



13th International Symposium on the Biology of Terrestrial Isopods (ISTIB13)

IRAKLEION, CRETE, GREECE, 2-5 JULY 2026



Platyarthus schoblii
(photo by Christodoulos Makris)

BOOK OF ABSTRACTS

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INTRODUCTION

The **Hellenic Institute of Speleological Research (HISR)** and the **Natural History Museum of Crete (NHMC)** of the **University of Crete**, organized the **13th International Symposium on the Biology of Terrestrial Isopods (ISTIB13)**. From **July 2nd to the 5th, 2026**, the NHMC in Irakleion, Crete, Greece, hosted the event to mark the **25th anniversary of ISTIB's return to the island**.

The ISTIB series, bringing together colleagues studying the amazing Oniscidea, began in 1983 in London, UK, and has continued undisrupted every 3 to 4 years: Urbino, Italy (1986); Poitiers, France (1990); Haifa, Israel (1997); Irakleion, Greece (2001); Aveiro, Portugal (2004); Tunis, Tunisia (2007); Bled, Slovenia (2011), Poitiers, France (2014), Budapest, Hungary (2017), Ghent, Belgium (2021 – virtual due to the Covid-19 pandemic), and Olomouc, The Czech Republic (2023).

Like all previous meetings, ISTIB13 accommodated contributions from all fields that use and/or focus on our beloved animals, such as taxonomy/systematics, evolutionary biology, morphology/anatomy, developmental biology, (eco)physiology, ecology, biogeography, molecular biology, behavior, etc. In addition, the **IUCN Woodlouse Specialist Group**, recently established to assess threat status of terrestrial isopods, had its first in-person meeting during the symposium.

The Organizing Committee expresses its gratitude to the sponsors that made the meeting possible:

- **NECCA** (Natural Environment and Climate Change Agency)
- The **Green Fund**
- The **Region of Crete, Regional Development Fund of Crete**

Also, the **Research Foundation Flanders (RWO)** that provided financial assistance to members of the IUCN WSG for attending the symposium.

The Organizing Committee

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PROGRAM

Thursday July 02, 2026

- 15:00 - 16:30 REGISTRATIONS
16:30 - 17:00 WELCOME – OPENING CEREMONY
17:00 - 18:00 INVITED LECTURE 1
Engineers of the underworld – key role of subterranean Oniscidea on ecosystems' services in the Anthropocene ■ **Reboleira A.S.P.S.**
18:00 - 18:30 COFFEE BREAK
Chair: **Stefano Taiti & Jana Bedek**
18:30 - 18:50 Morphological characterization of a new terrestrial isopod species *Platyarthrus* n. sp. from Tunisia ■ **Abidi S., Hamaied S.**
18:50 - 19:10 The terrestrial isopod fauna of Sardinia Italy diversity endemism and biogeographic affinities Malacostraca Oniscidea ■ **Taiti S., Montesanto G., Gardini P.**
19:10 - 19:30 On a new species of *Laureola* Barnard 1960 and two poorly known species of *Pseudolaureola* Kwon Ferrara Taiti 1992 from Madagascar Oniscidea Armadillidae ■ **Ganz M., Taiti S.**
19:30 - 19:50 Towards a revision of the terrestrial isopod family Agnaridae Schmidt, 2003 (Isopoda, Oniscidea) ■ **Gongalsky K.B., Byzov P.S., Medvedev D.A.**
19:50 - 20:10 Trait-based differences in terrestrial isopod extraction efficiency in Berlese-Tullgren funnels ■ **Goffin A., Van Den Bossche A., De Smedt P.**
20:30 SOCIAL EVENT

Friday July 03, 2026

- 09:30 - 10:30 INVITED LECTURE 2
Fifty years of crawling with isopods ■ **Hornung E.**
Chair: **Ivan Tuf**
10:30 - 10:50 Taxonomic composition and biogeographical patterns of Oniscoidea in traditional Wadi oases of northeastern Algeria
■ **Benchana I., Badis M., Medini-Bouaziz L.**
10:50 - 11:10 Homogenization and loss of specialization in terrestrial isopods along an urban gradient the role of local and landscape factors
■ **Gardini P., De Smedt P., Fattorini S., Audisio P., Sabatelli S.**
11:10 - 11:30 Agricultural practices filter gut microbiota and functional potentials reshaping the greenhouse gas emissions from isopod holobionts ■ **Wang B.**
11:30 - 12:00 COFFEE BREAK
Chair: **Katalin Szlavecz**
12:00 - 12:20 Terrestrial isopods diversity across contrasting Tunisian agroecosystems Influence of soil chemistry and tillage practices ■ **Fraj M., Sayari N., Bejaoui B., Chaveriat L., Martin P., Souty-Grosset C., Charfi-Cheikhrouha F.**
12:20 - 12:40 Phenology and life cycle of *Platyarthrus* sp Crustacea Isopoda Oniscidea from Ichkeul National Park ■ **Abidi S., Hamaied S.**
12:50 - 13:00 From environmental zeitgebers to social synergy keys to the survival and reproductive success of *Hemilepistus reaumurii* in Arid Habitats
■ **Habassi A., Nasri-Ammar K.**
13:00 - 13:20 *Ligidium hypnorum* a prominent element of wetland ecosystems
■ **Tajovský K., Tuf I.H.**

- 13:20 - 13:40 Fear of the scat Dietary mediated avoidance of predator faecal odours in the terrestrial isopod *Porcellio scaber* ■ Tuf I.H., Votoupalová J., Królová T.
- 13:40 - 15:30 LUNCH BREAK
- 15:30 - 16:30 POSTER SESSION
- Chair: **Kaloust Paragamian & Apostolos Trichas**
- 16:30 - 16:50 Hello darkness my old friend independent multiple cave and aquatic colonisation of European Trichoniscinae ■ Bedek J., Recknagel H., Fišer C.
- 16:50 - 17:10 Genetic insights into Oniscidea evolution: Progress and persistent questions ■ Dimitriou A.C., Sfenthourakis S.
- 17:10 - 17:30 An old forest indicator species in an anthropogenic world: the case of *Philoscia affinis* in Belgium ■ De Smedt P., Boeraeve P., Lock K., Arijs G., Segers S., Noël F., Hughes T., Sabatelli S., Gardini P.
- 17:30 - 17:50 The transcriptomic chimera molecular orchestration of the biphasic isopod moult ■ Sheizaf I., Robinson-Rechavi M., Chipman A.D.
- 17:50 - 18:10 Towards the Development of DNA Barcode Library for Terrestrial Isopods (Isopoda: Oniscidea) in Poland ■ Szpalek A., Grabowski M.
- 18:10 - 18:30 An update on the isopod phylogeny and the first terrestrial isopod genomes ■ Thomas Thorpe J.A.
- 18:30 - 18:50 COFFEE BREAK
- Chair: **Konstantin Gongalsky & Elisabeth Hornung**
- 18:50 - 19:10 Where to live in a diverse landscape. Terrestrial isopods (Oniscidea) along a gradient of herbaceous shrub and forest habitats ■ Martinka M., De Smedt P., Lebduška L., Braun M., Tuf I.H.
- 19:10 - 19:30 Drivers of abundance and species richness of litter dwelling woodlice in temperate forests Belgium as case study ■ Dauwe F., Sanczuk P., Lock K., Verheyen K., De Smedt P.
- 19:30 - 19:50 The postmarsupial manca stages of the Oniscidea a review of the current state of knowledge ■ Montesanto G.
- 19:50 - 20:10 Skeletal mechanics of the pereon in conglobating Crinocheta ■ Vittori M.
- 20:10 - 20:30 Developmental mechanisms of respiratory structures in terrestrial isopods ■ Inui N., Yao A., Fukushima K., Miura T.
- 20:30 DINNER

Saturday July 04, 2026 - Field trip

Sunday July 05, 2026

- 09:30 - 10:30 INVITED LECTURE 3
Terrestrial Isopods and the IUCN Red List of Threatened Species ■ Scott J.
- Chair: **Pallieter de Smedt**
- 10:30 - 10:50 Terrestrial isopods of Tunisia toward a national IUCN Red List ■ Charfi-Cheikhrouha F., Hamaied S., Medini-Bouaziz L.
- 10:50 - 11:10 The Red List of threatened isopods of Greece ■ Sfenthourakis S.
- 11:10 - 11:40 COFFEE BREAK
- 11:40 - 13:00 **IUCN Woodlouse Specialist Group**
- 13:00 - 14:00 LUNCH
- 14:00 - 14:20 OniscidBase Building a Global Database for Terrestrial Isopod Research Progress and Future Perspectives ■ De Smedt P., Gongalsky K.B., Kuznetsova D.M., Dauwe F., OniscidBase Team
- 14:20 - 16:00 **OniscidBase workshop**
- 16:00 - 16:30 CLOSING CEREMONY & FAREWELL

INVITED LECTURES

Fifty years of crawling with isopods

Elisabeth HORNUNG¹*

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I started getting acquainted with terrestrial isopods 50 years ago. During this half-century, I have had the opportunity to study these fascinating creatures from different perspectives, always adapting to the actual situation and applying new insights. I was fortunate to participate in all the symposia organized for sharing knowledge on woodlice, except for the first one in London. In the present talk, I wish to overview, summarize, and share with you the main topics and results I have dealt with during this rather long time period. The main topics and keywords of my interest over the years were:

- spatial and temporal patterns of isopod distribution; indication of environmental heterogeneity;
- isopod distribution at different scaling levels (from microhabitat to continental scale);
- population dynamics and reproductive patterns, reproductive strategies, and plasticity of certain species;
- oxygen consumption and productivity of terrestrial isopods;
- effects of perturbation, disturbance, urbanization, environmental pollution, and climate change on isopod species and populations;
- fluctuating asymmetry; histological studies;
- life history traits, habitat preference, naturalness – ecological indication, ecological state assessment, habitat features, and associated terrestrial isopod species;
- ecomorphology;
- diversity, introduction of species, composition of isopod assemblages in different habitat types, community composition;
- evolutionary adaptation of oniscidean isopods to terrestrial life: structural, physiological, and behavioral aspects;
- a sampling scheme and conservation implications.

