

A non-invasive colonist yet: The presence of *Podarcis muralis* in the lowland course of Crişul Repede River (north-western Romania)

István SAS-KOVÁCS^{1,*} and Éva-Hajnalka SAS-KOVÁCS²

1. University of Oradea, Faculty of Sciences, Department of Biology, Oradea, Romania.

2. Babeş-Bolyai University, Faculty of Biology and Geology, Department of Taxonomy and Ecology, Cluj-Napoca, Romania.

*Corresponding author, I. Sas-Kovács, E-mail: sas.steve@gmail.com

Received: 11. May 2014 / Accepted: 17. July 2014 / Available online: 23. November 2014 / Printed: December 2014

Abstract. In this paper we present the identification of an introduced population of *Podarcis muralis*, located outside of its distribution area in Romania, in the Crişul Repede (Sebes-Körös) Plain, in north-western Romania. In total, based on the individual colour, we identified 58 common wall lizard adults. We also captured 23 juveniles. The area occupied by the individuals of *Podarcis muralis* was estimated to be approximately 950 square meters. The identified common wall lizard population can be considered as a self-sustaining population rather than a sink population, with probability of dispersion.

Key words: native species, alien species, syntopic, distribution range, protected area, Natura 2000 network.

Podarcis muralis is a sub-Mediterranean species, native to Europe, with wide distribution (Gasc 1997, Böhme et al. 2009). The species is at the northern limit of its range in Romania, occurring primarily along the Carpathian Mountains and in several sites in the Danube River Basin and Dobruja (for distribution review, see Cogălniceanu et al. 2013). The abundance of the species in certain Romanian areas is also an indicator of the sub-Mediterranean influences which are felt in these regions (Covaciu-Marcov et al. 2009).

However, the common wall lizard is also important as species with high colonization power; being recorded many cases of the introduction of *Podarcis muralis* in territories outside the distribution area (see Table A1 in Kraus 2009). Thus the species has been introduced in different places of Europe, of which many extended the northern limit of its range (e.g. Germany – Schulte et al. 2011; Czech Republic – Šandera 2013; Poland – Wirga & Majtyka 2013; and for varying periods of time in southern England – for review, see Beebee & Griffiths 2000).

At the same time, there are also documented cases on the establishment of species in the New World, both in the United States (Hedeen 1984, cited in Deichsel & Gist 2001) and Canada (Gregory & Gregory 1999, Deichsel & Schweiger 2004, and the other references cited in Allan et al. 2006).

Both native and introduced populations have a high potential for natural expansion along railroad tracks. This has been observed in the invasive populations from USA (Hedeen & Hedeen 1999)

and in populations from the natural range (e.g. Kühnis & Schmocker 2008 cited in Schulte et al. 2013) as well, including Romania (Covaciu-Marcov et al. 2006, Strugariu et al. 2008, Gherghel et al. 2009).

In this paper we present the identification of a probably introduced population of *Podarcis muralis*, located outside of its distribution area in Romania, in the Crişul Repede (Sebes-Körös) Plain, in north-western Romania.

On 24th March 2012, guided by the custodian of the Natura 2000 site "Lunca Inferioară a Crişului Repede" (ROSCI0104), next to the dam near Tărian locality (47°5'17.80"N, 21°47'2.11"E) (Fig. 1) we observed and captured three individuals (two males and one female) of *Podarcis muralis*. Afterwards, in 2013 we revisited the habitat in March, May and September in order to confirm the presence of the identified population and to gather additional data about it. During the fieldworks in 2013 we have expanded the research area. Common wall lizards were captured by hand or were photographed in situ with Tamron SP 90mm f/2.8 Di Macro 1:1 lens mounted on a Canon EOS-600D digital camera. Snout-vent length (SVL) of captured individuals was measured using a digital dial calliper with 0.01 mm accuracy.

