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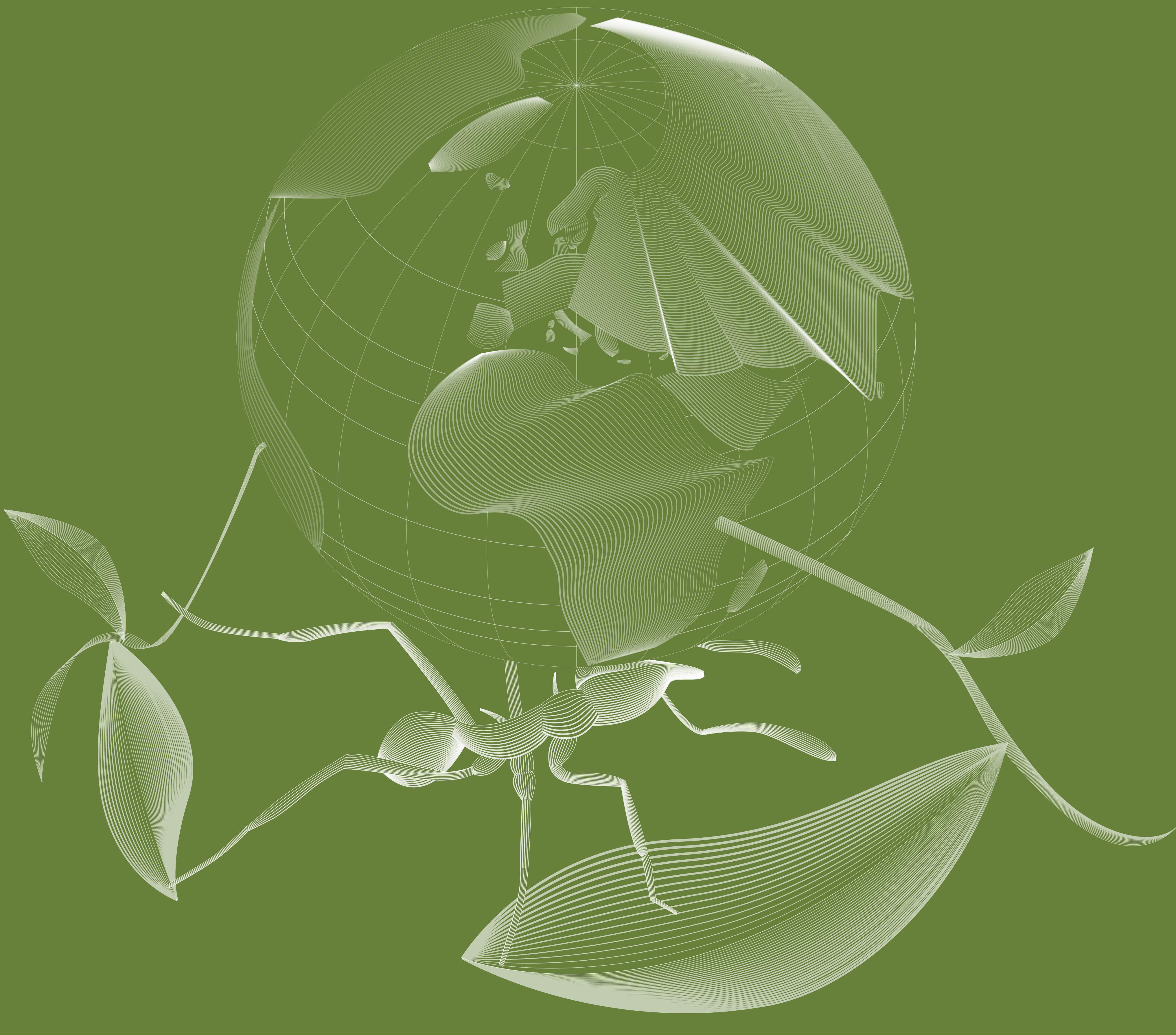

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GLOBAL SOIL BIODIVERSITY ATLAS

Supporting the EU Biodiversity Strategy and the Global Soil Biodiversity Initiative: preserving soil organisms through sustainable land management practices and environmental policies for the protection and enhancement of ecosystem services

