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Fig. 2. A suspected *Platydemus manokwari* found live inside the shell of a recently dead individual of a species of *Lucerna*. (Photo: Makiri Sei)

identification by Makiri Sei indicated that it was likely that this flatworm was *Platydemus manokwari*.

Justine, J.-L., Winsor, L., Barrière, P., Fanai, C., Gey, D., Han, A.W.K., La Quay-Velazquz, G., Lee, B.P.Y.-H., Lefevre, J.-M., Meyer, J.-Y., Philippart, D., Robinson, D.G., Thévenot, J. & Tsatsia, F. 2015. The invasive land planarian *Platydemus manokwari* (Platyhelminthes, Geoplanidae): records from six new localities, including the first in the USA. *PeerJ* 3: e1037.

Lowe, S., Browne, M., Boudjelas, S. & De Poorter, M. 2004. *100 of the World's Worst Invasive Alien Species*. Updated and reprinted version. Invasive Species Specialist Group, Auckland. 12 p.

Raut, S.K. & Barker, G.M. 2002. *Molluscs as Crop Pests*. CABI Publishing, Wallingford, UK.

Rosenberg, G. & Muratov, I.V. 2006. Status report on the terrestrial Mollusca of Jamaica. *Proceedings of the Academy of Natural Sciences of Philadelphia* 155: 117-161.

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NOTES ON VULNERABILITY OF THE MICROENDEMIC CLAUSILIID SPECIES *ACROTOMA ENGURIENSIS* FROM THE SOUTHWESTERN CAUCASUS

By Jozef Grego & Levan Mumladze

The pulmonate gastropod family Clausiliidae Gray, 1855 with its almost 1,300 recorded extant species is one of the most diverse land snail families worldwide. The extraordinarily high diversity results from a long history of evolution (since the late Cretaceous) and the environmentally driven fragmentation of populations in many genera. Such fragmentation resulted in a remarkable number of microendemic species, many of them representing relict taxa. Most of the small range and relict clausiliids occur almost exclusively in mountain habitats, where complex geomorphology and orogenesis contributed to the fragmentation of habitats and populations, leading to isolation over time. Within the European mountains several such radiation events took place. Genera with microendemic species include *Siciliaria* Vest, 1867 (Nordsieck, 2002) of southern Italy, *Alopia* H. & A. Adams 1855 (Fehér *et al*., 2013) of Romania, *Agathylla* H. & A. Adams, 1855 (Fehér *at al*., 2014) and *Montenegrina* Boettger, 1877 (Fehér & Szekeres, 2016) of the western Balkans, *Albinaria* Vest, 1867 (Hisrschfelder & Kittel, 2018) of Greece, *Armenica* Boettger 1877 and *Inobseratella* Lindholm, 1924 of Turkey, and *Christatria* Vest, 1867 (Uit de Weerd & Gittenberger, 2005) of the Levant and Israel. The western Caucasus hosts the clausiliid genera *Acrotoma* Boettger, 1881 and *Micropontica* Boettger, 1881 (Likharev, 1962; Sysoev & Shileyko, 2009) with many species occurring in fragmented, isolated populations (Likharev & Schileyko, 2007; Suvorov, 2002; Solodovnikov & Szekeres, 2017; Hausdorf *at al*., 2018). One of the most recently described species of the genus *Acrotoma*, the rock dwelling *A.* (*Iliamneme*) *enguriensis* Hausdorf, Walther & Neiber, 2018 (Fig. 1) is one such microendemic relict species with a supposedly high level of isolation, known to inhabit only two relatively small roadside cliffs along the road from Zugdidi to Mestia, close to the village of Jvari in Georgia. The two known localities of the species, both limestone cliffs about 40-50 m long and 5-20 m high, are very close to each other, at a distance of around 400 m. The limestone is covered by a dark green-greyish layer of microalgae, which serves as the main food for the rock-dwelling snail species (Fig. 2). Searches in the vicinity and in the broader neighbourhoods of both localities, along the road and below or above its level, did not find the species. Both localities had already been affected by anthropogenic activities during the construction of the road in the 1930s, but since then the surface area of cliffs increased and its microalgal layer recovered, and *A. eguriensis* managed to survive and even established relatively stable populations. The road, which

Fig. 1. live specimen *of Acrotoma eguriensis* Hausdorf, Walther & Neiber, 2018.

Fig. 2. Top: type locality of *Acrotoma eguriensis* Hausdorf, Walther & Neiber, 2018. Bottom: second northern locality of *A. eguriensis.*

supports moderately dense traffic (peaking in summer) seems to have minimum or no influence on the current populations and the current status is not faced with significant threat. As the species was apparently reintroduced to the cliffs after the road construction, it is very likely that it spread back from micropopulations in the close neighbourhood, though our effort to find such adjacent populations was unsuccessful.

