Ukrainian Journal of Ecology

Ukrainian Journal of Ecology, 2023, 13(2), 15-21, doi: 10.15421/2023_425

ORIGINAL ARTICLE

Identification of some terrestrial isopods at two stations in Algerian East

F.B. Ahmed[1*], A. Boukachabia[1], I. Houhamdi[2], M. Houhamdi[2], M. Boutarfa[3]

[1]Department of Biology, Environmental Science and Agroecology Laboratory, University Chadli Bendjedid El Tarf Algeria

[2]Laboratory of Biology, Water and Environment (LBEE), Faculty SNV-SUV, University May 1945 Guelma, BP 401 24000 Guelma, Algeria

[3]Historical Documents Translation Laboratory, University of Algiers 2 Abou El Kacem, Translation Institute, Algeria

**Corresponding author E-mail: babaahmed.fedia@yahoo.fr*

Received: *20 January, 2023; Manuscript No: UJE-23-87528;* ***Editor assigned:*** *23 January, 2023, PreQC No: P-87528;* ***Reviewed:*** *04 February, 2023, QC No: Q-87528;* ***Revised:*** *10 February, 2023, Manuscript No: R-87528;* ***Published:*** *17 February, 2023*

In Algeria, wetlands are considered as remarkable habitats for their faunal and floristic diversity. Very few studies have been devoted for the identification of terrestrial isopods. In order to contribute to the knowledge of this isopod fauna, a field campaign was carried out at two stations in the Algerian East (Annaba and El Tarf). The preliminary study of the general composition of Oniscoid populations showed that a total of 269 specimens were collected during 6 months of sampling (January 2021 to June 2021). The observation of the morpho-anatomical characters of the oniscids collected in the two sampling stations during the study period, allowed to identify, according to the identification key of Noël and Séchet (2014), 5 species of isopods attached to 04 genera including Armadillidium, Armadillo, Porcellio and Porcellionides and five (05) species *Armadillidium vulgare*, *Armadillofficinalis*, *Porcelliolaevis*, *Porcelliovariabilis* and *Porcellionidespruinosus*. We observe a stability of the richness at the level of the two stations during the winter and spring season, on the other hand, it tends to decrease during the summer when it reaches level 1. The highest value of the Shannon-Wiener diversity index was observed at Annaba station. However, the equitability index tends towards 1 for both sites. These data reflects a balance between the numbers of species in each station.

Keywords: Diversity, Terrestrial isopods, Oniscidae, Biodiversity.

Introduction

Biodiversity plays an important role in the functioning of ecosystems and in the many services they provide. These services include nutrient cycling, water cycling, soil formation, plant pollination, climate regulation, and pest and pollution control. Terrestrial ecosystems are essential components of our environment; They evolve according to their own bioecological dynamics.

Soil fauna constitutes the bulk of the biomass and animal biodiversity present in terrestrial ecosystems (Wall, et al., 1999). These organisms possess unique genetic characteristics and belong to different trophic levels, and each fulfills essential ecological functions (Ghilarov, 1977; Giller, 1996). The richness and abundance of soil fauna are controlled by regional factors such as climatic conditions, altitude, type of vegetation (Toutain, 1987; Bernier, 1996; Grossi and Brun, 1997; Materna, 2004), as well as by local factors such as the type of humus, the pH, the humidity, the chemical constitution of the soil and the degree of anthropisation (Ponge, 1993; Paquin and Coderre, 1997; Feener and Schupp, 1998; Bird, et al., 2000; Loranger, et al., 2001; Kuznetsova, 2002; Magura, et al., 2003; Scheue, et al., 2003; Cassagne, et al., 2003; Ponge, et al., 2004).

Communities of Oniscidea are considered among the most important groups of soil fauna, especially the decomposer community (Herrick, 2002; Wolter, 2001), as they play a crucial role in soil ecology (Quadros and Araujo, 2008). In addition, they are a food source for a variety of animals (Sunderland and Sutton, 1980; Van Sluys, Rocha and Souza, 2001). As macro decomposers, they contribute significantly to detritus processing (grinding, inoculation) and the nutrient release (Zimmer, Kautz and Topp, 2003) and they also occur in extreme habitats, such as salt marshes, arid grasslands and deserts (Hornung, Szlavecz and Dombos, 2015). Therefore, a good knowledge of the isopod fauna is crucial both for the Caruso and Lombardo, 2011; Messina, Pezzino, Montesanto, Caruso, and Lombardo, 2012; Messina et al., 2014). Caruso and Lombardo, 2011; Messina, Pezzino, Montesanto, Caruso, and Lombardo, 2012; Messina, et al., 2014).