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Mele; (PMA) P. Maillet; (PMO) P. Morton; (PNO) P. Normand; (PO) portengaround; (PT) P. Turconi; (PVA) P. Vaast; (PZI) P. Zieger; (RB) R. Bonetti; (RBO) R. Borriello; (RC) R. Constantino; (RCR) R. Creamer; (RD) rduta; (RDI) R. Dick; (RF) R. Faccenda; (RG) R. Großkopf; (RH) R. Hausken; (RHA) R. Hannawacker; (RHI) R. Hille; (RHL) R. Halling; (RHO) R. Holzner; (RHR) Ru. Hartnup; (RHU) R. Hausken; (RIR) Riraq25; (RK) R. Klips; (RKA) R. Kayser; (RM) R. Moreno; (RMA) R. May; (RML) R.M. López; (RMO) R. Morgado; (RMR) R. Marichal; (RMS) R. Moscato; (RO) Roland1952; (RP) R. Pravettoni; (RRCS) R.R. Castro Solar; (RS) R. Sperstad; (RSC) R. Schmelz; (RT) R. Tremblay; (RUG) R. Ugo; (RV) R. Vargas; (RWI) R. Wick; (SA) S. Axford; (SAJ) Society for Actinomycetes Japan; (SB) S. Brozek; (SC) S. Caufield; (SCN) S.C. Nelson; (SCO) Sterling College; (SD) S. Dondeyne; (SDA) S. Darbey; (SDR) S. Droege; (SE) Serena; (SF) S. Franzenburg; (SFA) Suzie's Farm; (SG) S. Goryachkin; (SH) S. Hallett; (SI) Stu's Images; (SJ) S. James; (SJA) S. Jarvis; (SJE) S. Jeffery; (SJF) S.J. Fonte; (SJR) S. Jurvetson; (SJS) S. Justis; (SK) S. Kaynas; (SL) S. Lough; (SLA) slappytheseal; (SLS) S.L. Stürmer; (SM) S. McCann; (SMA) S. Marotta; (SME) S. Means; (SMI) S. Miller; (SMM) S.M. Emery; (SMNG) Senckenberg Museum fuer Naturkunde Görlitz; (SMO) S. Mojumder; (SNA) snapp3r; (SNZ) Smithsonian's National Zoo; (SO) S. O'Neill; (SOA) S. Oats; (SOG) Son of Groucho; (SP) Sponk; (SPO) S. Pérez-Ortega; (SPR) S. Porter; (SPS) Science and Plants for Schools; (SRA) S. Rae; (SR-E) S. Rodríguez Echeverría; (SRN) S. Rankin; (SS) S. Shimano; (SSA) S. Salisbury; (SSC) Soil Science; (SSH) S. Shattuck; (SSN) S. Snapp; (SSSA) Soil Science Society of America; (SSW) S. Swanwick; (ST) S. Texturas; (STH) S. Thurston; (SUS) SuSanA Secretariat; (SZ) S. Zaki; (SZO) S. Zoia; (TAT) Tatters; (TBL) The British Library; (TC) T.H. Cooper; (TD) T. Decaëns; (TE) TinaEnviro; (TEF) T. Efthimiadis; (TEI) T. Eickhorst; (TF) T. Fraser; (TFG) T. Fogg; (TFO) T. Först; (TFTF) Trees For The Future; (TG) T. Gallali; (TGA) T. Galvez; (TGA) T. Gage; (TH) T. Harada; (TI) T. Itoh; (TIW) T. Iwane; (TJB) T.J. Beveridge; (TK) T. Komatsu; (TO) Torpe; (TOR) torbakhopper; (TPF) T.P. Farias; (TR) T. Ryan; (TRA) T. Rajeev; (TS) T. Samoff; (TSC) T. Sheerman-Chase; (TSL) T. Slotta; (TT) T. Tsunoda; (TTJ) T. The Jaguar; (TWA) T. Waters; (UCSFMC) UCSF Medical Center; (UFLA) Federal University of Lavras; (UKGP) ukgardenphotos; (UM) University of Minnesota; (UMLD) University of Miami Libraries Digital; (UMS) University of Michigan; (UNEP) U.N. Environment Programme; (UNIDO) U.N. Industrial Development Organization; (UNN) U.N. Nielsen; (USB) United Soybean Board; (USDA) U.S. Dept. of Agriculture; (USDE) U.S. Dept. of Education; (USFS) U.S. Forest Service; (USFWS) U.S. Fish and Wildlife Service; (USMG) U.S. Mission Geneva; (VF) V. Felde; (VG) V. Gutekunst; (VH) V. Hampl; (VL) V. Lang; (WANP) Western Arctic National Parklands; (WCL) WorldClim; (WCU) W. Cutler; (WDNR) Wisconsin Dept. of Natural Resources; (WIP) Winniepix; (WJ) W. Jaquith; (WPP) W.P. Pfliegler; (WSM) W. Smith; (WTC) W.T. Cassimiro; (WVDP) W. van der Putten; (WVE) W. van Egmond; (WWF) World Wildlife Fund; (YA) Y. Awoki; (YE) Y. Eglit; (YIF) yiftah-s; (YKN) Y. Knies; (YS) Y. Sekiguchi; (YUNGA) Youth and U.N. Global Alliance; (ZL) Z. Lü.

