

Short note

<https://doi.org/10.26496/bjz.2021.88>

Yet another carnivorous semi-slug found in Belgium: *Daudebardia rufa* (Draparnaud, 1805) (Gastropoda: Oxychilidae)

Louis Bronne^{1,*}, Johann Delcourt^{2,3} & Tom Van den Neucker^{4,5}

¹Natagora (NPO), Traverse des Muses 1, 5000 Namur, Belgium.

²University of Liège, Department of Biology, Ecology and Evolution, Service of Behavioural Biology, Institut de Zoologie (I1), Quai Van Beneden 22, 4020 Liège, Belgium.

³University of Liège, High Fens Scientific Station (SSHF), rue de Botrange 137, 4950 Robertville, Belgium.

⁴University of Antwerp, Department of Biology, Ecosystem Management Research Group, Universiteitsplein 1C, 2160 Wilrijk, Belgium.

⁵Biodiversity Inventory for Conservation NPO (BINCO), Walmersumstraat 44, 3380 Glabbeek, Belgium.

* Corresponding author: louis.bronne@natagora.be

Keywords. *Daudebardia rufa*, *Daudebardia brevipes*, distribution, first record, Belgium, snail, semi-slug.

Bronne L., Delcourt J. & Van den Neucker T. (2021). Yet another carnivorous semi-slug found in Belgium: *Daudebardia rufa* (Draparnaud, 1805) (Gastropoda: Oxychilidae). *Belgian Journal of Zoology* 151: 99–105. <https://doi.org/10.26496/bjz.2021.88>

This note reports the first record of the semi-slug *Daudebardia rufa* (Draparnaud, 1805) in Belgium and adds a new record of *D. brevipes* (Draparnaud, 1805). After the first report of *D. brevipes* in Belgium (Trooz, May 2020) [1], ten surveys were conducted at random natural or semi-natural locations along the river Vesdre, in order to assess to what extent the species was established. The surveys were carried out between September and December 2020. On December 20th 2020, the first author found two fresh empty shells of *D. rufa* on cobblestones at the bottom of a railway bridge embankment, situated between the Vesdre and a road in Ensival (50.5742° N, 5.8310° E), a village in the centre of the Province of Liège, Belgium (Fig. 1). Two days later, on December 22nd 2020, the second author found a living adult on the embankment wall at the opposite entrance of the bridge. On December 25th 2020, a fresh dead adult specimen was found. Another one was found on January 29th 2021, along with a live juvenile and an empty shell. An empty shell of *D. brevipes* was also collected at the same locality.

The site is located at the crossing between the left riverbank of the Vesdre valley (142 m above sea level) and a railway bridge, around a small tunnel. The soil consists of recent alluvial deposits of clay and sand. The bedrock is characterized by Devonian shales and dolomitic limestones. The bridge and its embankments are made of limestone. The slopes of these embankments are poorly consolidated, allowing the development of mosses, herbs, ferns, trees and shrubs, particularly on the northern side. Trees and



Fig. 1 – Site description: (a) Orthoview (scale bar = 50 m, the yellow arrows indicate where the specimens of *D. rufa* were found) [2]; (b) view of the northern side of the tunnel; (c) view of the southern side of the tunnel; (d) details of the stony slopes of the railway embankment. Pictures taken in December 2020 and January 2021.

shrubs had been cut in 2019, with the resulting wood chips scattered on the railway embankment, mainly at the NE of the tunnel. The riparian vegetation (including *Rubus* sp., *Fallopia japonica* and *Urtica dioica*) along the Vesdre had also been recently cut. Deduced from historical maps and image archives from [2][3][4], at least three cycles of maintenance and cutting were carried out over the last 20 years. Vegetation on the NW railway embankment, where most specimens were found, is dominated by *Salix caprea*, *Corylus avellana*, *Rubus* sp., *Asplenium trichomanes*, *Dryopteris* sp. and mosses. The NE embankment displays the same shrub assemblage, with the addition of *Acer pseudoplatanus*. The SW embankment is dryer and more sun-exposed, with very little vegetation. *Corylus avellana*, *Sambucus nigra*, *Crataegus monogyna*, *Rubus* sp., *Rosa canina*, *Senecio inaequidens* and *Urtica dioica* are the main species on the SE embankment, where two specimens of *D. rufa* were found. The woodland located at the SE is dominated by *C. avellana* and *Quercus robur*.