The aim of this study was to fill the gaps in the knowledge of Oniscidae in the eastern regions of Algeria by presenting the species of terrestrial isopods collected on its stations, knowing that the diversity and abundance of terrestrial arthropods can provide a rich basis of information to assist in biodiversity conservation efforts, planning and management of nature reserves" (Kremen, et al., 1993, Massa and Ingegnoli, 1999).

Materials and Methods

Sampling

The samples were collected twice a month for 6 months from January 2021 until June 2021, the specimens were collected by hand early in the morning using a randomly placed 50 × 50 cm quadrat were found under leaves and stones, when collected, the isopods are transferred to a labeled glass bottle containing 70° alcohol in order to preserve the collected specimens. The individuals collected are counted and then observed using a binocular magnifying glass. Each bottle is then returned to the laboratory for identification according to the key of (Noël and Sechet, 2014) and then counting of trapped individuals.

Study zone

The study was carried out at two stations in the Algerian East, including the first one is the wilaya of Annaba (6°54′ 15″ N, 7°45′ 07″ E) located at 600 km from the capital Algiers, in the extreme east of the country which it shares with its neighbor El-Tarf, open to the Mediterranean coast for 80 km. It extends over 1412 km². Its relief consists mainly of mountains with a forest vocation (52.16%); hills and piedmonts (25.82%) and plains (18.08%). The region is richly watered, it receives a precipitation of 650 to 1000 mm/year, its average temperature is 18°C and its climate is humid. The second station is El Tarf (36°46′01″N,8°18′49″E) located in the far North-east of the country, it covers an area of 2892 km^2.

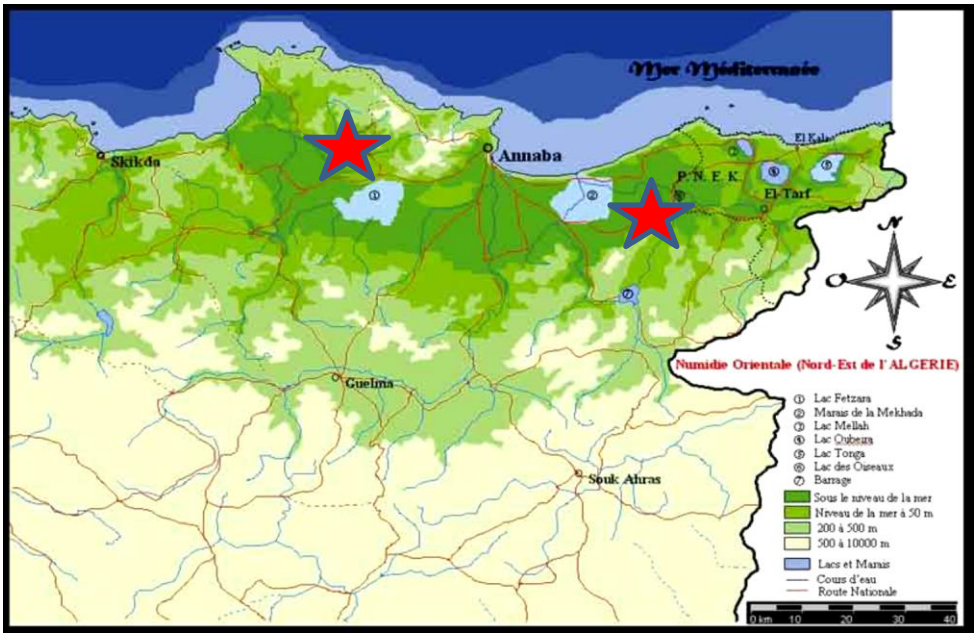

Fig. 1. Geographical location of the study sites.