Macrofauna – Isopoda

Morphology

Most species of isopods belong to the soil macrofauna, and adult sizes range from 5 to 15 mm, with some species reaching only 1 to 2 mm. Terrestrial isopods, commonly known as woodlice or pill bugs, have bodies divided into a cephalon (head), pereion (thorax) and pleon (abdomen). The cephalon bears the compound eyes, two pairs of antennae (one pair is vestigial, meaning functionless) and four pairs of mouthparts for food processing. The pereion has seven pairs of walking legs (pereiopods). The abdomen comprises five pairs of modified appendages (pleopods). The pleopods have become modified and adapted for respiration through the course of isopod evolution. In males, the first two pleopods are modified to participate in sperm transfer. The sperm is transferred to the female through the modified second pleopod which, after receiving the sperm from the penis, is then inserted into a female gonopore (genital pore). After successful copulation, the female moults and produces a structure on the ventral side of her thorax that resembles a pouch and is called marsupium. Inside the marsupium the eggs stay protected while they develop into young independent isopods. [63]

Taxonomy

Isopoda is an order of crustaceans (see page 31). The semi-terrestrial and 'truly' terrestrial isopods form a monophyletic (developed from a single common ancestral form) group (the suborder Oniscidea), with 3 637 described species.

Microhabitat

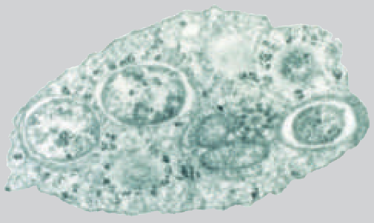
Numerous morphological, anatomical and physiological adaptations to the soil environment make isopods the most successful land inhabitants. Terrestrial isopods occupy essentially all terrestrial habitats, ranging from the supralittoral (shore of a lake, sea, or ocean) to the high alpine regions, from the tropics to the cold-temperate zones, from wetlands to deserts. They are crepuscular or nocturnal animals and spend the day mostly hidden underneath stones, coarse woody or loose bark, or in crevices, where they can easily be captured. In deserts, species of the genus *Hemilepistus* form monogamous (having a single partner during their lives) relationships and live inside self-dug burrows essential for their survival. As macro-detritivores, terrestrial isopods significantly contribute to decomposition processes through feeding on and digesting leaf litter, dispersing microbial spores and mediating microbial activity and nutrient cycles (see pages 102-106). Digestion is supported by microbes that are ingested together with food. In their gut, isopods can also develop symbiotic relationships with bacteria, but at least some part of the cellulose digestion seems to be facilitated by endogenous enzymes (cellulases). Gut bacterial symbionts live protected inside the digestive glands, which enables them to survive on nutrient-poor diets that are difficult to digest.