Engineers of the underworld – key role of subterranean Oniscidea on ecosystems' services in the Anthropocene

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Below the ground life provides fundamental ecosystems services for humanity and all ecosystems at the surface. Subterranean animals have long fascinated scientists throughout their bizarre appearance and eco-evolutionary relevance. Terrestrial isopods are well represented in belowground faunas worldwide. Many are threatened by percolating contamination from the surface and by habitat destruction, thus we urge to understand subterranean ecosystems functions and how they are impacted by human activities. We provide the first evidence that subterranean terrestrial isopod species are more sensitive to the effect of global warming and pollution than their close relatives at surface, based on experimentally derived species' tolerance data. Moreover, we show how species of cave-adapted terrestrial isopod process cave sediments, and how all this is involved in the mobilization of nutrients into the sediment. Its biological activity significantly increases subterranean sediments in organic matter content by bioturbation, contributing to increase subsoil quality. Thus, offering evidence of the relevance of ecosystem services delivered by terrestrial cave habitats. This is essential to understand the magnitude of the critical services provided globally, which are often overlooked, compared to those provided by groundwater communities. Understanding the role of terrestrial isopod cave species provides the basis for assessing the impact of contaminants in caves and is a key step to develop effective conservation measures for more extended subterranean ecosystems, especially in under global warming scenarios.

This work is funded by the Chair in Sustainability of Subterranean Ecosystems – Loulé, created by protocol between the Faculty of Sciences of the University of Lisbon, Câmara Municipal de Loulé and Bondstone. It is also framed within the College on Polar and Extreme Environments (Polar2E) of the University of Lisbon.

Terrestrial isopods and the IUCN Red List of Threatened Species

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With the launch of the IUCN Species Survival Commission Woodlouse Specialist Group, we hope to scale up IUCN Red List assessments for this group. But where are we starting from, and how do we get there? We will take a look at which terrestrial isopods have been assessed already, in which categories, and from which regions. Then we will have a quick tour of the IUCN Red List methodology, and what data are needed to carry out an assessment. We will also explore uses of Red List data and assessments after they are published, and how they can help to inform conservation action.

ORAL COMMUNICATIONS

An old forest indicator species in an anthropogenic world: the case of *Philoscia affinis* in Belgium

Pallieter DE SMEDT^{1,2*}, Pepijn BOERAEVE², Koen LOCK³, Gert ARIJS², Stijn SEGERS², Franck NOËL⁴, Thomas HUGHES⁵, Simone SABATELLI⁶, Pietro GARDINI⁶

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Ancient forests harbour high biodiversity due to their long-term continuity, stable microclimates, and structural complexity, but identifying them in the human-dominated landscapes of Western Europe is challenging. Soil organisms with limited dispersal can act as indicators of historical land use, although their usefulness is often limited by taxonomic difficulties. Terrestrial isopods offer a suitable alternative because they are relatively large and well studied taxonomically and ecologically in temperate regions.

In Belgium, several terrestrial isopods, including *Philoscia affinis* Verhoeff, 1908, have been considered indicators of forest continuity. Historically, this species was recorded exclusively in ancient forests, supporting its role as an indicator species. However, this view has been questioned following the discovery of urban populations in Antwerp, with further occurrences reported in other anthropogenic habitats across Belgium and the Grand Duchy of Luxembourg.

These urban populations often display two colour forms. One form, corresponding to the former variety *P. muscorum affinis* var. *nigrovittata* Verhoeff, 1908, has not been found in ancient forest habitats in north-western Europe but is common in southern Europe in both natural and human-altered environments. This study reviews the taxonomic status of these forms and investigates genetic relationships among urban and forest populations, including specimens from Italy.

Preliminary results show that: (1) urban populations are genetically distinct from ancient forest populations, suggesting human-mediated introduction; (2) colour forms within urban populations do not represent separate genetic lineages; and (3) *P. affinis* likely comprises multiple genetically distinct entities. Overall, forest-associated populations in Belgium remain reliable indicators of ancient woodland, while distinct lineages—likely introduced from southern Europe—have established themselves in north-western urban environments.

Keywords: ancient forest, biodiversity indicator, woodlice, invasive species, species genetics

Topic: Genetics/Genomics

The transcriptomic chimera: Molecular orchestration of the biphasic isopod moult

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The biphasic moult is a hallmark of the order Isopoda, yet its molecular orchestration remains largely unexplored. We performed a comparative transcriptomic analysis across three phylogenetically divergent species - *Armadillo officinalis*, *Porcellio laevis*, and *Armadillidium maculatum* - to identify the conserved genetic architecture of this unique moulting strategy. Our analysis reveals a universal “Transcriptomic Clock” that drives the moult cycle regardless of phylogenetic distance.

Crucially, we demonstrate that during the intramoult interval, the isopod exists as a “Transcriptomic Chimera” - a molecular split-state where the anterior and posterior halves occupy fundamentally different physiological conditions simultaneously. This anatomical decoupling involves a massive 33.6-fold surge in transcriptomic asymmetry: while the anterior half focuses on the breakdown and recycling of the old cuticle, the newly ecdysed posterior half prioritizes immune protection and the hardening of the new shell. Our findings reveal that the biphasic strategy is governed by a rigid, conserved genetic molecular toolkit that precisely coordinates these two halves. This study provides a new framework for understanding isopod functional genomics and the evolutionary stability of the biphasic moult program.

Keywords: transcriptomics, moulting, genetics, evolution

Topic: Genetics/Genomics

Towards the Development of DNA Barcode Library for Terrestrial Isopods (Isopoda: Oniscidea) in Poland

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Terrestrial isopods (Oniscidea) represent a key component of soil macrofauna, but their genomic representation in global databases has remained marginal for Polish populations. This study establishes the first comprehensive reference DNA barcode library (5' fragment of the cytochrome c oxidase subunit I, COI) for the Oniscidea of Poland, integrated with morphological verification and an updated national checklist. Molecular analysis of 191 newly generated sequences (658 bp Folmer region) across 35 morphospecies revealed the presence of 54 molecular operational taxonomic units, suggesting substantial cryptic taxonomic diversity. Extreme maximum intraspecific genetic distances were recorded in *Trachelipus rathkii* (up to 16.70%; 7 MOTU) and *Trichoniscus pusillus* (up to 13.42%), confirming the existence of highly divergent, unresolved species complexes. Additionally, six species are reported as new to the fauna of Poland, increasing the national checklist to 47 species. These results bridge a critical geographic gap in European genomic resources within the Polish Barcode of Life project (PoLBOL), and provide a robust baseline for future environmental DNA (eDNA) metabarcoding and soil biodiversity monitoring.

Keywords: integrative taxonomy, DNA barcoding, COI, cryptic species, PoLBOL

Topic: Genetics/Genomics

An update on the isopod phylogeny and the first terrestrial isopod genomes

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Evolutionary relationships within Isopoda have long been debated, with morphology and molecules yielding multiple conflicting hypotheses. The first genome-level datasets have resolved some nodes, but unexpected groupings that conflict with traditional taxonomy remain, including at the base of Oniscidea. Determining whether these patterns reflect molecular bias or genuine isopod evolutionary history requires broader taxon sampling and further in-depth analytical investigation. The first chromosome-level genomes from Oniscidea reveal diverse repetitive DNA content with a clear phylogenetic signal, alongside surprising chromosomal synteny between distantly related species. Although gene order is extensively rearranged within chromosomes, larger-scale chromosomal rearrangements such as fusions, fissions and inversions appear to be rarer. Both repetitive DNA composition and ancestral chromosome reconstruction across the phylogeny may therefore provide additional, independent lines of evidence for resolving isopod evolutionary relationships. Finally, there is good news: recent advances in sequencing methodology are showing promise in trials here in the Tree of Life Programme at the Wellcome Sanger Genome Institute, indicating that the production of chromosome-level genomes across the diversity of Oniscidea may at last be feasible.

Keywords: isopod phylogeny, phylogenomics, genomes, chromosome rearrangement

Topic: Genetics/Genomics

Morphological characterization of a new terrestrial isopod species: *Platyarthrus* n. sp. from Tunisia

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Species of the genus *Platyarthrus* are small terrestrial isopods (≤ 5 mm), blind and depigmented. The 30 species currently known worldwide are distributed mainly throughout the Mediterranean Basin. The present study provides a detailed morphological diagnosis of a new species from Tunisia and aims to establish its ecological preferences and determine its geographic distribution. For this purpose, an extensive field survey was conducted between March 2017 and April 2022 in 219 sampling stations covering northern, central, and southern Tunisia. These surveys enabled the sampling of *Platyarthrus* populations and the acquisition of detailed data on their biotope and microhabitat, including their associated ant hosts, as well as several edaphic parameters such as soil moisture, texture and pH. Specimens of *Platyarthrus* n. sp. were counted, sexed, and subjected to a detailed comparative morphological study based on the general body shape, cephalon and pleotelson morphology, tegumentary ornamentation, the structure of male pleopods I and II, pereopods I and VII, and scale-setae. Whole specimens and dissected appendages were illustrated using a Leica M205 C stereomicroscope and a Leica DM1000 LED light microscope and were photographed using scanning electron microscopy. This new species is readily distinguished from its Mediterranean congeners by the morphology of the male pleopods and its tegumentary ornamentation. Its current distribution is restricted to northern and northeastern Tunisia, where it inhabits biotopes characterized by *Tamarix africana* and *T. gallica*, low maquis of *Pistacia lentiscus*, and *Pinus halepensis* forests. *Platyarthrus* n. sp. is a hemi-myrmecophilous species; collected within ant and termite nests or independently under stones.