Almost nothing is known about the biology, habitat preference and survival strategy of this species. In 2018 we visited the locality in May, during the most humid period of the vegetative season, and here we share our observations. Having survived the winter season, the snails are hidden in tiny crevices, cracks and flat spaces between the limestone beds aestivating during hot and dry days. At least some of the hiding places may be relatively deeper, as some of the snails appeared on the surface only after three days of continuous rain, with their shell surfaces still covered by mud and limestone incrust. Similar behaviour was observed in the rock dwelling *Montenegrina hiltrudae fusca* Fehér & Szekeres, 2006 from Albania, where after a few rainy days the snails appeared all at once from their hiding places in crevices shortly after the rain had stopped, first juveniles, then adult specimens stained by mud. Many of the *A. eguriensis* individuals (about 20-25 %) freshly emerging from their crevices were covered by a strong, secondarily precipitated carbonate layer over their entire shells, while others had no trace of any precipitate and some even had eroded shell surfaces. Even in wet underground crevices the formation of such a relatively thick inorganic sinter layer would take some time, and probably only if each snail regularly returns to the same precise hiding place exposed to the carbonate saturated water supply. This would explain why the sinter overlay is observed only in part of the population in each locality (higher frequency at the more northern site) and why the species is restricted with its mobility to such a relatively small microhabitat. Probably the snails spend their entire lives within a few square metres of the limestone cliff. *Acrotoma enguriensis* and its closest relative *A. baryshnikovi* are rock dwelling and not true MSS (mesovoid shallow substratum) species, but both prefer subterranean habitats for their survival strategy during the winter and during dry summer days. The latter species was found only inside a cave entrance with accumulation of empty shells in the aestivation site. It is very likely that the presence of small caves associated with spaces and gaps between the limestone beds is one of the factors also determining the habitat preference of *A. enguriensis*. Very similar hidden microhabitats, but for their entire life cycle, are preferred by true MSS genera of Clausiliidae, such as *Sciocochlea* and *Tsoukatosia* from western Greece and the Peloponnese, which also have fragmented patchy distributions with isolated populations. It was also remarkable that both localities of *A. enguriensis* had only subvertical orientation of the limestone beds perpendicularly oriented to the slope of the cliff, while the neighbouring cliff sites that lacked the presence of this species had different orientations of the limestone beds, sometimes subvertical but oriented parallel to the slope and cliff, forming much less accessible interbed cavities, that would be suitable as shelters. The localities are situated at the southern edge of a NE-SW oriented limestone ridge between the valleys of the Enguri and Magana rivers. As the localities were visited during heavy rain with a strong northerly wind coming from the entrance of the Enguri Valley, it was obvious that both localities are sheltered from the dominant northerly wind. The other localities in the neighbourhood where the species was not detected were exposed to strong cold winds from the deep valley of the Enguri, resulting in a different quality of the microclimate, with alternating humidity. Probably the microhabitat preference of *A. enguriensis* consists of several factors, including the presence of suitable survival crevices and optimal climatic conditions of the locality, maybe associated with preferred types of algae and moss as food and other so far unknown factors.

The microhabitat character of the *A. enguriensis* locality also predisposes it to being vulnerable, as it is situated on the left side of the main highway connecting the regions of Zugdidi and Mestia. As tourism in Georgia is one of the fastest developing segments of the local economy, the local government would like to support it by massive road reconstruction, especially along the main highways. The region of Mestia, with characteristic Svan fortress-like settlements, with wonderful panoramas of the Greater Caucasus and Mount Ushba, is one of the most attractive tourist destinations in Georgia, not only for hiking but most recently also for winter sports in newly built ski resorts. It is just a matter of time before the road from Javari to Mestia is

reconstructed and broadened to serve the increasing numbers of visitors and provide more comfortable travelling between the two locations. If broadening of the main highway were to be done in the usual way by massive cliff removal (excavating large parts of the cliff, throwing the debris down the slope to the bottom of the valley and casting a concrete support wall instead of the cliff), the populations of *A. enguriensis* would be eliminated almost immediately after the start of construction. As it is not very likely that other populations would be found on undisturbed areas along the ridge, or that some small surviving population could re-populate the disturbed cliffs without their natural algal layer, *A. engurensis* is definitely under threat of extinction by these activities. Unfortunately, none of the mollusc species (except Data Deficient *Helix buchii* Dubois de Montpereux, 1839) is protected or even red-listed, in Georgia. Accordingly, there is no legal basis for the protection of such small-range animals, which further aggravates potential threats to this and other species. An environmental appeal has to be made to the local government and construction companies to reconstruct the highway in an environmentally friendly way without demolishing the entire cliff and hillside, especially around the only known localities of *A. enguriensis* and, if necessary, to allocate suitable resources for such an environmentally friendly solution. Unfortunately, in several countries this does not work and saving a single endemic mollusc counts for little in comparison with the increased construction costs and is usually ignored. We already have negative examples of road construction related destruction of habitat and microendemic clausiliid localities in Albania, where highway construction destroyed one of the two known localities of microendemic *Montenegrina perstriata plenostoma* Fehér and Szekeres, 2006 along the Pogradec to Lin road on the bank of Lake Ohrid. Similarly, the type localities of two MSS species, *Tsoukatosia evauemgei* N. Reischütz, A. Reischütz & P.L. Reischütz, 2012 (Reischütz *et al*., 2018) in the Peloponnese and *Sciocochlea llogarenis* A. & P.L. Reischütz, 2009 (Reischütz *et al*., 2016) in Albania were destroyed. We strongly hope that the Georgian microlocalities will not follow the negative examples from other parts of Europe and that an appropriate solution for the locality conservation will be found. In this way the list of human-driven extinctions would not need to be extended by a remarkable gastropod species from the western Caucasus.