In total, based on the individual colour, we identified 58 common wall lizard adults (Fig. 2). In September 2013 we captured 23 juveniles. SVL of the smallest adult was 49mm, and of the largest adult 81mm (232mm with tail). The smallest juvenile was only 21mm SVL (Fig. 3). The area occupied by the individuals of *Podarcis muralis* was estimated to be approximately 950 square meters.

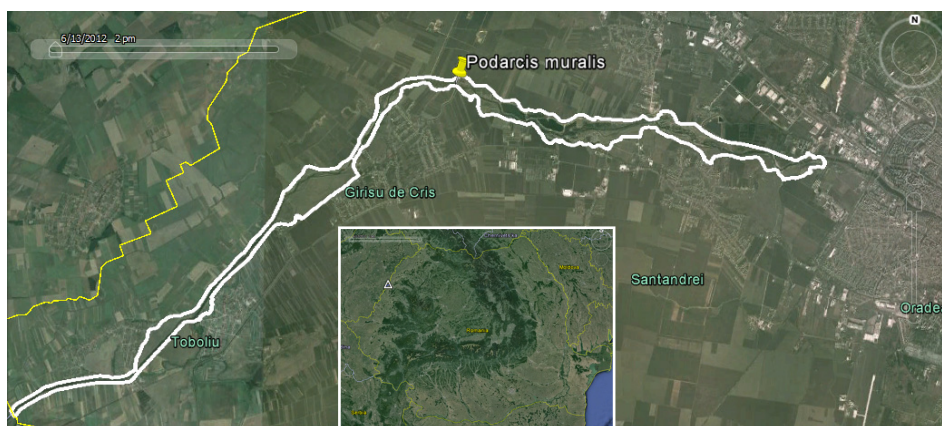


Figure 1. The limits of the “Lunca Inferioară a Crișului Repede” (ROSCI0104) protected area and the position of the studied population (map after GoogleEarth free version).



Figure 2. Adult individuals of *P. muralis* from the studied area.



Figure 3. Juvenile of *P. muralis* from the studied area.

The identified population is about 40 and 46 km away from the nearest known population of *Podarcis muralis* in the Apuseni Mountains (at Vărciorog and Peștiș localities – Covaciu-Marcov et al. 2003).

The first three individuals of *Podarcis muralis* (in 2012) were sampled from the gabions brought several years ago to fortify the right bank of the river Crișul Repede (Sebes-Körös) downstream of the dam from Tărian. Based on the observation

made, we concluded that the individuals have arrived recently, with the gabions meant to strengthen the bank of river. Such introductions with building materials are certainly common, but often insufficient to form a population with long-term viability.

Therefore, we intended to revisit the place next year to see if there are common wall lizards anymore and if there is a possibility of their establishment in the future. During fieldworks in 2013 we have noticed that the gabions are not the only habitat used by the individuals of *Podarcis muralis* (Fig. 4). We have found a high number of adults (27) including on the stones and pieces of concrete left since the building of the dam at Tărian. Therefore, the species' presence must be much older, dating probably from the 70s when intense hydro-technical works had been performed along the Crișul Repede River (Petrea et al. 2006). This is the only feasible explanation of the presence of species in the studied habitat, since there is no railway communication nearby. The nearest population that inhabits railroads is at a distance of 54 km, where the species arrived from Apuseni Mountains due to the habitat provided by railways (Covaciu-Marcov et al. 2006).

The considerations on the age of the identified population of *Podarcis muralis* are not in contradiction with the available herpetofaunistic data (Covaciu-Marcov et al. 2000), considering both the location of the population and the small area occupied, which did not allow an easy recording; even its current discovery was owed to chance.