Keywords: terrestrial isopods, taxonomy, new species, geographic distribution, microhabitat, ant hosts

Topic: Systematics

Taxonomic composition and biogeographical patterns of Oniscoidea in traditional Wadi oases of northeastern Algeria

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Traditional oases located along Wadis represent unique agroecosystems within arid regions. Owing to their ecological and biogeographical singularity, this study aims to investigate the taxonomic composition and biogeographical affinities of Oniscoidea in these systems. Stratified sampling campaign were conducted in 2022 and 2023 across nine Wadi oases from different bioclimatic zones in northeastern Algeria. Based on a satisfactory sampling effort, specimens were identified using regional taxonomic keys and by comparison with reference collections of terrestrial isopods from North Africa at the National Museum of Natural History of Paris, particularly the Vandel collection. A total of 13 Oniscoidea species were recorded, belonging to six genera and three families. From a biogeographical perspective, the assemblage includes eight endemic species to North Africa, two Mediterranean species, and three cosmopolitan species. Notably, several species are reported here for the first time in Algeria. This study provides new insights into the taxonomic composition and biogeographical patterns of terrestrial isopods in Wadi oases and highlights their importance as reservoirs of taxonomic diversity in arid Algerian ecosystems.

Keywords: terrestrial isopods, biodiversity, agroecosystems, arid regions, North Africa

Topic: Systematics

On a new species of *Laureola* Barnard, 1960 and two poorly known species of *Pseudolaureola* Kwon, Ferrara & Taiti, 1992 from Madagascar (Oniscidea: Armadillidae)

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Terrestrial isopods (Isopoda: Oniscidea) are a diverse and ecologically important taxon, yet knowledge of their diversity in the world remains uneven. Madagascar, the fourth largest island on the planet, is one of the most biodiverse places on Earth, representing a global hotspot for biodiversity with endemism rates reaching 91% for non-marine invertebrates. Nevertheless, only 52 species of terrestrial isopods are currently known from Madagascar, of which 43 are endemic, representing an 82.7% rate of endemism. A new species of *Laureola* from Andohahela National Park is described. Figures of *Laureola longispina* (Barnard, 1956) from Mount Selinda, Zimbabwe, are also given, as to better characterize the genus and pose the basis for much needed future revisions. Moreover, redescrptions of two previously described species, *Akermania sylvatica* Barnard, 1958 and *Pseudolaureola hystrix* (Barnard, 1958), both from Madagascar, are provided and the former species is transferred to the genus *Pseudolaureola*.

Keywords: Oniscidea, Madagascar, taxonomy, endemism, new species.

Topic: Systematics

Towards a revision of the terrestrial isopod family Agnaridae Schmidt, 2003 (Isopoda, Oniscidea)

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Agnaridae is one of the main families of terrestrial isopods, sometimes representing the majority of local faunas (e.g. Central Asia, South-East China). Up to now, the morphological characters of the genera belonging to this family remained intermixed causing a lot of misinterpretations. Using integrative taxonomy including (i) macromorphological characters (shape of exopod pleopod I, form of pereon tergite I, and others); (ii) micromorphological characters (mainly, shape of dorsal setae and position of noduli laterales); and (iii) genetic markers (COI and H3 genes) we propose a new system of the family. The revision includes several characters either omitted in earlier systems or surveyed not consistently throughout the genera. We propose to avoid characters with dubious or ambiguous meanings which can be interpreted differently by a specialist (tergite tuberosity, coloration, relative length of parts etc.). Based on this approach, we revealed substantial heterogeneity within the main agnarid genera (*Protracheoniscus*, *Lucasioides*, *Desertioniscus*, *Hemilepistus*) which we propose to split into more uniform groups. In the proposed system, Agnaridae will include 27 genera. The genus *Phalaba* Budde-Lund, 1910 is proposed to be excluded from Agnaridae. Either material or descriptions of all 203 species belonging to Agnaridae were examined and species ascribed to the new system of genera. The analysis of distribution of the family and new genera confirms a hypothesis that the centre of origin of the family is Central Asia with the highest diversity of both species and genera.

Keywords: Isopoda, Oniscidea, new genus, woodlouse

Topic: Systematics

The terrestrial isopod fauna of Sardinia (Italy): diversity, endemism and biogeographic affinities (Malacostraca, Oniscidea)

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Italy is one of the countries with the highest diversity of terrestrial isopods worldwide. At present 390 species are known, of which 234 are endemic (~60%). Sardinia is the second largest island in the Mediterranean (24,090 km²) with a complex geology and paleobiogeographic history. The island hosts a remarkably rich woodlouse fauna: our investigations in recent years have increased the number of known Oniscidea from 83 to 115 species, with many under description. A total of 49 species (22 new) can be considered assubterranean, i.e., trogllobiotic (25 species), stygobiotic (three species) or endogean (21 species). Only five species are considered trogllophilic. Most of the subterranean species of Oniscidea from Sardinia belong to the Synocheta (30 species in the families Trichoniscidae and Styloniscidae). Among the Crinocheta, the subterranean species are less numerous, belonging to the family Spelaeoniscidae (new to the island; three species), Platyarthridae (two species), Cylisticidae (one species), Agnaridae (one species), and Armadillidiidae (12 species). The epigean fauna currently includes 66 species, of which six are still undescribed. The most represented families are the Philosciidae (seven species), Porcellionidae (19 species), and Armadillidiidae (13 species). From a biogeographical perspective, the Sardinian fauna reflects both ancient paleogeographic connections and more recent evolutionary diversification processes. Particularly noteworthy are the Tyrrhenian representatives of the genera *Catalauniscus*, *Oritoniscus*, *Nesiotoniscus*, and *Scotoniscus* (Trichoniscidae), which highlight strong faunistic affinities with the north-eastern Iberian Peninsula and southern France, regions formerly connected to the Corsica–Sardinia microplate during the Oligocene. On the other hand, the newly recorded occurrence of the family Spelaeoniscidae, previously known only from Sicily, Spain and Algeria, also indicates western Mediterranean faunal connections. At the same time, the high number of endemic subterranean and surface-dwelling taxa suggests an important role of long-term isolation and *in situ* diversification in shaping the present-day fauna of the island.

Keywords: Oniscidea, Sardinian fauna, biodiversity hotspot, island biogeography, endemism

Topic: Systematics

Phenology and life cycle of *Platyarthrus* sp. (Crustacea, Isopoda, Oniscidea) from Ichkeul National Park

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Reproductive phenology and life cycles of terrestrial isopod species in the genus *Platyarthrus* have not been extensively studied. The present work aims to study the reproductive mode and life cycle of the new species *Platyarthrus* sp. (work in progress). Therefore, the *Platyarthrus* sp. population from Ichkeul National Park was selected, and monthly sampling was conducted over 25 months from March 2019 to June 2021. The collected specimens were measured, sexed, and divided into six categories (mancas, juvenile males, mature males, non-reproductive females, and reproductive females—the latter further subdivided into ovigerous females and non-ovigerous females). Subsequently, these specimens were distributed into size classes, and a length-frequency analysis was performed using ANAMOD software to detect and monitor cohorts throughout the study period. A total of 1818 specimens of *Platyarthrus* sp. were collected, with sizes ranging from 1 mm to 4.1 mm. During the study period, *Platyarthrus* sp. from Ichkeul exhibited seasonal reproduction from February to December, followed by a period of sexual rest in January. This species exhibited a variable lifespan ranging from 7 to 16 months and was capable of producing up to 7 broods. It is an iteroparous, semiannual species. The sex ratio was mostly biased in favor of females. Significant differences in the fecundity and fertility of the Ichkeul *Platyarthrus* sp. were found between the spring and the summer/autumn seasons.

Keywords: terrestrial isopods, Platyarthridae, Ichkeul Park, seasonal reproduction, life cycle, cohort, fecundity, fertility, sex ratio

Topic: Ecology

Terrestrial isopods diversity across contrasting Tunisian agroecosystems: Influence of soil chemistry and tillage practices

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Terrestrial isopods are recognized as sensitive bioindicators of soil ecological conditions, yet their responses to contrasting Mediterranean agroecosystems remain insufficiently documented. This study investigated isopod diversity and community composition across three agroecosystem types in the Majerda plain: vegetable crops, orchards and forage systems, characterized by contrasting soil management and tillage practices. Isopods were sampled using pitfall traps in the same twelve plots during spring 2009 and 2010. A total of 420 individuals belonging to eight species were recorded. Forage systems associated with no-tillage practices exhibited significantly higher species richness and Shannon diversity ($p < 0.05$), whereas intensively managed vegetable systems supported less diverse assemblages. Community composition differed significantly among agroecosystem types ($F = 2.51$, $p = 0.013$), with a significant interaction between management regime and sampling year ($p = 0.003$). Indicator species analysis (Indval) revealed that *Porcellionides pruinosus* and *Armadillidium sulcatum* were associated with orchard systems, while *Armadillidium tunisiense* and *Chaetophiloscia elongata* characterized forage systems under reduced soil disturbance. Variations in soil ionic composition and organic matter quality (C/N ratio) were significantly associated with shifts in isopod assemblages. These findings highlight the potential of Oniscidea communities as bioindicators of agricultural management and soil ecological conditions in Mediterranean agroecosystems.

Keywords: agroecosystems, bioindicators, Mediterranean agriculture, Oniscidea, soil management

Topic: Ecology

Homogenization and loss of specialization in terrestrial isopods along an urban gradient: The role of local and landscape factors

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Urbanization is a major driver of biodiversity change; however, its impact on soil macrodetritivore communities and their functional composition still remains overlooked. Terrestrial isopods, key soil macrodetritivores involved in decomposition processes, are increasingly used as model organisms to assess environmental change. In this study, we investigated the influence of landscape-scale urbanization and local environmental variables on terrestrial isopod communities in Rome (Italy), to test three hypotheses: (H1) taxonomic and functional community composition vary along the urbanization gradient, leading to biotic homogenization; (H2) local factors contribute more to these changes than landscape-scale urbanization; and (H3) species show non-random associations with the urban gradient. We examined variations in taxonomic and functional β -diversity, multivariate composition, and species-habitat association from 48 plots across 16 sites sampled in spring and autumn. Each plot was characterized in terms of landscape characteristics and local microhabitat and edaphic chemo-physical conditions. Overall, 42 species were collected in the study area. In accordance with H1, urbanization affected isopod communities, increasing taxonomic and functional homogenization. Taxonomic and functional β -diversity decreased with increasing urbanization, driven by greater contributions of richness differences and loss of the most sensitive species. Local-scale variables accounted for a general larger proportion of community variation than landscape-scale variables, partially supporting H2. Finally, we found non-random associations between species and urbanization, with habitat specialists thriving only in semi-natural and suburban forests, while urban areas were mostly dominated by tolerant generalist species, confirming H3. In summary, our study revealed that urbanization filters isopod communities through the combined influence of landscape-scale gradients and local environmental conditions, especially soil properties and habitat structure, highlighting the conservation importance of structurally complex urban green spaces for soil macrodetritivores and related soil ecosystem functions.