The empty shells and the live adult-sized specimen of *D. rufa* collected in Ensival (Fig. 2) fit the description of the species and differ from the closely related *D. brevipes* [5][6][7]. The stretched body length of the adult *D. rufa* measured 16 mm and its shell width measured 4.5 mm. The last whorl of the adult shell is strongly ear-shaped and the upper and lower parts of the shell mouth are almost parallel, so that the shell appears oblong. The coiled part of the shell occupies 40 to 50% of the total width; in comparison, *D. brevipes* has a concave shell outline and the coiled part occupies only 30 to 40% of its total width [5][6][7]. There are no significant anatomical differences between *D. rufa* and *D. brevipes* [5].

Daudebardia rufa is found in parts of Central and Southern Europe (Fig. 3), the Ukraine, Turkey and Algeria [6][7]. Recently, *D. rufa* was also found in Western Europe, including the Netherlands [8] and UK [9]. Fossil records of *D. rufa* dated to the Eemian interglacial period (circa 130-115kyr BP) from the Somme region in France [10] suggest that its range reached further westward than known at present, apart from the recent find in the UK [9]. *Daudebardia rufa* is found in humid deciduous highland and montane forests, typically between 300 and 1500 m elevation, often near water [6][7][11]. In Central

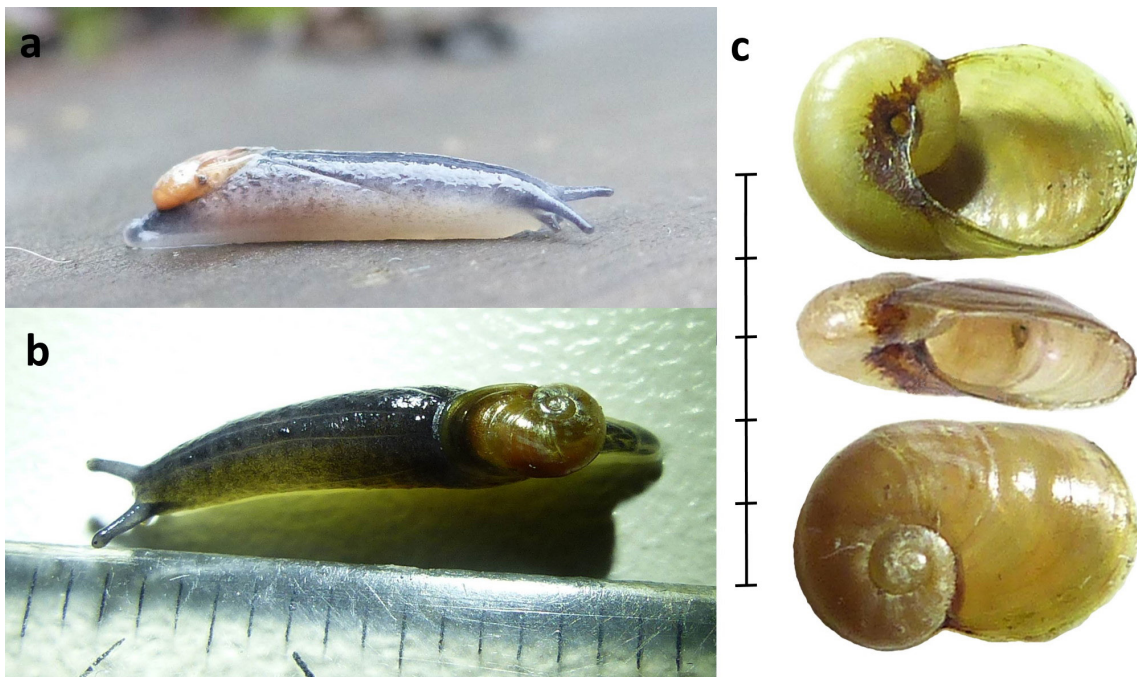


Fig. 2 – The live adult specimen of *Daudebardia rufa* found in Ensival (a–b) and its shell (c). Scale bar is in mm.