Fehér, Z., Németh, l., Nicoară, A. & Szekeres, M. 2013. Molecular phylogeny of the land snail genus *Alopia* (Gastropoda: Clausiliidae) reveals multiple inversions of chirality. *Zoological Journal of the Linnean Society* 167(2): 259-272.

Fehér, Z., Parmakelis, A., Koutalianou, M., Mourikis, T., Erőss, Z.P. & Krízsik, V. 2014. A contribution to the phylogeny of Albanian *Agathylla* (Gastropoda, Clausiliidae): insights using morphological data and three mitochondrial markers. *Journal of Molluscan Studies* 80(1): 24-34.

Fehér, Z. & Szekeres, M. 2016. Taxonomic revision of the rock-dwelling door snail genus *Montenegrina* (2016) Boettger, 1877 (Mollusca, Gastropoda, Clausiliidae). *ZooKeys* 599: 1-137.

Egorov, R.E. 2001. *Clausiliidae (Serrulininae, Alopiinae, Mentissoideinae). Treasure of Russian shells, 5(1)*. Colus Publishing Co, Moskva, 61 p.

Egorov, R.E. 2002. Clausiliidae (Clausiliinae, Baleinae). *Treasure of Russian shells, 5(2)*. Colus Publishing Co, Moskva, 78 p.

Likharev, I.M. 1962. *Clausiliidae. Fauna SSSR, Molluski. 3(4)*. USSR Academy of Sciences, Moskva, Leningrad. 317 p. [in Russian].

Likharev, I.M., Schileyko, A.A. 2007. A new species and a new subgenus of *Acrotoma* O. Boettger, 1881 New Clausiliidae from Abkhazia 165 (Pulmonata, Clausiliidae). *Ruthenica* 17: 65-67.

Nordsieck, H. 2002. Contributions to the knowledge of the Delimini (Gastropoda: Stylommatophora: Clausiliidae). *Mitteilungen der Deutschen Malakozoologischen Gesellschaft* 67: 27-39

Nordsieck, H. 2005. Systematics of the Mentissoideinae (Gastropoda: Stylommatophora: Clausiliidae). *Archiv für Molluskenkunde* 134: 53-64.

Pokryszko, B.M., Cameron, R.A.D., Mumladze, L. & Tarkhinashvili, D. 2011. Forest snail faunas from Georgian Transcaucasia: patterns of diversity in a Pleistocene refugium. *Biological Journal of the Linnean Society* 102: 239-250.

Solodovnikov, I.A. & Szekeres M. 2017. Three new species of Clausiliidae (Gastropoda, Pulmonata) from Abkhazia. *Ruthenica* 27(4): 159-165.

Suvorov, A.N. 2002. A new subgenus and three new species of the genus *Acrotoma* O. Boettger, 1881 (Pulmonata Clausiliidae) from western Transcaucasia. *Ruthenica* 12: 161–166.

Sysoev, A.V. & Schileyko, A.A. 2009. *Land snails and slugs of Russia and adjacent countries*. Pensoft Publishers, Sofia, Moskva, 312 p.

Uit de Weerd, D.R. & Gittenberger, E. 2005. Towards a monophyletic genus *Albinaria* (Gastropoda, Pulmonata): the first molecular study into the phylogenetic position of eastern *Albinaria* species. *Zoological Journal of the Linnean Society* 143(4): 531-542.

Uit de Weerd, D.R. & Gittenberger, E. 2013. Phylogeny ofthe land snail family Clausiliidae (Gastropoda, Pulmonata). *Molecular Phylogenetics and Evolution* 67: 201-216.

Reischütz, A., Reischütz, P.L. & Szekeres, M. 2016. The Clausiliidae subfamily Phaedusinae (Gastropoda, Pulmonata) in the Balkans. *Nachrichtenblatt der Ersten Vorarlberger Malakologischen Gesellschaft* 23: 93-117.

Reischütz, A., Reischütz, P.L. & Szekeres, M. 2018. The genus *Tsoukatosia* Gittenberger 2000 (Gastropoda, Clausiliidae, Phaedusinae) in the Parnon Mountains (Greece, Peloponnesos). *Nachrichtenblatt der Ersten Voralrberger Malakologischen Gesellschaft* 25: 51-58.

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CONSERVATION OF NON-MARINE MOLLUSCS IN CENTRAL SOUTHERN BRASIL: RECENT ADDITIONS TO THE INVENTORY OF SANTA CATARINA STATE

By A. Ignacio Agudo-Padrón

During 2018, based on the latest systematic list (Agudo-Padrón, 2018), ten new species (eight gastropods, six native, two non-native invasives) and two native bivalves were added to the current inventory of non-marine molluscs occurring in the state of Santa Catarina, the small geographically central