Keywords: urban biodiversity, Mediterranean cities, woodlice, β -diversity, microhabitat conservation

Topic: Ecology

Trait-based differences in terrestrial isopod extraction efficiency in Berlese-Tullgren funnels

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Berlese–Tullgren funnels are commonly used for extracting soil fauna due to their efficiency and suitability for standardized, large-scale experiments. They enable the estimation of species abundance and potential population effects on ecosystem functions. However, these applications depend on species-specific extraction efficiencies, which remain unknown for terrestrial isopods. This study aims to quantify extraction efficiency and extraction speed for eleven species with contrasting trait combinations under four treatments. Ten individuals per species were placed in funnels under two substrate types (oak leaf litter and humus) and two light conditions (light and no light), with five replicates. Passage was recorded after 1, 2, 3, 4, 7, 10, and 14 days.

Mean crossing rates ranged from 2% to 98%, indicating substantial variation among species and treatments. Substrate type was the primary driver of variation in both passage success and speed, whereas the effect of light depended on substrate. Most species exhibited higher passage success in leaf litter, often with faster passage under light conditions. A duration of seven days appears sufficient when light is applied to the experiment, particularly in leaf litter, while extending to 14 days yielded only slight improvements, mainly for some species in humus. In humus, species-specific differences were more pronounced, as several species were unable to cross the denser substrate. Exceptions to general trends included *H. danicus*, which maintained similar performance across substrates under light, and *T. pusillus*, which showed consistently low passage success.

Trait-based analysis indicated weak and inconsistent relationships between body size and crossing probability. In contrast, traits such as desiccation resistance, habitat affinity, and distributional parameters were more clearly associated with passage success.

The calculated efficiencies are a highly valuable contribution to population abundance estimations in the field. Further research can focus on intermediate substrate types and a broader range of taxa.

Keywords: Berlese-Tullgren funnels, extraction efficiency, ecological traits

Topic: Ecology

From environmental zeitgebers to social synergy: Keys to the survival and reproductive success of *Hemilepistus reaumurii* in arid habitats

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The desert isopod *Hemilepistus reaumurii* exhibits sophisticated adaptive strategies that facilitate its survival in extreme arid environments. This study investigates the synergistic effects of photoperiodic and thermoperiodic/thermic cues on the cooperative behaviors of *H. reaumurii*, specifically regarding burrow excavation and defense. Our findings demonstrate that these abiotic factors function as potent zeitgebers (synchronizers), entraining the biological clock to align reproductive phenology with optimal environmental windows. Furthermore, the equitable division of labor—balancing burrow defense and excavation within pairs—significantly enhances reproductive fitness. We elucidate the mechanisms by which this behavioral and physiological synchronization serves as a fundamental driver for the successful colonization of hostile habitats.

Keywords: *Hemilepistus reaumurii*, cooperative behaviors, environmental synchronizers, reproductive fitness, digging activity, burrow defense

Topic: Ecology

Where to live in a diverse landscape? Terrestrial isopods (Oniscidea) along a gradient of herbaceous, shrub and forest habitats

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Terrestrial isopods function as detritivores in natural ecosystems and many species show distinct preferences for specific ecological conditions, making them sensitive to changes in their environment. Despite this, terrestrial isopods are rarely considered in nature conservation planning in Central Europe. In this study, we examined how terrestrial isopods respond to an environmental gradient ranging from herbaceous vegetation over shrub stands to forest habitats. We placed 95 pitfall traps across five habitat types: herbaceous habitats, shrub habitats, transitions between herbaceous and shrub habitats, forest edges, and forests. Around each trap, we estimated the cover of herbs, shrubs, and trees within radii of two, five, and ten metres. Phytosociological sampling was conducted within the smallest radius to characterise the vegetation community, and Ellenberg indicator values were used to describe additional environmental conditions around the traps. We also recorded microclimatic conditions, specifically temperature and soil humidity. The data were analysed using both univariate and multivariate statistical methods. Data loggers recorded the highest temporal humidity inside herbaceous stands, whereas the lowest humidity was found at forest edges, in the forest and within shrub habitat. The highest temperatures were measured in herbaceous habitats, while the lowest and most stable temperatures occurred in forests, followed by shrub habitat and forest edges. Preliminary results showed the highest activity-density of terrestrial isopods in transitional zones, i.e. transition between herbaceous and shrub habitats and at forest edges. A preference for forest edges was strongest on sandy soils. The strongest vegetation-related predictors were forest edge position and the cover of herbs, shrubs, and trees within a ten-metre radius around the traps. These preliminary results suggest that terrestrial isopod communities respond not only to large-scale ecotonal effects in diverse habitat mosaics, but also to smaller-scale transitions between herbaceous habitats and spatially restricted shrub habitat.

Keywords: distribution, habitat mosaic, microclimate, terrestrial isopods, vegetation gradient

Topic: Ecology

***Ligidium hypnorum*, a prominent element of wetland ecosystems**

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Ligidium hypnorum is a woodlouse found across Europe and western Asia. It is characterized primarily by extreme sensitivity to desiccation, generally closely tied to stably moist habitats. It is one of the most hygrophilous terrestrial isopods in Central European wetlands. It requires an environment with high relative humidity, most often near flowing and stagnant waters, in floodplain forests or on waterlogged meadows. It is considered an indicator of original old forests (so-called ancient woodland) and preserved wetland ecosystems. Its presence signals a high groundwater level and peat formation processes. It functions as a detritophag, feeding on decomposing organic residues, especially leaf litter, moss and associated microorganisms, significantly contributing to the recycling of nutrients in the wet soils. It is active mainly at dusk and at night, its peak activity is in spring (May) and autumn, when habitat conditions are most favorable. During the dry summer, it retreats deeper into the substrate or into the wetter layers of the soil. The main breeding season occurs in the summer months (June–July). Unlike many other species, it cannot roll into a ball and its only defense against predators is extremely fast movement, with which it tries to escape to safety in a shelter. Using the example of evaluating available data from research on various wetland and non-wetland biotopes in the Czech Republic, we will try to elaborate on the currently known ecological parameters of this species, which often dominates our wetlands.

Keywords: *Ligidium hypnorum*, wetlands, epigeic activity, distribution

Topic: Ecology

Agricultural practices filter gut microbiota and functional potentials, reshaping the greenhouse gas emissions from isopod holobionts

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Terrestrial isopods are abundant detritivores essential for nutrient cycling in agricultural soils and are susceptible to agricultural practices. However, how agricultural intensification driven by increased inputs reshapes isopod microbiomes (*Porcellio* spp.), functional potential, and how these changes relate to holobiont greenhouse gas emissions, remains poorly understood. Here, we conducted wheat-maize rotation mesocosms with six management practices (two post-agricultural soils: bare and abandoned; and four agricultural soils in a full factorial design of fertilization and tillage management) to elaborate linkages among microbiome community structure, functional gene potential, and gas emissions using 16S rRNA and high-throughput qPCR. Intensification reduced gut microbial richness, diversity and simplified network complexity, shifting communities from diverse consortia in low-input systems toward Firmicutes-dominated assemblages (notably *Bacillus*) with reduced Proteobacteria and Actinobacteria. While low-input systems maintained modular networks and balanced communities and supported a broader and more abundant repertoire of carbon, nitrogen and phosphorus cycling genes, whereas homogenized under intensive agriculture exhibited a narrowed and functionally biased gene set. Additionally, fertilized treatments markedly increased carbon dioxide and nitrous oxide emissions from isopod holobionts, whereas low-input systems reoriented emission toward methane dominance with strongly constrained nitrous oxide release. Our Path models revealed that agricultural intensity expanded soil nutrient pools while reducing soil environmental stability and microbial functional capacity, while gut bacterial diversity enhances ecosystem multifunctionality. Overall, the results show that agricultural practices reorganized isopod gut microbiomes from diverse, interaction-rich consortia to homogenized, functionally constrained assemblages, with concomitant shifts in ecosystem-level carbon and nitrogen emissions. These findings highlight soil-fauna gut microbiota as an integrative bioindicator and a mechanistic linkage between agricultural management and belowground biogeochemical cycling.

Keywords: agricultural intensification, Isopod gut microbiome, nutrient cycling, greenhouse gas emissions, biotic homogenization

Topic: Ecology

Hello darkness, my old friend—independent multiple cave and aquatic colonisation of European Trichoniscinae

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Understanding evolutionary change driven by ecological factors is of the utmost importance for conserving and managing wild populations in a changing world, where many are expected to encounter environmental change. A valuable system for studying evolutionary response to such changes is represented by closely related species that have adapted to different environmental conditions. The repeated, parallel colonisation of novel environments can be considered a natural experiment, offering an opportunity to assess the associations between environment, phenotypic and genomic variation, as well as whether evolutionary changes unfold predictably along the same trajectories. Here, we present the subfamily Trichoniscinae as a suitable model system for studying evolutionary questions associated with environmental transitions. It comprises surface, cave, terrestrial, semi-aquatic and aquatic species from 50 genera. Eighteen genera of trichoniscins are exclusively subterranean, and six genera harbour both surface and cave species. Additionally, while dozens of cave and a few surface trichoniscins can survive submerged for days, six cave species have reverted to aquatic lifestyle completely. Here we are presenting the first preliminary multilocus phylogeny of the Trichoniscinae, using 85 species from 20 genera. Inferred from the available topology, we hypothesise a minimum of nine independent cave colonisations across southern Europe and two reversals to aquatic lifestyle in Sardinia and North Macedonia. The subterranean genera are monophyletic (*Alpioniscus*, *Cyphonethes*, *Titanethes*, *Spaleonethes*), but not closely related. The phylogenetic relationships of genera which harbour surface and cave species remain unresolved. Multiple independent environmental transitions make Trichoniscinae an ideal system to study comparative evolution.