Diversity, abundance and biomass

The Mediterranean region is a hotspot of isopod diversity, and Europe is the most studied region. Relatively little is known about terrestrial isopods in many tropical countries. Regional species richness increases from the cold-temperate to the warm-temperate and the tropical zones. Local abundances are quite variable and are particularly high in temperate forests and grasslands, reaching about 100 to 600 individuals per square metre.

Isopod manipulators

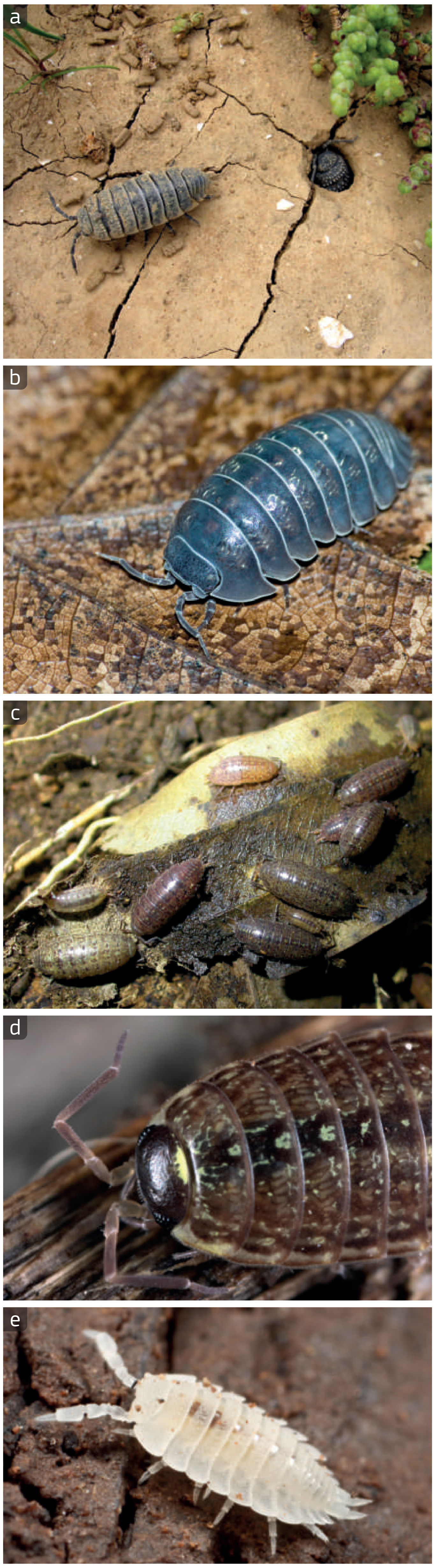
- Bacterial symbionts, such as *Wolbachia*, can induce sex changes and force males to develop into functional females.
- Parasitic acanthocephalan worms can manipulate the pigmentation and behaviour of the infected individuals.



A bacterium of the genus *Wolbachia*. These bacteria are sex manipulators not only in isopods but also in insects and nematodes. The mechanisms responsible for the manipulation are still under investigation. (SO)

The typical segmented body gives some species of terrestrial isopods the flexibility to be able to curl into a ball to protect themselves from danger. Despite this, the woodlice are preyed upon by a number of animals. Toads, spiders, millipedes and the occasional wasp are the main predators of the woodlouse. (DT)

A live specimen of the isopod *Porcellio scaber*, a species commonly found in European forests, gardens and composts. It has also colonised North America, South Africa and other areas, largely through human activity. It is also the most common species of isopod found in Australian gardens. (SF)



Diversity of terrestrial isopods. (**a**) The desert isopod *Hemilepistus reaumurii*, in Tunisia. One individual guards the entrance of its burrow against intruders. (**b**) *Armadillidium vulgare*, a species distributed worldwide. (**c**) Neotropical terrestrial isopods *Balloniscus glaber* and *Atlantoscia floridana* (the smallest individual on the picture). *Balloniscus glaber*, similar to many other terrestrial isopods, show diverse forms of body pigmentation and colour polymorphy. (**d**) *Philoscia muscorum* is a common European woodlouse. (**e**) *Platyarthrus hoffmannseggi* usually lives inside ant nests. (AQ, GM, DT, AM)