Europe, *D. rufa* has been reported from *Fagus*, *Fraxinus*, *Quercus*, *Carpinus* and *Salix* forests [11][12][13][14], as well as from scrublands and grasslands on mountain slopes [13]. In southern regions, it has been recorded in *Fagus* forests, sparse *Quercus* and *Fraxinus* forests and ravine forest fragments with *Acer pseudoplatanus* [15][16][17]. Like *D. brevipes*, *D. rufa* is mesohygrophilic and cold-resistant [18]. The species does not tolerate warm and dry conditions, and is therefore mostly subterranean, living in deep, loose soil. Acidic soils are avoided [6][7][11]. During cooler periods, in spring, late autumn, and on mild winter days, *D. rufa* can be found under stones, moss, leaf litter and decaying wood [11]. *Daudebardia rufa* is carnivorous and mainly feeds upon molluscs, earthworms, isopods and insect larvae [6][7][11].

Daudebardia rufa is a rare species, although it is more common and widespread than *D. brevipes* [7] (Fig. 3). The conservation status of *D. rufa* differs regionally. In Germany, *D. rufa* is categorized as endangered [19]; in the Czech Republic, as near threatened [20]; in Switzerland, as vulnerable [11]; and in Austria, as of least concern [21]. At the western edge of its range (Fig. 3), the presence of *D. rufa* has been established for a long time in Luxembourg [22] as well as in France and Germany along the Rhine valley [23][24]. Remarkably, both *D. rufa* and *D. brevipes* have recently been reported from several new localities in Western Europe (Fig. 3). In 2016, a population of *D. rufa* was found in Wales (UK) [9]. In 2017, fresh shells of *D. rufa* and *D. brevipes* were found together in the western part of the German Eifel, at two different sites in the Urft valley (Pardey, pers. comm.), and a live juvenile of *D. rufa* south of Aachen (Majoer, pers. comm.). In 2019, a single specimen of *D. brevipes* was found in a greenhouse in Ghent, Belgium [25]. In May 2020, live specimens of *D. brevipes* were found in a natural environment in Belgium, along the Vesdre [1]. Finally, in November 2020, empty shells and live specimens of both species were found in the valley of the Eyserbeek in the Netherlands [8]. Interestingly, the rivers Urft