Keywords: cave animals evolution, ecological transitions, freshwaters, phylogenetic, Trichoniscidae

Topic: Evolution/Phylogeny

Genetic insights into Oniscidea evolution: Progress and persistent questions

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Relatively late compared to other arthropod groups, the first genetic data for terrestrial isopods were generated and analysed at the beginning of the 2000s. Since then, numerous studies have been published, yet fundamental questions regarding higher-level taxonomy remain unresolved. Initial attempts relied on conserved ribosomal genes, producing phylogenies that aimed to resolve evolutionary relationships mainly among distant oniscidean taxa. However, after the compilation of the first genetic datasets, phylogenies based on genetic alone or combined genetic and morphological data failed to recover consistent evolutionary patterns between studied taxa based solely on genetic or on combined genetic and morphological data exposing inconsistencies in our understanding of deeper evolutionary patterns. Even the monophyly of the group, and hence the terrestrialization scenario(s), could not be corroborated by different studies based on genetic evidence. Both, at shallow and deep phylogenetic levels, the integration of genetic data has led to repeated taxonomic revisions, challenging the validity of current classifications and calling for a re-evaluation of traditionally used characters. At the same time, hidden genetic diversity has been uncovered, leading to the description of new species. Estimates suggest that the total number of species may reach up to 7,000 which is almost double the number currently described. The continued accumulation of genetic data is expected to provide deeper insights into the evolutionary processes that shaped this ecologically successful taxon, including the transition to terrestrial life and its subsequent expansion across nearly all terrestrial biomes. Furthermore, the potential integration of new fossil and paleogeographic evidence is anticipated to improve our understanding of the timing of the group's origin, as well as universal underlying evolutionary mechanisms of adaptation, taking advantage of the unique history of this taxon among global biodiversity.

Keywords: evolution, phylogeny, molecular systematics, terrestrialization

Topic: Evolution/Phylogeny

The postmarsupial manca stages of the Oniscidea: a review of the current state of knowledge

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Terrestrial isopods have an ametabolous development, so the term “manca” is employed instead of “larva” when referring to the early postmarsupial stages. The same term is also used for the final stages of marsupial development. The state of knowledge concerning the developmental stages of the suborder Oniscidea is, at present, quite limited. Given the number of new species discovered each year and the growing trade involving this taxon, very little is still known about the entire life cycle of most species. In order to comprehend the biology of these animals, it is critical to undertake a study of the early free-living stages following their emergence from the pouch of the mother’s body. In the limited case studies that have been conducted, it has been observed that the number of offspring released from the pouch is a variable that is positively correlated with the mother’s size, measured as cephalothorax width. Postmarsupial development is characterized by three distinct stages of metamorphosis, distinguished by sequential molts. The first manca stage, designated M1, is the shortest and can last a few hours or approximately a day. The remaining two manca stages, designated M2 and M3, are characterized by a duration of several days. In some species, extended parental care is observed during the M1 stage. The duration of these stages exhibits interspecies variation, with the most significant disparities observed in M1. Conversely, the analysis of larval stages could yield substantial benefits, not only through enhancing our comprehension of developmental biology, but also by facilitating our understanding of the phylogenetic relationships within species. This review presents a comparative analysis of the post-marsupial larval stages that have been studied to date from a morphological and eco-ethological perspective. A review of the current state of knowledge is accompanied by a proposal of future research directions.

Keywords: reproductive biology, morphology, ecology, ethology

Topic: Morphology

Skeletal mechanics of the pereon in conglobating Crinocheta

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Terrestrial isopods belonging to the “roller” morphotype can roll into an almost perfect ball, concealing their ventral surface and appendages. While the morphological features of conglobating isopods have been described by other authors, we aimed to further our understanding of the mechanism of conglobation by directly comparing the extended and enrolled body positions with novel imaging techniques. We examined the rollers *Armadillo officinalis* and *Armadillidium vulgare* using micro-computed X-ray tomography (micro-CT). Isopods were rapidly frozen in liquid nitrogen to preserve the fully extended and fully enrolled body positions and scanned using a Neoscan 80 X-ray microtomograph equipped with a thermal stage at -10 °C. Our results showed that the points of rotation between consecutive body segments are positioned dorsolaterally between sequential tergites and not ventrolaterally at the junction between the sternites and the tergites of pereonites as previously suggested. This position of the point of rotation facilitates the ventral flexion of the pereon, as corresponding muscles attach ventrally to the point of rotation. The transient nature of the articulations between sequential segments and the hydrostatic support provided by the haemolymph allow rollers to flex their pereons laterally, which would not be possible if bilateral hinge joints would be utilized for dorsoventral flexion. As an isopod rolls into a ball, the sternites of the pereon can bend along a flexible suture at their midline, folding inwards during rolling and bulging outwards when the pereon is extended. The examined rollers have shorter sternites that do not overlap when the pereon is extended, exposing the extensive arthrodial membranes between them. The sternites only overlap when the animal rolls, creating furrows that accommodate the pereopods.

Keywords: exoskeleton, rollers, *Armadillidium*, *Armadillo*, micro-CT

Topic: Morphology

Terrestrial isopods of Tunisia: Toward a national IUCN Red List

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Since the early 1990s, increasing scientific attention has been devoted to the study of terrestrial isopods in Tunisia where research efforts and systematic surveys conducted across the country have revealed a remarkable diversity of terrestrial isopods related to a wide range of ecological environments, from humid forest ecosystems and coastal zones to semi-arid, arid and saharan inland habitats. Nearly fifty species were collected and identified belonging to 12 families, some families are represented by only one species such as Agnaridae, Bathytropidae, Detonidae, Ligidae and Stenoniscidae. In contrast, the family Porcellionidae with 16 species followed by Platyarthridae with 9 species and Armadillidiidae with 8 species. While some species are widespread and abundant such as *Porcellio laevis*, *P. variabilis*, *Porcellionides pruinosus*, *Armadillidium tunisiense*, etc. but other species are represented by small populations and restricted distributions such as *Porcellio djahizi*, *P. dominici*, *Armadillidium ichkeuli*, *Platyarthrus monstirensis*, *Trichorina ghezal-aensis*, etc. These characteristics may increase their vulnerability to environmental disturbances, including habitat destruction, urbanization, agricultural intensification, pollution, and climate change. Endemic species are particularly important because their restricted distribution makes them more susceptible to extinction risks at both local and global scales. This presentation aims to draw attention to terrestrial isopods species facing increasing threats and conservation concerns, in order to facilitate the establishment of a national Red List based on the criteria of the International Union for Conservation of Nature (IUCN). Preparing a national Red List for terrestrial isopods will contribute not only to identify species threatened but also to prioritize conservation actions and guiding environmental management strategies for this zoological group playing a fundamental ecological role in decomposition processes, nutrient cycling, and soil ecosystem functioning.

Keywords: soil biodiversity; endemic species; threatned species; IUCN Red list; conservation

Topic: Conservation

The Red List of threatened isopods of Greece

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All terrestrial isopod species known from Greece were included in the national project 'Red List of Threatened Species of Greece' funded by the Natural Environment and Climate Change Agency, aiming to assess most plants, fungi and animals recorded in the country. The Hellenic Zoological Society implemented the project for animal species. A total of 241 species of terrestrial isopods were assessed against IUCN's Red List criteria, using the relevant SIS tool kit, and distribution maps were produced for 228 of these (the remaining are distributed either throughout the country or along all coastal areas). 162 of the species are endemic to Greece, so their national assessments are also global assessments and have been delivered to IUCN for inclusion in the respective database and website. According to the assessments, 19 species (all endemics) are Critically Endangered, 7 species (all endemics) are Endangered, 20 (11 endemic and 9 non-endemic) are Vulnerable, 11 are Near Threatened (all endemics), 99 Data Deficient (70 endemic and 29 non-endemic), and 85 Least Concern (44 endemic and 41 non-endemic). All Critically Endangered species are known from a single locality, with 11 being troglobitic. All Endangered species are also known from a single locality and 4 are troglobitic, whereas all Vulnerable species are based on criterion D2, i.e., restricted distribution and known from <5 localities, and 9 are troglobitic. The most common threat inferred is reduction of habitat quality due to human activities in conjunction to very small population size. Among epigeal species, the most threatened ones are those living exclusively in riparian habitats of southern Greece, which are continuously shrinking or destroyed by a combination of unsustainable water treatment and increasing aridity due to climate change. The next step is to design and implement action plans threatened species, giving priority to CR.

Keywords: Red List, IUCN, critically endangered, vulnerable, Greece

Topic: Conservation

Drivers of abundance and species richness of litter-dwelling woodlice in temperate forests: Belgium as case study

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Woodlice (Oniscidea) contribute significantly to key ecosystem processes in temperate forests, such as litter decomposition, nutrient cycling, and carbon sequestration. Despite this, little is known about the relative importance of the factors controlling their abundance and distribution patterns. However, such knowledge is urgently needed to deepen our understanding of the role of woodlice in ecosystem functioning and to predict their responses to global change.

In this study we aimed to identify the key drivers shaping woodlice abundance and species richness in Belgian forests. Therefore, we took litter samples in 118 forest patches across the country, after which woodlice were extracted by Berlese-Tullgren funnels. Next, we quantified the effect of climate, soil, litter and landscape variables on woodlice species richness and abundance using (general) linear models and a variation partitioning analysis. Additionally, also millipedes (Diplopoda) and centipedes (Chilopoda) were sampled and distribution patterns of the three taxa were compared.

Woodlice abundance averaged 41.0 ($\pm$ 5.5) individuals/m², with 16 species recorded. The dominant litter-dwelling species were *Trichoniscus pusillus* (55.5% of the specimens), *Philoscia muscorum* (13.6%), *Oniscus asellus* (7.2%) and *Porcellio scaber* (6.7%).

Woodlice species richness was primarily driven by climatic variables and litter quality, whereas litter weight was the dominant factor for centipedes and millipedes. Model performance for woodlice abundance was poor, preventing robust conclusions. Centipede and millipede abundance was primarily driven by litter weight and soil properties, and to a lesser extent by climatological variables. In addition, for centipedes, landscape forest cover had an important effect. The low model fit for woodlice may be explained by the dominance of *Trichoniscus pusillus*, a highly generalist species part of a species complex whose abundance remains difficult to predict.