The hypothesis of the longer presence of the *Podarcis muralis* population is also strengthened by the fact that larger individuals (SVL greater than 70mm) occurred near the dam, while averaged sized individuals (SVL=49-63mm) used mostly the gabions. Juveniles occurred mainly in the dry vegetation on the concrete alley that connects the dam and the gabions. It is well known that the wall lizards have a pronounced territoriality, adult males defending their home ranges (Boag 1973 cited in Schulte et al. 2013). Due to this spatial structuring, the young individuals may become floating ones, dispersers of the population (Boag 1973). But in the case of non-native individuals / populations it can be observed a decrease of territoriality, probably due to the pressure of the environment (e.g. in the case of US populations - Brown et al. 1995). If non-native populations have suitable area with many unoccupied habitats, and suitable pathways of dispersion, the younger



Figure 4. Basking sites of *P. muralis* in the studied area.

(floating) individuals may become dispersers rather than competitors (Schulte et al. 2013). Before the bringing of gabions the individuals of the population probably had to cope with a limited availability of basking sites, near the dam. The fact that we did not identified males that suffered tail

loss, also indicates a more reduced territoriality of males, at least in the past. With the start of the arrangement of the river bank and the setup of gabions, the suitable habitat increased immediately, and this could lead to the retrieval of territoriality.

The only species of lizard occurring syntopically in the surveyed habitat is *Lacerta agilis*. In the speciality literature *Podarcis muralis* is considered an aggressive species (Gruschwitz & Böhme 1986, cited in Deichsel & Gist 2001), with pronounced territoriality (Edsman 1990, cited in Heym et al. 2013) and high invasiveness potential (e.g. Behler & King 2000), to which syntopic species always exhibit an avoidance response (e.g. Bertram 2004, cited in Heym et al. 2013, Schulte et al. 2012). Concerning the investigated population we did not observe such avoidance behaviour of the syntopic *Lacerta agilis* individuals. Most likely the lack of aggressive behaviour against *Lacerta agilis* is primarily due to the use of different basking substrate. In the surveyed habitat, *Podarcis muralis* uses as basking site the rocks from the dam and the gabions, while *Lacerta agilis* uses the sites covered with vegetation, which are often shadier. This observation is consistent with the results of Heym et al. (2013).

Nevertheless, a hypothetical problem might occur if the project of hydrotechnical improvement of Crişul Repede (Sebes-Körös) River (announced in 2012) downstream of the municipality of Oradea to the border with Hungary (announced in local press, i.e. Țic 2012) is realised. This project implies bank armouring as well, most likely with gabions, which could favour the expansion of the *Podarcis muralis* population along the lowland section of Crişul Repede (Sebes-Körös) River. After Allan et al. (2006) these lizards clearly have reached high numbers fairly quickly from very small founding populations. Presently, the population is limited by the size of suitable area. Enlarging the interaction area between the introduced common wall lizard and the sand lizard, across the entire lowland section of Crişul Repede (Sebes-Körös) River could raise conservation issues. Both species are native in Romania, and also species of community interest in need of strict protection through the Habitats Directive (Council Directive 92/43/EEC) and its Romanian national projection (O.U.G. 57/20.06.2007).

In conclusion the identified *Podarcis muralis* population can be considered as a self-sustaining population rather than a sink population, with probability of dispersion. But a long term monitor-

ing is needed to evaluate the future implications of the population on the biodiversity of the area.

Acknowledgement. First at all, we want to thank Aqua Crisius Asociation, Oradea, Romania <<http://www.aquacrisius.ro>>, the custodian of the protected area, for the access permission. We also want to thank the persons who accompanied us during field study in 2012 (Mihai Togor – leader of Aqua Crisius; Diana Cupşa and Ilie Telcean - University of Oradea), and in 2013 (Adina Pop, Florin Pantiş – candidates for BSc in Biology at the University of Oradea).