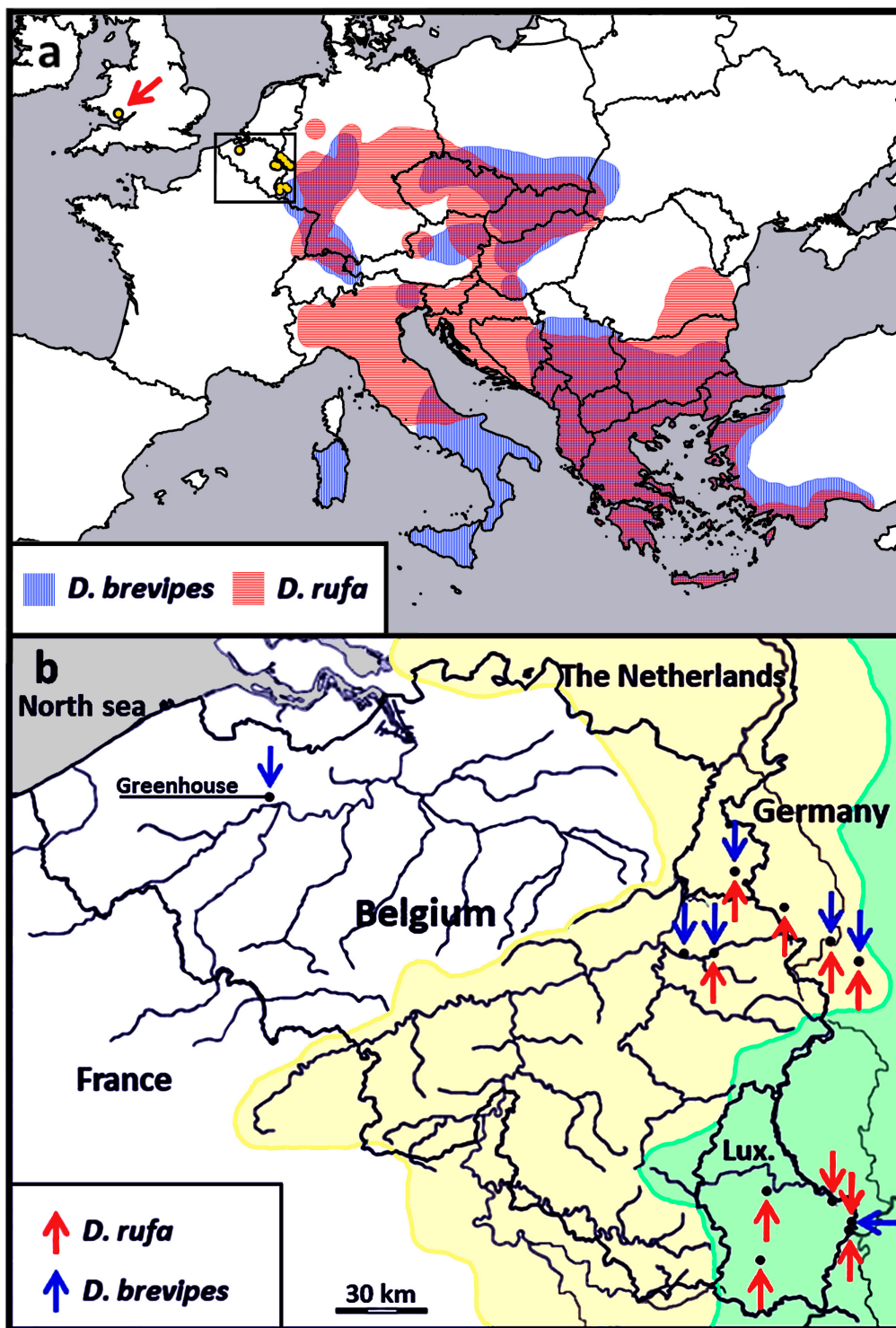


Fig. 3 – (a) Range map of *Daudebardia rufa* and *D. brevipipes* in Europe, redrawn from WELTER-SCHULTES [7]. Yellow dots indicate recently reported localities along the western part of their ranges. The locality of *D. rufa* in the UK [9] is indicated by the red arrow. (b) Reported records of *Daudebardia* from Benelux and adjacent localities in Germany are indicated in the cut-out below, corresponding with the black rectangle in the top panel (a). The Meuse and Rhine basins are indicated in pale yellow and pale green, respectively. Black dots on the bottom panel (b) indicate published and unpublished records (see text) and records available from the GBIF portal [28].

in Germany, Vesdre in Belgium and Eyserbeek in the Netherlands, all belong to the Meuse basin. This suggests that *D. rufa* and *D. brevipes* are firmly established along the Meuse basin, despite the Rhine basin long being considered as the westernmost range limit of both species (Fig. 3).

The recently established presence of both *Daudebardia* species in the Meuse basin could be the result of a westward range expansion. However, BRONNE & VAN DEN NEUCKER [1] hypothesised that the *D. brevipes* population along the Vesdre in Trooz may have been previously overlooked, based on the relatively pristine habitat. This may also be the case for *D. rufa*, although the site at Ensival is clearly more disturbed than the site at Trooz, and it therefore cannot be ruled out that *D. rufa* was introduced. Likewise, OWEN *et al.* [9] expressed uncertainty about whether *D. rufa* is an overlooked native species or a species recently introduced in Wales (UK). The find of *D. rufa* along the Vesdre in Ensival resulted from surveys carried out after the earlier find of *D. brevipes* in Trooz. Similarly, the find of *D. brevipes* in the Netherlands along the Eyserbeek was the result of targeted searches after the previous find of *D. rufa*, which was first reported on a data portal for citizen scientists [8]. Online data portals such as iNaturalist and Waarnemingen.be/Observations.be are valuable early warning systems to detect upcoming invasive species [26], but could also play an important role in monitoring neoforeign species (i.e., species that have expanded their range as a response to human-induced environmental changes [27]) and in detecting previously overlooked native species.

Although it is not clear whether *D. rufa* and *D. brevipes* were introduced or should be considered (neo)native, our study shows that both species are firmly established in the Meuse basin. The presence of juvenile specimens of *D. rufa* indicates that the Belgian population is self-sustaining. The rapid communication of the first Belgian records of *D. rufa* and *D. brevipes* and the overview of the current distribution of both species in Western Europe (Fig. 3) could serve as a baseline for further monitoring the newly recorded populations. Given that *D. rufa* and *D. brevipes* may be (neo)native in Belgium and given their general rarity in Europe, protective measures should be considered for both species, although the uncertainty regarding the origins of the Belgian *Daudebardia* populations should be taken into account. Such measures may include protection of their preferred habitat, in particular deciduous forests with deep soils in the vicinity of small rivers [6][7][11].