Our results highlight the need to further unravel woodlice distribution patterns by increasing sample size, integrating species-specific responses, finer-scale environmental variables and different temperate regions.

Keywords: terrestrial isopods, soil fauna, temperate forests, distribution patterns, variation partitioning

Topic: Biogeography

OniscidBase - Building a global database for terrestrial isopod research -progress and future perspectives

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Terrestrial isopods (Isopoda: Oniscidea), commonly known as woodlice, are among the most recognisable soil-dwelling invertebrates and are crucial for soil functioning. They are widely distributed from temperate to equatorial ecosystems, and their distribution is strongly influenced by environmental factors, such as soil type, temperature and humidity. However, data on patterns of their diversity, abundance, and biomass, which are crucial for assessing their importance in ecosystem functioning worldwide, are lacking. Furthermore local georeferenced datasets are very scattered and often inaccessible .

To address these challenges and advance terrestrial isopod research worldwide, OniscidBase was launched. This developing initiative aims to build the most comprehensive global database on terrestrial isopods, bringing together georeferenced data on the distribution, abundance and biomass of terrestrial isopod species, and associated environmental parameters. With this initiative, we aim to make distribution data accessible for macroecological studies, address fundamental questions about the response of terrestrial isopods to environmental changes and deepen our understanding of their role in ecosystem functioning and soil health.

The development of OniscidBase is now well underway and the first stage of the data collection is finalized. We present an update on the progress already made and an overview of the data collected so far. We discuss some first patterns, identify key gaps in the database and highlight priorities for further data collection. Finally, we will give an overview of the planned project timeline and outline future perspectives.

Keywords: woodlice, species distribution, georeferenced data, macroecology, soil fauna, biogeography, database, diversity

Topic: Biogeography

Developmental mechanisms of respiratory structures in terrestrial isopods

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Pancrustacea, a monophyletic group that includes crustaceans and insects, has repeatedly colonized terrestrial environments. A key adaptation for this transition is the acquisition of air-breathing organs. Isopod crustaceans provide a model for studying terrestrialization because they exhibit forms from aquatic to fully terrestrial. In several terrestrial isopod lineages, specialized respiratory structures (“pseudotrachea” or “lung”) have evolved in abdominal appendages (pleopods), showing considerable morphological diversity among lineages. In this study, we investigated the developmental mechanisms of respiratory structures in terrestrial isopods. Using the common terrestrial isopod *Porcellio scaber*, which possesses lungs in the anterior two pairs of pleopods, we examined lung development histologically. We found that epithelial tissues undergo invagination and branching during the post-embryonic developmental stages (manca stages), and that lungs develop through successive molts. Comparative analyses of species with different respiratory structures (*Nagurus okinawaensis*, *Alloniscus balssi*, and *Armadilloniscus* cf. *ellipticus*) showed that early pleopod morphology is conserved, whereas respiratory structures arise through lineage-specific modifications during post-embryonic development. To explore the molecular basis of lung development, we performed gene expression analyses in *P. scaber*. Orthologs of *trachealess* (*trh*) and *ventral veins lacking* (*vvl*), which are related to trachea and gill development in pancrustaceans, were identified. *In situ* hybridization chain reaction revealed that *trh* and *vvl* are strongly expressed in pleopodal endopods (gills) during embryogenesis, but not in the anterior pleopodal exopods where lungs develop. Comparative RNA-seq analysis between lung-bearing and non-lung-bearing pleopodal exopods identified candidate genes involved in early lung morphogenesis, including transcription factors such as *cut* and *blistered*. In particular, *cut* is known to be involved in spiracle formation in insects. These results suggest that isopod lungs are not directly homologous to crustacean gills or insect tracheae, while some aspects of the developmental mechanisms underlying air-breathing organ formation may have evolved convergently between insects and terrestrial isopods.

Keywords: evolutionary developmental biology, terrestrialization, pleopodal lungs, *Porcellio scaber*

Topic: Morphology

Fear of the scat: Dietary-mediated avoidance of predator faecal odours in the terrestrial isopod *Porcellio scaber*

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Terrestrial isopods face intense predation pressure and have evolved a suite of anti-predator strategies, including the avoidance of predator-frequented microhabitats. The role of vertebrate faecal odours in predator recognition remains poorly understood. This study aimed to quantify the avoidance behaviour of *Porcellio scaber* when exposed to various predator-derived chemical cues. Using a binary choice arena, we tested isopod responses to the excrement of two contrasting vertebrate predators: the bearded dragon (*Pogona vitticeps*) and the Japanese quail (*Coturnix japonica*).

To examine whether avoidance is diet-dependent, both vertebrate predators were subjected to three dietary treatments: (1) a baseline vegetarian diet (lettuce for lizards, grain for quail), (2) a generalist insectivorous diet (supplemented with mealworms), and (3) an oniscophagous diet (supplementary *P. scaber*). Aqueous extracts prepared from the collected faeces were tested against a water control. The distribution of isopods within the arena was monitored for 15 minutes to assess spatial preference.

Our results show that *P. scaber* significantly avoided quail excrement, with the magnitude of avoidance positively correlating with the predator's diet; the strongest aversion was elicited by faeces from quail fed on isopods. Conversely, no avoidance was observed for bearded dragon excrement; surprisingly, the isopods exhibited a preference for these samples. This discrepancy may be attributed to sample degradation, as the lower defecation rate of the lizard necessitated a longer collection period (two months) compared to the quail (two weeks). Alternatively, we propose the “evolutionary familiarity” hypothesis: while phasianid birds (like quail) are sympatric with *P. scaber* in Europe and represent a long-term evolutionary threat, Agamidae lizards are largely absent from the isopod's native range, potentially resulting in a lack of innate recognition of their chemical signatures. These findings suggest that predator recognition in isopods is a complex process mediated by both dietary cues and evolutionary history.

Keywords: antipredatory strategy, avoidance, kairomones, predation, trophic interactions

Topic: Behaviour

POSTER COMMUNICATIONS

The postmarsupial manca stages of *Armadillidium gestroi* Tua, 1900 (Crustacea, Isopoda, Oniscidea)

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A study of the postmarsupial manca stages of *Armadillidium gestroi* Tua, 1900 is conducted through a detailed morphological analysis. This species is endemic to western Liguria, a region in northwestern Italy, and its biology remains largely unknown. This species is characterized by its rupicolous habits, which often lead it to be found at cave entrances. The manca stages of this species had never been previously described. The rearing of ovigerous females was conducted under controlled conditions, enabling the observation and documentation of their developmental stages from the moment of release from the pouch through to the onset of juvenile stage, which was distinguished by the complete development of the seventh pair of pereopods. Each newborn was closely monitored to record the subsequent molts that mark the three postmarsupial manca stages. The duration of manca stage M1 is approximately 29–33 hours, manca stage M2 lasts approximately 9 days, and manca stage M3 lasts approximately 12–13 days. Body length is approximately 1.8 mm for M1, approximately 2 mm for M2, and approximately 2.4 mm for M3. The cephalothorax width was also measured to provide a growth indicator for each stage. The mean values of the cephalothorax width were: 0.515 mm for M1, 0.613 mm for M2, and 0.705 mm for M3. The morphological modifications in the three postmarsupial manca stages were described, and SEM images were taken. The distinguishing characteristics among mancae are illustrated, and comparisons are made with manca stages of other terrestrial isopod species.

Keywords: reproductive biology, morphology, manca, offspring

Topic: Morphology

Uncovering the blueprint of tricorn sensilla

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The cuticle of terrestrial isopods forms highly diverse and complex micrometre-scale surface structures. Although the general process of cuticle formation is well described, the complexity of these structures suggests equally intricate cellular mechanisms underlying their development, which remain largely unknown. This study aimed to elucidate the formation of tricorns, sensilla unique to terrestrial isopods, which exhibit a highly complex 3D architecture.

Tergites of *Porcellio scaber* and *Armadillidium pallasii* individuals at different premoult substages were dissected and fixed with aldehydes. One set of samples was prepared for observation of the surface architecture and the ultrastructure of forming tricorns by scanning and transmission electron microscopy, respectively. A second set was processed to examine cytoskeletal reorganisation. Microtubules were visualised using anti- α -tubulin primary antibodies and AlexaFluor647-labelled secondary antibodies, while actin filaments were labelled with AlexaFluor594-conjugated phalloidin.

In the examined species, the tricorn sensilla exhibit markedly different surface architectures, but both are characterised by a sensillar seta with an anteriorly positioned epicuticular scale. The sensillum contains the dendritic segments of three sensory cells. Enveloping cells support the sensillum at the epidermal level. Cells involved in the development of the sensillum and its associated epicuticular scale, likely including both enveloping and neighbouring epidermal cells, undergo significant shape changes to form a template for the deposition of the setal and scale cuticle. Our results show that this template arises from microtubule- and actin-mediated cytoskeletal dynamics. A sheath of electron-dense material surrounds the dendritic segments in the ecdysial space during the development of new sensilla.

This work has been supported by the infrastructural centre “Microscopy of biological samples”, (MRIC UL, IO-0022-0481-07) located at the University of Ljubljana, Biotechnical Faculty, and the Slovenian Research and Innovation Agency (ARIS, P1-0184, scheme for young researchers).

