, 2020), horticultural trade (Jablonski *et al.,* 2025), and cargo boats (Oskyrko *et al.,* 2020). However, in this case, the marble quarry was an exporter of resources from the area; thus, the introduction of the wall lizard from other regions is less plausible (rather, individuals from Ruşchiţa were introduced in other localities alongside with the marble). The presence of railway populations was previously explained by migrating along railways or by introduction with the railway ballast (Covaciu-Marcov *et al.,* 2006).

Probably, the railway offers the most appropriate habitats for the wall lizard's requirements in the region. This assumption is supported by the aspect of the habitat neighboring the railway, as well as by the fact that the region has a relatively cooler climate (Mândruţ, 2006) compared to other areas populated by *P. muralis* in Romania (Fuhn and Vancea, 1961; Cogălniceanu *et al.,* 2013). Moreover, in the vicinity (approximately 15 km), there is a low-altitude *Zootoca vivipara* population (Bogdan *et al.,* 2011), a cold-adapted species (Fuhn and Vancea, 1961), which suggests that the region and habitats are not particularly favorable for *P. muralis*. In this context, the wall lizard may have been advantaged by increasing temperatures over the past few years (Nagavciuc *et al.,* 2022;

Ionita and Nagavciuc, 2025). Probably, the railway corresponds with the habitat and temperature requirements of *P. muralis*, as in other cases (Covaciu-Marcov *et al.,* 2006). This fact indicates that *P. muralis* is one of the winners of anthropization, as it could adapt to artificial habitats which resemble its natural habitats (e.g., Covaciu-Marcov *et al.,* 2006; Wirga and Majtyka, 2013; Sas-Kovács and Sas-Kovács, 2014; Jablonski *et al.,* 2025). At the same time, this was a secondary railway line (C.F.R., 1987, 2012), which likely did not have a significant negative impact, even during its peak traffic. Additionally, compared to roads, railways appear to have a lesser negative impact on soil quality (Sion *et al.,* 2023). It remains to be seen to what extent the renaturalization of the railway and the development of plant communities will cause the disappearance of this population in the course of time, as it could not beneficiate from the railway closer like other animals (e.g., Leaney, 1983; Higginson and Dover, 2021; Pop *et al.,* 2021a, b; Dylewski *et al.,* 2022, 2025).

Conclusions

The railway *P. muralis* population from Voislova demonstrates the species' capacity to extend its distribution range when corridors with appropriate conditions are available, even if these are represented by anthropogenic structures, such as railways. However, this population, even if it currently seems stable (as evidenced by the presence of juveniles), may be threatened in the future by the advancement of renaturalization along this abandoned railway, which will likely modify at least some of the current habitat conditions.

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