Acknowledgements

Three of the surveys along the Vesdre were conducted by Kurt Boux and Yolan Bosteels. Étienne Meuleman and the Royal Belgian Society of Malacology (SRBM), as well as Alain Bertrand helped with the compilation of the bibliography. Caroline Orban and Martijn Van Roie proofread the text. Two anonymous reviewers and the editor are thanked for improving the manuscript.

References

- [1] BRONNE L. & VAN DEN NEUCKER T. (2020). The carnivorous semi-slug *Daudebardia brevipes* (Gastropoda: Oxylidae) in Belgium: an overlooked native species? *Belgian Journal of Zoology* 150: 197–202. <https://doi.org/10.26496/bjz.2020.81>
- [2] GOOGLE (s.d.) *Map of Wegnez-Ensival, Belgium* [map]. Google Earth 2005, 2007, 2009, 2015, 2016, 2021. Google, Aerodata International Surveys, Maxar Technologies, & Geobasis-DE/BKG. Available from <https://earth.google.com> [accessed 26 August 2021].
- [3] GOOGLE (s.d.) *Rue du Purgatoire, Ensival, Belgium*. Google Street View 2009-2013-2017-2020. Available from <https://google.com/maps> [accessed 30 December 2020].
- [4] SERVICE PUBLIC DE WALLONIE (s.d.) *Orthophotos 2001-3, 2006-7, 2009-10, 2012-13, 2015, 2016, 2018, 2019, 2020* [map]. Available from <https://geoportail.wallonie.be> [accessed 30 December 2020].

- [5] RIEDEL A. (1967). Dauebardiinae (Gastropoda, Zonitidae) Bulgariens. *Annales Zoologici* 24: 463–483.
- [6] KERNEY M.P. & CAMERON R.A.D. (1979). *A Field Guide to the Land Snails of Britain and North-West Europe*. Collins, London.
- [7] WELTER-SCHULTES F.W. (2012). *European Non-Marine Molluscs, a Guide for Species Identification*. Planet Poster Editions, Göttingen.
- [8] TEMPELMAN D. (2021). Nieuw in Nederland: de semi-naaktslak *Dauebardia rufa* (Draparnaud, 1805). *Spirula* 426: 35–36.
- [9] OWEN C., ROWSON B. & WILKINSON K. (2016). First record of the predatory semi-slug *Dauebardia rufa* (Draparnaud, 1805) from the UK (Eupulmonata: Dauebardiidae). *Journal of Conchology* 42: 119–121.
- [10] ANTOINE P., LIMONDIN-LOZOUET N., AUGUSTE P., LOCHT J.-L., GALHEB B., REYSS J.-L., ESCUDÉ É., CARBONEL P., MERCIER N., BAHAIN J.-J., FALGUÈRES C. & VOINCHET P. (2006). Le tuf de Caours (Somme, France): mise en évidence d'une séquence eemienne et d'un site paléolithique associé. *Quaternaire* 17 (4): 281–320. <https://doi.org/10.4000/quaternaire.880>
- [11] BOSCHI C. (2011). *Die Schneckenfauna der Schweiz. Ein umfassendes Bild- und Bestimmungsbuch*. Haupt, Bern/Stuttgart/Wien.
- [12] SÓLYMOS P., GAUDÉNYI T., DELI T. & NAGY A. (2004). Data on the land snail fauna of the Fruska Gora Mountain (Serbia) with some biogeographical remarks. *Malacological Newsletter* 22: 149–153.
- [13] GEORGIEV D.G. (2005). Species diversity and habitat distribution of the Malacofauna (Mollusca: Bivalvia, Gastropoda) of Surnena Sredna Gora Mountain (Southern Bulgaria). In: GRUEV B., NIKOLOVA M. & DONEV A. (eds) *Proceedings of the Balkan Scientific Conference of Biology in Plovdiv (Bulgaria) from 19th till 21st of May 2005*: 428–435.
- [14] ČILIAK M. & ŠTEFFEK J. (2011). Preliminary malacological survey of the site of community importance Kamenná Baba (Branisko–Bachureň). *Folia faunistica Slovaca* 16: 85–89.
- [15] SÓLYMOS P. (2000). Data on the recent mollusc fauna of the western part of the Villány Hills, S Hungary. *Malacological Newsletter* 18: 105–108.
- [16] FERRERI D., BODON M. & MANGANELLI G. (2005). Molluschi terrestri della provincia di Lecce. *Thalassia Salentina* 28: 31–130. <https://doi.org/10.1285/i15910725v28p31>
- [17] HALLGASS A. & VANNOZZI A. (2016). Terrestrial gastropods (Mollusca Gastropoda) from Lepini Mountains (Latium, Italy): a first contribution. *Biodiversity Journal* 7: 93–102.
- [18] IRIKOV A. & MOLLOV I. (2015). Terrestrial gastropods (Mollusca, Gastropoda) of Strandzha Mountain and the Black Sea coast (Bulgaria and Turkey). *Historia naturalis bulgarica* 21: 13–48. <https://doi.org/10.13140/RG.2.1.3908.0809>
- [19] HACKENBERG E. & MÜLLER R. (2017). Rote Liste und Gesamtartenliste der Weichtiere (Mollusca: Gas-tropoda und Bivalvia) von Berlin. In: Der Landesbeauftragte für Naturschutz und Landschaftspflege / Senatsverwaltung für Umwelt, Verkehr und Klimaschutz (Hrsg.) *Rote Listen der gefährdeten Pflanzen, Pilze und Tiere von Berlin*. <https://doi.org/10.14279/depositonce-5845>
- [20] JUŘIČKOVÁ L. & KUČERA T. (2005). Ruins of medieval castles as refuges for endangered species of molluscs. *Journal of Molluscan Studies* 71: 233–246. <https://doi.org/10.1093/mollus/eyi031>
- [21] REISCHÜTZ A. & REISCHÜTZ P.L. (2007). *Rote Liste der Weichtiere (Mollusca) Österreichs*. In: ZULKA K.P. (red.) *Rote Listen gefährdeter Tiere Österreichs. Teil 2: Kriechtiere, Lurche, Fische, Nachtfalter, Weichtiere*: 363–433. Grüne Reihe des Lebensministeriums 14/2.