Keywords: tricorn sensilla, electron microscopy, confocal microscopy

Topic: Morphology

Rediscovery and redescription of the endemic *Armadillidium baldense* Verhoeff, 1902 (Isopoda, Oniscidea) from Monte Baldo, northern Italy

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Armadillidium baldense Verhoeff, 1902 (Isopoda, Oniscidea, Armadillidiidae) is a terrestrial isopod originally described from a single male and two female specimens collected at Monte Baldo Maggiore (northern Italy) which is located on the eastern shore of Lake Garda. Since its initial description, the species has only been mentioned in a few publications, all lacking anatomical figures, and had not been documented for over a century. During a field excursion organized by the Department of Biology of the University of Pisa, numerous specimens were collected beneath boulders on the summit of Cima Valdritta, Monte Baldo (2219 m a.s.l., 45°43'35" N, 10°50'38" E), the type locality of the species. Comparison of diagnostic characters with the type material deposited at the "Zoologische Staatssammlung München" confirmed the identification of the collected specimens as *A. baldense*. A comprehensive redescription of the species is here provided based on the new material. The full body has been illustrated according to current taxonomic standards, through camera lucida drawings and scanning electron microscopy (SEM) photographs. The distribution of *A. baldense* appears strictly confined to the summit of Monte Baldo, placing it among the numerous narrow-range endemics characteristic of the northern Mediterranean region, which holds the highest diversity of terrestrial isopod species per unit area worldwide. The restricted range of the species is consistent with a broader biogeographic pattern in which taxa with limited dispersal ability became isolated on mountain systems during the warmer and drier intervals of the Pleistocene, following immigration waves from surrounding areas. The present redescription fills a long-standing gap in the literature and contributes to addressing the taxonomic impediment affecting cryptic invertebrate diversity.

Keywords: taxonomy, biogeography, morphology, anatomy, biodiversity

Topic: Systematics

Ontogenetic changes in stable isotope composition ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) of two synanthropic woodlice species

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Soil saprophages contribute to the decomposition of dead organic matter in a variety of ecosystems. Efficient nutrient cycling is a necessary condition for soil health. Woodlice are one of the most widespread groups of soil saprophages. Despite the abundance of information on feeding behavior, age-related variation in the diet of woodlice remains poorly studied. Understanding how the diet of woodlice changes with age is essential for assessing their position in the trophic structure of soil communities. We applied the stable isotope analysis of carbon and nitrogen to four ontogenetic stages of two synanthropic cosmopolitan species, *Cylisticus convexus* and *Oniscus asellus*, and their food sources in a city park in Moscow, Russia. We determined isotopic signatures for woodlice manca, juveniles, young adults, and adults. In *C. convexus*, the $\delta^{13}\text{C}$ values remained constant, while juveniles, young adults and adults were enriched in ^{15}N compared to manca. In *O. asellus*, $\delta^{13}\text{C}$ values remained constant except for the last age (adults), when they were enriched in ^{13}C by about 1.5‰, compared to other ages. *O. asellus* was enriched in $\delta^{15}\text{N}$ in early ages, then depleted in the young adult age and enriched again in the adult age. This phenomenon could be driven by lipid storage or diet quality. Both species shared the microhabitat, and consumed wood-decomposing microorganisms, but divided their trophic niches. These results confirm ontogenetic shifts in substrate use within woodlice populations. Our results demonstrate the need to consider the age of woodlice when interpreting isotopic data and assessing their trophic roles in soil ecosystems.

Keywords: terrestrial isopods, ontogenesis, trophic ecology, isotope analysis

Topic: Ecology

Before it's science, it's already a business: Integration of a first base for the study of populations of the mound group (*Porcellio*; *Oniscidea*): ecology, evolutionary hypotheses and associated trade

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This work presents the first ecological and morphological database (with taxonomic implications) of the previously unstudied population complex of the rock-dwelling group of the genus *Porcellio* in southeastern Spain, whose members are also traded in the collecting sector. The study integrates ecological, morphological, and observational data to characterize their population structure, evolutionary dynamics, and taxonomic delimitation. These isopods exhibit a high degree of specialization for rock-dwelling microhabitats, especially in karst systems, where they occupy fissures under conditions of high humidity, displaying strict water dependence, gregarious behavior, and limited dispersal. Through field observation and stereomicroscopy analysis, a morphotype database has been constructed, allowing for the understanding of intra- and interpopulation variability. The results indicate that fragmentation of the rocky habitat favors population isolation and promotes divergence processes and potential speciation at a microgeographic scale, consistent with a microallopatric evolution model. Furthermore, a discrepancy was detected between the morphotypes traded and the actual taxonomic units, suggesting a simplification that could obscure cryptic diversity. This situation poses conservation risks due to unregulated harvesting, highlighting the need for integrative approaches and ecological criteria in trade management.

Keywords: cryptic diversity, *Monticola* group, *Porcellio*, divergence, microallopatric evolution, karst systems.

Topic: Ecology

Dynamics of leaf-litter palatability during decomposition: A case study using *Porcellio scaber*

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Leaf litter decomposition represents a fundamental process in soil ecosystems, facilitating nutrient release and the transformation of organic matter. While microorganisms are primary drivers, macro-decomposers play an indispensable role; their feeding preferences can significantly accelerate decomposition rates through litter fragmentation and the subsequent stimulation of microbial activity. This study aimed to investigate the dynamics of leaf-litter palatability for macro-decomposers as decomposition progresses. Specifically, the research evaluated how different plant species and their respective decomposition stages influence the feeding behavior of the common rough woodlouse (*Porcellio scaber*). Furthermore, the study explored the relationship between specific chemical constituents of the litter and its overall palatability.

In a controlled 92-day laboratory experiment, isopods were provided with leaf litter from four deciduous species: small-leaved lime (*Tilia cordata*), black alder (*Alnus glutinosa*), common hazel (*Corylus avellana*), and sycamore maple (*Acer pseudoplatanus*). Each litter type was tested at various stages of decomposition. To quantify palatability and its effects on the decomposers, several parameters were systematically monitored throughout the experiment, including individual consumption rates, faecal production, isopod survival, and fluctuations in body mass.

The results demonstrated that *Porcellio scaber* exhibited distinct preferences, favoring litter characterized by higher nitrogen content and a lower C/N ratio. Among the tested species, black alder was identified as the most palatable. However, the anticipated linear increase in palatability over time—often associated with the leaching of secondary metabolites—was not consistently observed across all species. The data suggest that feeding activity was modulated not only by litter quality but also by the physiological condition of the isopods and potential stress induced by laboratory conditions. These findings imply that chemical composition alone may not serve as an exhaustive predictor of realized palatability, highlighting the complexity of macro-decomposer interactions in soil food webs.

Keywords: detritivory, Isopoda, litter quality, Oniscidea, soil macrofauna

Topic: Ecology

The interplay of urbanization pressure, landscape context, and edge effects on terrestrial isopod diversity in rural settlements

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Rural settlements are key elements of human-modified landscapes, yet their internal biodiversity patterns remain poorly understood. We investigated the taxonomic and functional diversity of terrestrial isopod communities in 64 villages across Hungary and Romania, using a stratified design that accounted for urbanization pressure (villages within city agglomerations vs. distant "ring" villages) and landscape context (agricultural vs. forest-dominated), while within-village patterns were assessed along edge-to-centre spatial gradients. We hypothesized that (i) diversity declines with increasing urbanization pressure and agricultural dominance, and (ii) edge effects are stronger in forested landscapes and less urbanized settings due to spillover from surrounding habitats. In total, 16 species and 10,249 individuals were captured during the survey. Species richness showed a context-dependent response, driven by the interaction between urbanization pressure and landscape. In city agglomerations, villages embedded in forested landscapes supported higher richness than those in agricultural matrices, while this difference disappeared in distant villages. Shannon diversity and functional dispersion were unaffected by the examined factors. Several metrics revealed consistent spatial structuring along the village transect. The Average Rarity Index was significantly higher at village edges, suggesting that these transition zones act as refuges for rare species. Conversely, functional originality peaked in village centres, indicating that core areas harbour species with unique trait combinations. Functional specialization and activity-density responded interactively to landscape context and spatial position: in agricultural landscapes, activity-density was higher in centres, while specialization was significantly greater at the edges. These findings demonstrate that the responses of isopod communities to urbanization pressure and within-village spatial gradients are strongly modulated by the surrounding landscape matrix. Our study highlights that maintaining forest cover and protecting village-edge transition zones are vital for preserving both taxonomic richness and specialized functional roles in rural ecosystems.

Keywords: biodiversity, human-modified landscape, urbanization pressure, spatial gradient, functional originality

Topic: Ecology

Antioxidant responses of *Porcellio variabilis* to microplastic exposure: A study of *Panax ginseng* as a natural protective agent

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This research provides new insights into the effects of microplastics (MPs) on soil organisms and highlights the importance of terrestrial isopods, especially *Porcellio variabilis*, as a valuable ecotoxicological model. The study had two main objectives: first, to evaluate the impact of two concentrations of MPs (C1 and C2), and second, to investigate the protective role of *Panax ginseng* when used as both a preventive and curative treatment. Specimens were collected from an agricultural area in Goubellat, north-west Tunisia.

Results showed that exposure to MPs triggered an antioxidant response, initially increasing the activity of enzymes such as superoxide dismutase and catalase. However, this was followed by a decline, likely due to the exhaustion of the organism's defense mechanisms. These findings suggest that MPs significantly disturb redox balance and cause considerable physiological stress in *P. variabilis*.

The addition of *Panax ginseng* demonstrated a strong protective effect, likely due to its high content of antioxidant, phenolic, and mineral compounds. Its anti-inflammatory and neuroprotective properties helped reduce oxidative stress and improved the organisms' tolerance to MP exposure, suggesting its potential as a natural mitigation agent in polluted soils.

Overall, the study confirms that *P. variabilis* is an effective model for studying microplastic pollution in Mediterranean soils and emphasizes the potential of natural bioactive compounds in protecting against emerging environmental contaminants.

Keywords: microplastics (MPs), oxidative stress, superoxide dismutase, catalase, *Panax ginseng*

Topic: Physiology

Age-dependent variation in locomotor activity and circadian rhythms in *Armadillidium granulatum*

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The locomotor behavior of the Oniscidea *Armadillidium granulatum* Brandt, 1833 was characterized and the effect of age on its locomotor patterns was examined. Individuals of *A. granulatum* were collected from the supralittoral zone of Sebkha El Ouafi. Adult and young specimens were maintained during spring under two successive regimens: a light-dark (LD) cycle followed by constant darkness (DD) at a constant temperature.

Whatever the age, double-plotted actograms and waveforms showed that specimens of *A. granulatum* concentrated their activity during both experimental and subjective nights. In addition, most locomotor activity patterns were unimodal; however, adults and juveniles intensified their activity around the dusk and in the middle of the night, respectively.

