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Four new records of invasive gastropods in Vienna

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Abstract: In the years 2020 and 2021, new detections of four invasive gastropod taxa were reported in Vienna. Three of them, *Tandonia kusceri*, *Cernuella virgata* and *Cernuella cisalpina* were recorded in Favoriten. For *T. kusceri* this was the first record in Austria. *Cernuella cisalpina,* which differs morphologically only by a smaller size from *C. virgata* sensu stricto, is a taxon with controversial status. Both forms were now found almost syntopic in Vienna, allowing to observe in the future whether they interbreed there. The mitochondrial lineages of both forms showed a genetic distance of 8.4 %. However, present data is not sufficient to resolve the taxonomy of these taxa. The fourth newly detected taxon is *Discus rotundatus f. abietina*. Free-living specimens were noted for the first time near an old arm of the Danube. This Mediterranean form of an otherwise native species has so far only been observed in greenhouses in central and northern Europe.

Keywords: *Tandonia kusceri*, *Cernuella cisalpina*, *Cernuella virgata*, *Discus rotundatus* f. *pyramidalis*, *Discus rotundatus* f. *abietina,* Austria, new records, invasive species

Zusammenfassung: In den Jahren 2020 und 2021 wurden Neunachweise von vier invasiven Gastropodentaxa in Wien belegt. *Tandonia kusceri, Cernuella virgata* und *Cernuella cisalpina* wurden in Favoriten nachgewiesen, bei *T. kusceri* war dies der Erstnachweis in Österreich. Die beiden Arten der Gattung *Cernuella* wurden das zweite Mal in Österreich festgestellt. *Der Status von C. cisalpina* ist umstritten, da sie sich morphologische lediglich in der geringeren Größe von *C. virgata* unterscheidet. Die beiden Formen wurden nun in Wien syntop festgestellt, weshalb in Zukunft getestet werden könnte, ob sie sich hier vermischen und kreuzen. Die mitochondriellen Linien beider Formen weisen eine genetische Distanz von 8,4 % auf. Die vorliegenden Daten reichen jedoch nicht zur Klärung der Taxonomie aus. Das vierte neu nachgewiesene Taxon ist *Discus rotundatus f. abietina*. Nahe einem Donau-Altarm wurden erstmals freilebende Exemplare festgestellt. Diese mediterrane Form einer ansonsten heimischen Art wurde in Mittel- und Nordeuropa bislang nur in Gewächshäusern beobachtet.

Schlüsselwörter: *Tandonia kusceri*, *Cernuella cisalpina*, *Cernuella virgata*, *Discus rotundatus* f. *pyramidalis*, *Discus rotundatus* f. *abietina,* Österreich, Neufunde, invasive Arten

Introduction

Records of free-living invasive gastropods in Austria are constantly increasing in species numbers and localities during the last decades (e.g., Reischütz 2002). The current report lists up another four cases of introduced land gastropods in Vienna, Austria. A barcode sequence of the mitochondrial cytochrome c oxidase subunit 1 gene (*COI*) was obtained from all taxa, which will be published within the next months in BOLD (Kruckenhauser et al. in prep.).

Results and Discussion

Tandonia kusceri (H. Wagner, 1931) is a slug originating from the western Balkan region (Korábek et al. 2016, Čejka et al. 2020), which has been overlooked for a very long time in Slovakia and Hungary, where it was mistaken for its congener *Tandonia rustica* (Millet, 1843) (Čejka et al. 2020). In addition, *T. rustica* is also known to be an introduced species in Eastern Austria and Hungary (Reischütz 1986, Turóci et al. 2020). The true identity was revealed by Korábek et al. (2016), who also claimed, that reports of *T. rustica* in Eastern Austria listed in Reischütz (1986) might be misidentifications of *T. kusceri* and should be revised. P.L. Reischütz (personal comm.) rejected this hypothesis, as he knew already at that time from several trips to former Yugoslavia *T. kusceri* well, and also its morphological differences compared to *T. rustica*. Anyway, one specimen of *T. kusceri* was found in Southeastern Vienna on September 9th, 2020, by Hannah Schubert during a survey in the course of the project "Molluscs of the rural development areas in Vienna" in the southeastern border region of Vienna near Unterlaa (Fig. 1). Another specimen was found by Michael Duda during a search on the 5th of February 2021. Both specimens showed the external trait typical for this species, a more reticulated ornamentation

Fig. 1: Living specimen of *Tandonia kusceri* found on September 9th, 2020 in Unterlaa (approx. length: 35 mm). Photo: M. Duda

on the upper side. This enables to distinguish it from its superficially similar congener *T. rustica*, which is covered by fine dark spots on the upper side. The determination was reconfirmed by genetic data, as one specimen (AL-8292) was genetically analyzed using the DNA barcode sequence of the mitochondrial *COI* gene.

The area where the species was recorded, is a shelter belt created as a part of the "Wald der jungen WienerInnen" (Forest of the young Viennese) campaign in the 1990s. Both specimens were found under rotting wood. The area is under heavy anthropogenic influence from the surrounding intensive agricultural use and deposited green waste and debris from the settlement north of it. It is very likely, that *T. kusceri* already has a possible broader distribution around the reported area in the adjacent settlement areas in private gardens.

Cernuella cisalpina (Rossmässler, 1837) and *Cernuella virgata* (Da Costa, 1778) are two Mediterranean or Mediterranean and Western European species, respectively, which have been introduced to other parts of Europe (Neckheim 2006), or even North America and Australia.