- [22] FERRANT V. (1892). Beiträge zur Molluskenfauna des Grossherzogtums Luxemburg (Schluss). *Bulletin de la Société des naturalistes luxembourgeois* 2: 21–26.
- [23] GERMAIN F. (1930). Mollusques terrestres et fluviatiles (1ère partie). *Faune de France* 21: 1–477.
- [24] BICHAIN J.M. (2016). *Description et répartition des escargots terrestres du Haut- et du Bas-Rhin. Malacofaune d'Alsace Vol. 1*. Available from http://www.odonat-grandest.fr/telechargements/FauneAlsace/CahiersTechniquesMalaco/malacofaune_v1_2016.pdf [accessed 25 January 2021].
- [25] VAN DEN NEUCKER T. & SOORS J. (2019). The carnivorous semi-slug *Daudebardia brevipes*, a remarkable new greenhouse snail in the botanical garden of Ghent (Belgium) (Gastropoda, Oxychilidae). *Spixiana* 42: 192.
- [26] SWINNEN K.R.R., VERCAYIE D., VANREUSEL W., BARENDSE R., BOERS K., BOGAERT J., DEKEUKELEIRE D., DRIESSENS G., DUPRIEZ P., JOORIS R., STEEMAN R., VAN ASTEN K., VAN DEN NEUCKER T., VAN DORSSELAER P., VAN VOOREN P., WYSMANTEL N., GIELEN K., DESMET P., HERREMANS M., all working groups, species validators and recorders (2018). Waarnemingen.be – Non-native plant and animal occurrences in Flanders and the Brussels Capital Region, Belgium. *BioInvasions Records* 7: 335–342. <https://doi.org/10.3391/BIR.2018.7.3.17>
- [27] ESSL F., DULLINGER S., GENOVESI P., HULME E.P., JESCHKE J.M., KATSANEVAKIS S., KÜHN I., LENZNER B., PAUCHARD A., PYŠEK P., RABITSCH W., RICHARDSON D.M., SEEBENS H., VAN KLEUNEN M., VAN DER PUTTEN W.H., VILÀ M. & BACHER S. (2019). A conceptual framework for range-expanding species that track human-induced environmental change. *BioScience* 69: 908–919. <https://doi.org/10.1093/biosci/biz101>
- [28] GBIF.ORG (24 February 2021). GBIF Occurrence Download. <https://doi.org/10.15468/dl.4a7xq5>

Manuscript received: 8 March 2021

Manuscript accepted: 1 September 2021

Published on: 13 September 2021

Branch editor: Kurt Jordaens