Periodogram analysis revealed both circadian and ultradian components. The circadian period was significantly longer under DD than under the LD cycle for both adults and juveniles. Juveniles were characterized by the most stable and well-defined locomotor activity rhythm. Furthermore, adult specimens were more active under entraining conditions whereas juveniles exhibited longer activity durations under DD.

In relation to environmental stability and variability, the observed differences in locomotor activity characteristics observed between juveniles and adults may reflect a need for greater plasticity to cope with changing environmental conditions.

Keywords: Oniscidea, Sebkha, circadian rhythm, activity patterns

Topic: Behaviour

From avoidance to activity rhythms: Behavioral effects of trace metals in *Armadillidium granulatum*

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Behavioral responses to trace metals (TM) in *Armadillidium granulatum* Brandt, 1833, collected from Sebkha El Ouafi, connected to the lagoon of Ghar El Melh, were studied under controlled laboratory conditions. An avoidance test was conducted in individuals exposed to cadmium (Cd), lead (Pb) and zinc (Zn) for 48 hours. Locomotor activity was examined under entraining conditions (LD) and constant darkness (DD) in both the control animals and those exposed to contaminated soil. Regardless of the metal tested, the animals did not exhibit avoidance behavior. The effective concentration (EC50) was determined to be 3.4 mg/L for Cd, 451 mg/L for Pb, and 1043 mg/L for Zn.

Furthermore, the results revealed the existence of nocturnal behavior whatever the experimental conditions. Periodogram analysis showed the existence of both ultradian and circadian periods. The latter was generally longer in contaminated specimens than in control ones, under both entraining conditions and constant darkness. Animals exposed to cadmium exhibited the highest activity duration under DD ($\alpha_{DD} = 8h01 \pm 3h27$), in contrast to that observed under the LD cycle ($\alpha_{LD} = 3h43 \pm 2h36$). Additionally, control specimens and those exposed to Cd and Pb showed a phase delay, whereas those exposed to Zn exhibited a phase advance.

Keywords: trace metals, avoidance behaviour, circadian rhythms, *Armadillidium granulatum*

Topic: Behaviour

Collective circular movement in *Armadillo sordidus*: A novel light-induced phenomenon

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Collective movement in terrestrial isopods has rarely been documented and almost never discussed. Here, we report a novel behavioral phenomenon in isopods from the species *Armadillo sordidus*: large nocturnal aggregations forming coordinated circular movements involving thousands of individuals. The behavior was observed naturally in several locations in northern Israel and could be experimentally induced using artificial white light. Ultraviolet light and magnetic fields did not induce this behavior. Image analysis revealed approximately 5500 individuals within a single aggregation, and manual tracking confirmed a clear circular movement pattern. The observed sex ratio (1:4 males to females) and presence of many gravid females suggest that the behavior is not reproductive. Instead, the circular motion appears to represent a density-dependent, light-induced aggregation response. To our knowledge, this is the first formal documentation of collective circular movement in isopods, potentially arising from anthropogenic light pollution. (<https://doi.org/10.1002/ece3.73487>)

Keywords: ALAN, behaviour, collective movement

Topic: Behaviour

Biosurveillance of metal pollution around a Tunisian Steelworks using soil indices and hepatopancreatic biomarkers in terrestrial isopods

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Steelmaking activities are major sources of trace metal contamination in terrestrial ecosystems, yet their biological effects on soil invertebrates remain insufficiently documented in North Africa. This study investigated surface soils surrounding the El Fouladh steelworks (Menzel Bourguiba, north-eastern Tunisia) and assessed terrestrial isopods as bioindicators of metal stress. Soil samples collected along a contamination gradient were analyzed for Cd, Cu, Fe, Pb and Zn, and pollution was evaluated using contamination factor (CF), pollution load index (PLI), degree of contamination (Cdeg), modified degree of contamination, and ecological risk index. In parallel, metal accumulation and ultrastructural alterations were examined in the hepatopancreas of isopods from polluted and reference sites.

The results showed marked metal enrichment in soils near the steelworks. Median concentrations reached 665.78 mg kg⁻¹ for Zn, 75.77 mg kg⁻¹ for Cu, 192.47 mg kg⁻¹ for Pb, and 0.79 mg kg⁻¹ for Cd, with several values exceeding guideline thresholds. The overall PLI was 2.04, indicating site-wide pollution, while sites from the central section of the contamination gradient showed the highest contamination. Cadmium represented the greatest ecological concern, with a cumulative potential ecological risk (REP) of 373.21. In isopods, the hepatopancreas generally contained higher Cd, Cu, and Zn concentrations than the whole body, confirming its central role in metal storage. Specimens from contaminated sites also showed clear ultrastructural damage, including abnormal tubule shape, irregular surface swelling, progressive brush-border disorganization, cytoplasmic condensation, reduction of the basal labyrinth, and depletion of lipid droplets.

These findings demonstrate the strong impact of steel industry emissions on surrounding soils and support the use of terrestrial isopods, particularly hepatopancreatic biomarkers, as sensitive tools for ecotoxicological biosurveillance of contaminated terrestrial habitats.

Keywords: terrestrial isopods, metal pollution, ecotoxicological biosurveillance, hepatopancreas, electron microscopy

Topic: Other

Predicting distributions to support conservation: The role of maximum entropy modeling in terrestrial isopods

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Terrestrial isopods are key components of soil biodiversity worldwide, playing a fundamental role in organic matter decomposition and nutrient cycling. Despite their ecological importance, their distribution patterns, ecological requirements, and conservation status remain insufficiently understood at broad spatio-temporal scales.

In this context, Maximum Entropy modeling (MaxEnt) has emerged as a particularly powerful and widely adopted approach for investigating species–environment relationships and predicting potential distributions. By integrating presence-only data with environmental variables, MaxEnt estimates the most uniform distribution of species presence across geographic space while respecting the constraints imposed by known occurrences, making it especially suited for taxa with sparse or incomplete records such as terrestrial isopods.

This communication emphasizes the major contribution of MaxEnt to the conservation of terrestrial isopods. MaxEnt-derived habitat suitability maps provide essential insights for identifying priority areas for conservation, detecting biodiversity hotspots, and highlighting regions that may serve as refugia under environmental change. MaxEnt also enables the projection of potential distribution shifts under future climate scenarios, thereby supporting proactive and spatially explicit conservation planning. Furthermore, MaxEnt modeling contributes to improving our understanding of the ecological and biogeographical processes shaping isopod communities, particularly for endemic, rare, or poorly documented species, by quantifying the relative contribution of climatic, edaphic, and topographic variables to species distributions.

Overall, MaxEnt represents a key methodological tool for advancing both the ecological understanding and the conservation of terrestrial isopods, offering valuable perspectives for preserving soil biodiversity in the face of ongoing global change.

Keywords: ecological niche, models, MaxEnt, terrestrial isopods, predict, distribution, conservation.

Topic: Biogeography

The terrestrial isopods of the Grand Duchy of Luxembourg

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The only publication completely and solely dedicated to the terrestrial isopods in the Grand Duchy of Luxembourg dates from 1956 and since then almost no research on terrestrial isopods happened in this small western European country. From fall 2023 until fall 2025 Spinicornis, the Belgian terrestrial isopod research group, performed a statewide inventory and reexamined the terrestrial isopod collection of the National Museum of Natural History (MNHNL). The field surveys were carried out during fall and spring and covered every 10km x 10km UTM grid cell in the country (51 in total). In each grid cell, three different biotopes were systematically visited, covering the most relevant habitat for terrestrial isopods. The biotopes visited were (1) a forest, (2) a stream or river and (3) a graveyard if present in the grid cell. Isopods were hand collected by turning stones/dead wood and by sieving the litter layer. Literature review and verified citizen science observations resulted in limited but valuable additional data on the distribution of some rarer species. The number of known species for the country increased from 21 to 28 species. For each species, a distribution map was created and the habitat preferences were analyzed. There are two distinct ecological regions in the Grand Duchy of Luxembourg, with seven species having a clear preference for only one of those ecological regions. Oesling in the north is part of the wider Ardennes region and is the preferred region for *Philoscia affinis*. Guttland lies in the south and is an ecologically more diverse region containing river valleys, plateaus and rocky outcrops. *Cylisticus convexus*, *Haplophthalmus danicus* and *Trachelipus rathkii* are some of the species only recorded in Guttland. The inventory of the Grand Duchy of Luxembourg extends the inventories made in Belgium using the same sampling design.

Keywords: terrestrial isopods, Luxembourg, check list, habitat preference

Topic: Biogeography

Terrestrial isopods in subterranean habitats of the Czech Republic

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Although representatives of terrestrial isopods (Isopoda: Oniscidea), which are classified as troglobitic, are almost completely absent in Central Europe, research conducted in the Czech Republic over the past few decades has collected relatively rich data on the occurrence of these arthropods in diverse underground habitats. Summary of recent findings of 27 species of terrestrial isopods recorded in karstic and non-karstic underground systems is presented. In addition to the predominantly troglloxenic representatives, several species can be listed as troglphilic or otherwise associated with underground habitats. In karstic areas predominated *Androniscus dentiger*, *Cylisticus convexus*, *Haplophthalmus mengii* and *Trichoniscus pygmaeus*. Non-karstic systems were also rich in the number of recorded species, but troglloxenic forms prevailed and the species composition was determined by the local above-ground fauna and the migratory abilities of individual representatives, with the species *Armadillidium vulgare*, *Protracheoniscus politus*, *Trachelipus rathkii* and *Trachelipus ratzeburgii* prevailing. The isopod *Trichoniscus alemannicus* was historically recorded in the Czech Republic originally in caves. Some species known as rare inhabitants of the upper organic and mineral layers of the soil were more often found in deeper structural layers, including subterranean habitats and cave systems, suggesting close relationships between the soil and subterranean fauna. The results indicate that Central European subterranean habitats represent a possible important refuge for some relatively rare invertebrates including terrestrial isopods with less known or questionable distribution throughout Europe.

Keywords: terrestrial isopods, subterranean habitats, karstic caves, non-karstic caves, Czechia

Topic: Biogeography



Armadillo karametae (photo by Spyros Sfenthourakis)

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