

First record of the pill bug *Armadillidium arcangelii* Strouhal, 1929 (Crustacea: Isopoda) in Slovenia

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Abstract. Numerous novel occurrences of *Armadillidium arcangelii*, a terrestrial isopod native to Italy, have been reported in recent years in synanthropic habitats across much of Europe. These records indicate that the species is rapidly spreading, likely via the transport of plants. On 21. 9. 2023, a male of this species was collected on turf near Seča on the Slovenian coast. This is the first record of *A. arcangelii* in Slovenia. The record is all the more relevant as *A. arcangelii* is a potential agricultural pest.

Izvleček. Prva najdba pasavčka vrste *Armadillidium arcangelii* Strouhal, 1929 (Crustacea: Isopoda) v Sloveniji – V zadnjih nekaj letih so v sinantropnih habitatih v različnih delih Evrope opazili kopenskega enakonožca, pasavčka vrste *Armadillidium arcangelii*, ki izvira iz Italije. To kaže na hitro širjenje te vrste, najverjetneje s transportom rastlin. Samca vrste *A. arcangelii* smo našli 21. 9. 2023 na trati ob morju blizu Seče. To je prvo opažanje vrste *A. arcangelii* v Sloveniji. Najdba je pomembna tudi, ker je bila vrsta prepoznana kot potencialen škodljivec na poljščinah.

Terrestrial isopod crustaceans (Oniscidea) are a substantial part of soil invertebrate fauna. Over the past decades, numerous species have been introduced to parts of the world where they had not been present previously (Sfenthourakis & Hornung 2018). In certain regions of North America, the terrestrial isopod fauna may consist almost entirely of introduced species, predominantly of European origin (Szlavecz et al. 2018).

Recently, an enigmatic *Armadillidium* species has been recorded from numerous locations in Europe and Britain, with most of these occurrences likely representing recent introductions. While some uncertainty remained regarding the identity of the species that is rapidly colonizing synanthropic habitats across Europe, its morphological features matched those of *Armadillidium arcangelii* Strouhal 1929 (Noël et al. 2022), a species native to Italy (Schmalfuss 2003). In the past decade, these pill

bugs have been collected and examined in the United Kingdom (Gregory 2014; Hughes et al. 2024), Spain (Garcia & Cabanillas 2021), France, Greece, the Netherlands (Noël et al. 2022), and Belgium (De Smedt & Van Dijk 2023). Citizen science data on the iNaturalist platform (<https://www.inaturalist.org/>) suggest that it is likely present in several other European countries as well, including Austria, Croatia, Germany, Poland, and Portugal (Noël et al. 2022). Nevertheless, the identification of this species, now widespread in Europe, is provisional, as *A. arcangelii* is morphologically very similar to *Armadillidium apenninorum* and *Armadillidium marmoratum*, and some of these species names might be synonyms (Schmalfuss 2003; Noël et al. 2022; Hughes et al. 2024).

On 21. 9. 2023, a single adult male of a terrestrial isopod belonging to the genus *Armadillidium* was collected by the author of this field note on the Slovenian Adriatic coast (Fig. 1). The small, mottled pill bug was found under dead wood on a public turf along the shore near Seča (45.502944 N, 13.589944 E; 5 m a.s.l.). Further examination of the habitus and male characters revealed that the isopod matches the descriptions of *A. arcangelii*. The isopod and its dissected appendages are kept in the author's collection at the Department of Biology, Biotechnical Faculty, University of Ljubljana.

Several features can be used to identify *A. arcangelii*. The species is relatively small, with females reaching 8–9 mm in length and males being smaller (Strouhal 1929; Noël et al. 2022). The colour, while variable, is usually mottled brown (Strouhal 1929; Noël et al. 2022; Fig. 1A). The antennal lobes are small, protruding, and rounded, and the dorsal margin of the frontal shield reaches slightly above the frontal edge of the cephalothorax (Fig. 1A, B). The proximal article of the flagellum of the second antenna is shorter than the distal article (Strouhal 1929; Fig. 1A). The lateral parts of the posterior margin of pereonite 1 are curved, not sharply bent (Fig. 1A). The pleotelson is triangular, with straight lateral edges and rounded tip (Strouhal 1929; De Smedt & Van Dijk 2023; Fig. 1C). Diagnostic characters include the shape of the uropods (Strouhal 1929) and male characters, specifically the male pereopod 7 and pleopod 1 (Garcia & Cabanillas 2021; Noël et al. 2022). The posterior edge of the uropod exopodite in both sexes is not rounded (Strouhal 1929; Fig. 1C). The exopodite of the male pleopod 1 ends in a triangular



distal lobe and the posterior edge of the exopodite bends near the distal end of the perispiracular area (Garcia & Cabanillas 2021; Noël et al. 2022; Fig. 1D). The tip of the male pleopod 1 endopodite

curves outwards (Noël et al. 2022; Fig. 1E). The ventral edge of the ischium on the male pereopod 7 is straight (Noël et al. 2022; Fig. 1F).



Figure 1. *Armadillidium arcangelii*, male, collected near Seča, Slovenia. A – habitus; B – cephalothorax; C – pleotelson with uropods; D – pleopod 1 exopodite with a bent posterior edge (arrowhead); E – pleopod 1 endopodite with the tip curving outward (arrowhead); F – straight ventral edge of ischium (arrowhead) on pereopod 7. Scale bars: 1 mm (A); 0.5 mm (B, C, F); 100 µm (D); 50 µm (E) (photo: M. Vittori).

Slika 1. *Armadillidium arcangelii*, samec, nabran blizu Seče v Sloveniji. A – habitus; B – glavopršje; C – pleotelzon z uropodi; D – eksopodit pleopoda 1 s pregibom na posteriornem robu (puščica); E – endopodit pleopoda 1 s konico, upognjeno navzven (puščica); F – raven ventralni rob ischiума (puščica) na pereopodu 7. Merilca: 1 mm (A); 0,5 mm (B, C, F); 100 µm (D); 50 µm (E) (foto: M. Vittori).

In Britain, initial reports came from greenhouses, but the species has since also been reported in garden centres (Hughes et al. 2024). In Spain, it was reported in habitats affected by human activities such as mining and industrial waste disposal near Madrid and Cádiz (García & Cabanillas 2021; García & Rojas 2021). In France, the species occurs in synanthropic habitats outdoors, mainly close to the coast (Noël et al. 2022). In Belgium, *A. arcangelii* was recorded on the green roofs of the University of Hasselt, where it was collected on several occasions over the span of 4 years (De Smedt & Van Dijk 2023).

The main route of the introduction of the species to several European locations was likely the transport of plants (Noël et al. 2022; De Smedt & Van Dijk 2023; Hughes et al. 2024). While terrestrial isopods generally do not cause agricultural damage, *A. arcangelii* was recently identified as a potential agricultural pest in Italy, as it may feed on young melon plants (Fusaro et al. 2024). The species had not been known to affect crops before.

As it had not been reported in Slovenia previously, despite extensive past research of the area (Potočnik 1984), and as it is known to have been introduced in other parts of Europe, *A. arcangelii* may have been introduced to Slovenia. Nevertheless, since Italian populations are relatively close, it is also possible that the species spread to Slovenia naturally, or that it was present in this area in the past, but never collected or recognized. Given its wide distribution and rapid spreading (Noël et al. 2022), the finding of *A. arcangelii* in Slovenia had been expected. Considering previous checklists of the terrestrial isopod fauna of Slovenia (Vittori et al. 2023), recent records (Jakob et al. 2024), and the record of *A. arcangelii* reported here, there are currently 76 recorded species of Oniscidea in the country.

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