The forest cover, estimated at 57% or 167,688 Ha, is essentially composed of Kermes oak, Cork oak, Zeen oak, Maritime pine and Eucalyptus reforestation. The climate of El Tarf is a humid Mediterranean climate, up to 1200 mm of rainfall is recorded with snowfall at altitude. The economic activities practiced: breeding, fishing, tourism and subsistence agriculture. The wilaya has a great biodiversity in animal and plant species with the specificity of a mosaic of ecosystems (marine, dune, lake, forest) giving it biological and ecological importance in the Mediterranean basin. This environment is completely open, it is a meadow characterized by a combination of legumes and grasses (Fig. 1).

Results

Abundance and species richness

Our results shows a relatively high abundance of species in Annaba during the winter season. On the other hand, a fall in species which begin from spring and decreases significantly, especially at the level of the El Tarf station (Table 1 and 2).

The richness is diversified in winter when the maximum number of species is recorded with a decrease until summer and this at the level of the two study stations (Annaba and El Tarf).

Table 1. Abundance and species richness at Annaba station.

Annaba	Abundance	Species richness
Winter	138	5
Spring	29	4
Summer	5	1

Table 2. Abundance and species richness at the El Tarf station.

El Tarf	Abundance	Species richness
Winter	76	5
Spring	20	4
Summer	1	1

The shannon index/equitability

The population equilibrium indexes H´ evolve in the same way, the maximums are observed in winter and the minimums in summer for the two stations (Annaba and ElTarf). However, both stations showed an equitability index that tends towards 1. These data reflects equilibrium between the numbers of species in each station (Fig. 2).

The diversity is higher in Annaba compared to El Tarf with almost a balanced individual representativeness (Table 3 and 4).

Table 3. Shannon and equitability index at Annaba station.

Annaba	Shannon index	Equitability Index
Winter	2.210	0.952
Spring	1.704	0.786
Summer	1	1

Table 4. Shannon and equitability index at El Tarf station.

El Tarf	Shannon index	Equitability Index
Winter	2.108	0.908
Spring	1.648	0.824
Summer	1	1

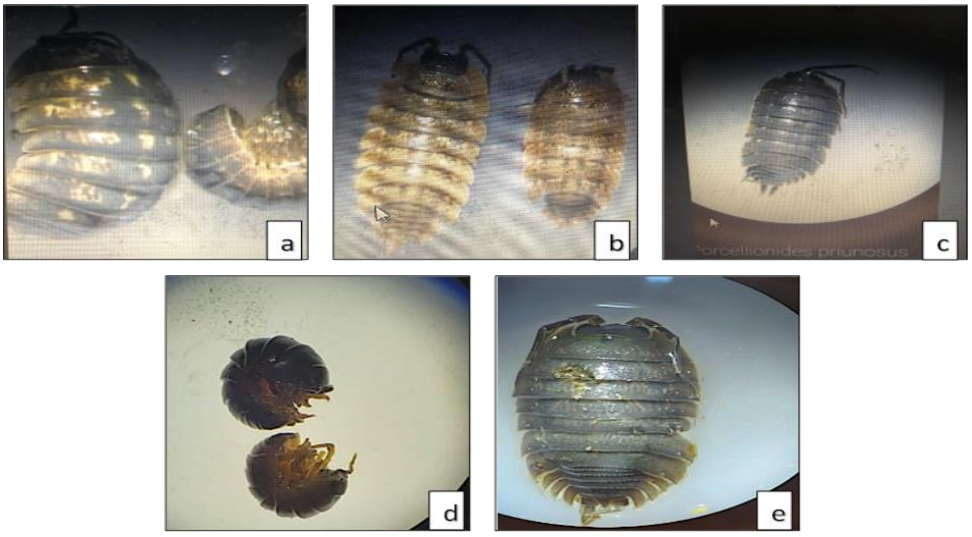

Fig. 2. Species collected at the two study sites. a) *Armadillidium vulgare;* b) *Porcelliovariabilis;* c) *Porcellionidespruinosus;* d) *Armadilloofficinalis;* e) *Porcellioleavis.*