References

- Allan, G.M., Prelypchan, C.J., Gregory, P.T. (2006): Population profile of an introduced species, the common wall lizard (*Podarcis muralis*), on Vancouver Island, Canada. *Canadian Journal of Zoology* 84: 51–57.
- Beebee, T.J.C., Griffiths, R.A. (2000): Amphibians and reptiles - a natural history of the British herpetofauna. HarperCollins Publishers, London.
- Behler, J., King, F. (2000): National Audubon Society: Field Guide to Reptiles and Amphibians. New York: Alfred A. Knopf Inc.
- Bertram, N. (2004): Ecology of the Introduced European Wall Lizard, *Podarcis muralis*, near Victoria, British Columbia. – Thesis, Master of Science, BNRS, University College of the Cariboo.
- Boag, D.A. (1973): Spatial relationships among members of a population of wall lizards. *Oecologia* 12: 1-13.
- Böhme, W., Pérez-Mellado, V., Cheylan, M., Nettmann, H.K., Krecsák, L., Sterijovski, B., Schmidt, B., Lymberakis, P., Podloucky, R., Sindaco, R., Avci, A. (2009): *Podarcis muralis*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 05 May 2014.
- Brown, R.M., Taylor, D.H., Gist, D.H. (1995): Home range ecology of an introduced population of the European wall lizard *Podarcis muralis* (Lacertilia; Lacertidae) in Cincinnati, Ohio. *The American Midland Naturalist* 133: 344-359.
- Cogălniceanu, D., Rozyłowicz, L., Székely, P., Samoilă, C., Stănescu, F., Tudor, M., Székely, D., Iosif, R. (2013) Diversity and distribution of reptiles in Romania. *ZooKeys* 341: 49–76
- Covaciu-Marcov, S.D., Ghira, I., Venczel, M. (2000): Contribuții la studiul herpetofaunei din zona Oradea. *Nymphaea, Folia Naturae Bihariae* 28: 143-158.
- Covaciu-Marcov, S.D., Sas, I., Cupşa, D., Meleg, G., Bud, B. (2003): Studii herpetologice în regiunea Munților Pădurea Craiului și Plopișului (Jud. Bihor, România). *Analele Universității din Oradea, fasc. Biologie* 10: 81-95.
- Covaciu-Marcov, S.D., Bogdan, H.V., Ferenti, S. (2006): Notes regarding the presence of some *Podarcis muralis* (Laurenti 1768) populations on the railroads of western Romania. *North-Western Journal of Zoology* 2: 126-130.
- Covaciu-Marcov, S.D., Cicort-Lucaciu, A.S., Dobre, F., Ferenti, S., Birceanu, M., Mihuț, R., Strugariu, A. (2009): The herpetofauna of the Jiului Gorge National Park, Romania. *North-Western Journal of Zoology* 5(Suppl. 1): S01-S78.
- Deichsel, G., Gist, D.H. (2001): On the origin of the common wall lizards *Podarcis muralis* (Reptilia: Lacertidae) in Cincinnati, Ohio. *Herpetological Review* 32: 230-232.
- Deichsel, G., Schweiger, S. (2004): *Podarcis muralis* (Common Wall Lizard). Canada: British Columbia. *Herpetological Review* 35: 289-290.