Fig. 2: Living adult specimens of *Cernuella virgata* (left, approx. shell diameter 23 mm) and *Cernuella* cf. *cisalpina* (right, approx. shell diameter 8 mm) from Triester Straße. Photo: Alexander C. Mrkvicka

Both species have also been recorded in Austria, *C. cisalpina* in central Lower Austria (Stojaspal & Stummer 1981) and *C. virgata* in Breitenlee in northern Vienna (Fischer & Duda 2004). While the population of *C. virgata* is still evident (Duda, personal observation in 2020), *C. cisalpina* disappeared after several years (Reischütz 2002). There are discussions about the status of *C. cisalpina,* as it looks identical in shell and genital anatomy to *C. virgata* (Manganelli & Giusti 1987), but with smaller dimensions (see Fig. 2). Therefore, it was placed in synonymy with *C. virgata* by Hausdorf & Sauer (2009). Other authors prefer to separate both species. In 2012, when Welter-Schultes summarized information supporting a separation into two species, he reported, that *C. cisalpina* shows 7 to 8 mm shell height and 9 to 12 mm shell width, while *C. virgata* is considerably larger and more variable with 8 to15 mm shell height and 12 to 23 mm shell width. He also pointed out some differences in ecology and lifestyle: *C. cisalpina* rather prefers to live on the soil surface often hidden under stones, while *C. virgata* climbs up the vegetation during hot and dry weather, similar to other xerothermophilous snails. In Italy, both species occur sympatrically without intermediate forms.

In August 2020 two new, nearly syntopic populations of both forms were recorded in Vienna (Fig. 2). They were discovered in the south of Vienna, in the 11th district, close to Wienerberg, next to the Triester Straße. The surroundings of this area are dominated by industrial real estate. The Triesterstraße was once an important street connecting eastern central Europe with the northern Adriatic Sea, nowadays it is still a highly frequented street connecting Vienna with its southern surroundings. *Cernuella cf. cisalpina* was found by Carina Steinkogler at a grass strip next to a petrol station at Triester Straße 104 on short cut grass. *Cernuella virgata* was found just about 60 m north to this place by Alexander C. Mrkvicka on the 4th of August 2020 behind a bus station at the crossing of Computerstraße and Triester Straße on and in higher ruderal vegetation. Of each population, a DNA barcode sequence of the *COI* gene of one adult specimen was obtained (bigger morphotype: specimen AL-8291, smaller morphotype: specimen AL-8290). The two sequences show a p distance of 8.4 %. Puizina et al. (2013) assigned one specimen from the railway station of Castelnuovo Berardenga in Central Italy to *C. cisalpina*, which was originally investigated by Manganelli et al. (2005). But this specimen was only included in a network based on another marker sequence (mitochondrial 16S rRNA gene) shown by Puizina et al. (2013) and no *COI* data was available. Nevertheless, the network showed only unclear separation to other forms of *C. virgata* investigated in that study.

Despite the presence of several additional sequences of *C. virgata* in GenBank (e.g., Chueca et al. 2018, Gomez-Rodriguez et al 2019) indicating that this taxon may

Fig. 3: Frontal view of *Discus rotundatus* f. *abietina*. Specimen no. Al-8300. Photo: Julia Schindelar, NHMW

contain several quite distinct mitochondrial lineages, our findings can neither resolve the question of species delimitation between *C. virgata* and *C. cisalpina* nor the question of interspecific variation and cryptic diversity within *C. virgata*. Anyway, perhaps this nearly syntopic occurrence of both taxa is an additional puzzle stone and may stimulate further, more comprehensive investigations.

The name *Discus rotundatus* f. *pyramidalis* (Jeffreys, 1862) is sometimes used for populations of the otherwise native *D. rotundatus*, which originate from southwestern Europe and occur in greenhouses in central and northern Europe (Horsák et al. 2013). Other authors, like Leiss & Reischütz (1996) used the name *D. rotundatus* f. *abietina* (Bourguignat, 1864) for this morphotype. It can be distinguished by the slightly more elevated shell, which leads to a "pyramid-like" shape when viewed from the side, but this trait is sometimes ambiguous (see also Fig. 3). So far, this form was restricted to warm greenhouses in central and northern Europe (Horsák et al. 2013). Some suspected it to be of Mediterranean origin (Horsák et al. 2013), while others like Plate & Frömming (1953) rather suspected a morphological reaction to the warm and moist conditions in warm greenhouses. When first mentioned by Jeffreys (1862), it was described as "from Swansea and other places", while Bourguignat (1864) described the form "*abietina*" from mountain forests in Kabylia in Algeria. F. Welter-Schultes (pers. comm.) remarked, that the name "*Helix rotundata pyramidalis*" is very likely a junior primary homonym of *Helix pyramidalis* Sowerby, 1841 from the Philippines.

Free-living specimens of this form were found in Vienna in the surroundings of an old river arm called "Kleehäufel" near the motorway junction "Kaisermühlen". This seems to be the first record of this form outside of greenhouses in Central Europe. A comparison of the *COI* sequence of one specimen (specimen AL-8300) with the BOLD database showed close relationships to *Discus rotundatus* from Corsica, which confirms the Mediterranean origin of this population, according to Horsák et al. (2013). For the moment, the use of the name "*D. rotundatus* f. *abietina*" is recommended for this morphotype. Since the taxonomic assignment of this form is not yet resolved we use the label "forma" albeit it is not a taxonomic rank. Any further taxonomic decisions cannot be drawn at the current state of knowledge and must be part of broader investigations.

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