- Edsman, L. (1990): Territoriality and competition in wall lizards. PhD thesis, Department of Zoology, University of Stockholm.
- Gasc, J.P., Cabela, A., Crnobrnja-Isailovic, J., Dolmen, D., Grossenbacher, K., Haffner, P., Lescure, J., Martens, H., Martínez-Rica, J.P., Maurin, H., Oliveira, M.E., Sofianidou, T.S., Veith, M. and Zuiderwijk, A. (1997): Atlas of Amphibians and Reptiles in Europe. Societas Europaea Herpetologica and Musée National d'Histoire Naturelle, Paris
- Gherghel, I., Strugariu, A., Sahlean, T.C., Zamfirescu, O. (2009): Anthropogenic impact or anthropogenic accommodation? Distribution range expansion of the common wall lizard (*Podarcis muralis*) by means of artificial habitats in the north-eastern limits of its distribution range. Acta Herpetologica 4(2): 183-189.
- Gregory, L.A., Gregory, P.T. (1999): The reptiles of British Columbia: a taxonomic catalogue. Wildlife Bulletin No. B-88, Wildlife Branch and Resources Inventory Branch, British Columbia Ministry of Environment, Lands and Parks, Victoria, B.C.
- Gruschwitz, M., Böhme, W. (1986): *Podarcis muralis* (Laurenti, 1768) – Mauereidechse. In: W. Böhme (ed.), Handbuch der Reptilien und Amphibien Europas. Vol. 2/II. Aula-Verlag, Wiesbaden. 434p.
- Hedeen, S.E. (1984): The establishment of *Podarcis muralis* in Cincinnati, Ohio. Herpetological Review 15:70-71.
- Hedeen, S.E., Hedeen D.L. (1999): Railway-aided dispersal of an introduced *Podarcis muralis* population. Herpetological Review 30: 57-58
- Heym, A., Deichsel, G., Hochkirch, A., Veith, M., Schulte, U. (2013): Do introduced wall lizards (*Podarcis muralis*) cause niche shifts in a native sand lizard (*Lacerta agilis*) population? A case study from south-western Germany. Salamandra 49(2): 97-104.
- Kraus, F. (2009): Alien reptiles and amphibians: a scientific compendium and analysis. Springer, New York. 563p.
- Kühnis, J.B., Schmocker, H. (2008): Zur Situation der Mauereidechse (*Podarcis muralis*) im Fürstentum Liechtenstein und im schweizerischen Alpenrheintal. Zeitschrift für Feldherpetologie 15:43-49.
- Petrea, D., Rus, I., Petrea, R. (2006): Restructurări plan-spățiale în evoluția recentă a albiei Crișului Repede (între Ciucea și Oradea). Revista de Geomorfologie 8: 35-44.
- Schulte, U., Bidinger, K., Deichsel, G., Hochkirch, A., Thiesmeier, B., Veith, M. (2011): Verbreitung, geografische Herkunft und naturschutzrechtliche Aspekte allochthoner Vorkommen der Mauereidechse (*Podarcis muralis*) in Deutschland. Zeitschrift für Feldherpetologie 18: 161-180.
- Schulte, U., Gassert, F., Geniez, P., Veith, M., Hochkirch, A. (2012): Origin and genetic diversity of an introduced wall lizard population and its non-native cryptic congener. Amphibia-Reptilia 33: 129-140.
- Schulte, U., Veith, M., Mingo, V., Modica, C., Hochkirch, A. (2013): Strong genetic differentiation due to multiple founder events during a recent range expansion of an introduced wall lizard population. Biological Invasions 15(12): 2639-2649.
- Strugariu, A., Gherghel, I., Zamfirescu, S.R. (2008): Conquering new ground: on the presence of *Podarcis muralis* (Reptilia: Lacertidae) in Bucharest, the capital city of Romania. Herpetologica Romanica 2: 47-50.
- Șandera, M. (2013): Map of distribution of *Podarcis muralis* in the Czech Republic. In: Zicha O. (ed.) Biological Library – BioLib. Available at: <<http://www.biolib.cz>>.
- Wirga, M., Majtyka, T. (2013): Records of the common wall lizard *Podarcis muralis* (Laurenti, 1768) (Squamata: Lacertidae) from Poland. Herpetology Notes 6: 421-423.
- Tic, A. (2012): Atenție, bărci pe Criș! La doi pași de oraș, orădenii se vor putea da cu ambarcațiuni mici pe Crișul Repede. Bihoreanul (online edition): 09/May/2012/10:47, available at: <<http://www.ebihoreanul.ro/>>
- ***** Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
- ***** O.U.G. nr. 57/20.06.2007, Privind regimul ariilor naturale protejate, conservarea habitatelor naturale, a florei și faunei sălbatice. [Romanian Law]
- ***** Google Inc. 2009. Google Earth (Version 5.1.3533.1731) [Software]. Available from <<http://too.lazy.to.look.it.up/>>