Discussion

This preliminary research work aiming to the evaluation of terrestrial isopods in two study areas showed the presence of a total of 269 individuals of isopods collected. These ones are divided into 3 families Porcellionidae, Armadillidiidae and Armadillidae and 4 genera Porcellionides, Porcellio, Armadillidium and Armadillo. The genus Porcellionides is represented by the species Porcellionidespriunos while the genus Porcellio is represented by two species, Porcelliovariabilis and Porcelliolaevis. For the genus Armadillidium, it is represented by the species Armadillidium vulgare and the genus Armadillo by the species Armadilloofficinalis. This is due to the selectivity of the technique used (sight hunting) which does not allow the collection of small-scale terrestrial isopods such as Platyarthrus, Ligia, Tyloset on the other hand of the types of habitats surveyed and of a minimal number of samplings. In addition, in relation to other studies carried out on the diversity of terrestrial Isopods in different regions of the world, this collection remains restricted to two stations in the Algerian East. In fact, 13 species of terrestrial Isopods are identified in south-western Cameroon (Schmalfuss et al., 1982), 14 species in northern Brazil (Lopes et al., 2005), 30 species in the former Yugoslavia (Schmalfuss, 1998) and 13 species in north-eastern Italy (Paoletti, et al., 1999; Warburg, et al., 1984) identified climate as the main factor affecting the distribution and abundance of isopods and their association with habitat types is strongly affected by soil and humus types (Judas and Hauser 1998).

The distribution of Oniscidae was significantly correlated with seasonal variation in plant associations. The same was exposed on the shores of the lagoon of Ghar El-Melh (Khemaissia, et al., 2012b). Achourie, et al., (2008a) showed that the greatest diversity of species was linked to the greatest diversity of flora. Several studies have demonstrated that the variation in the distribution of isopods is strongly influenced mainly by environmental factors (Paris, 1963; McQueen and Carnio, 1974; Kheirallah, 1979; Dangerfield, 1993; ZimmeR, 2004), in particular temperature (Hopkin and Read 1992 Zimmer et at., 2000; Souty Grosset et al., 2005; Hasall, et al., 2006; Fraj, et at., 2010; Khemaissia et at., 2017). Moreover, other studies have shown that their variation is according to the different bioclimatic zones (Khemaissia, et al., 2017). The life cycle of woodlice can be affected by natural fluctuations in the environment (Jones and Hopkin, 1998).

Conclusion

This study allowed us to identify some species of terrestrial isopods present in two sites of the extreme North-East of Algeria. This work could serve as a reference for any research work that will be carried out subsequently to study the evolution of biodiversity in these regions with the use of other methods and other sampling techniques (the barber pot) in different types of habitats. It aims to assess the biological diversity of isopods and test the influence of environmental conditions on their abundance and distribution. The influence of particularly climatic environmental conditions on the richness, abundance and distribution of isopods constitutes a key element of this ecological component. However, the abundance and specific richness values are high during the winter season and

tend to fall during the summer in the different stations studied. Similarly for the population equilibrium indexes which evolve in the same way, where the maximums are observed in winter. The equitability index proved an equilibrium between the numbers of species in each station.

References

Achouri, M.S., Hamaied, S., Charfi-Cheikhrouha, F. (2008). The diversity of terrestrial Isopoda in the Berkoukech area, Kroumirie, Tunisia. Crustaceana, 81:917-929.

Achouri, M.S., Medini-Bouaziz, L., Hamaied, S., Charfi-Cheikhrouha, F. (2008). Diversity of terrestrial isopods at the Oued Laou region (Northeast of Morocco): preliminary results. Du bassin versant vers la mer: Analyse multidisciplinaire pour une gestion durable. Travaux de l'Institut Scientifique, Rabat, Série générale, 5:75-79.

Bird, S., Coulson, R.N., Crossley Jr, D.A. (2000). Impacts of silvicultural practices on soil and litter arthropod diversity in a Texas pine plantation. Forest Ecology and Management, 131:65-80.

Cassagne, N., Gers, C., Gauquelin, T. (2003). Relationships between Collembola, soil chemistry and humus types in forest stands (France). Biology and Fertility of Soils, 37:355-361.

Colombini, I., Fallaci, M., Milanesi, F., Scapini, F., Chelazzi, L. (2003). Comparative diversity analysis in sandy littoral ecosystems of the western Mediterranean. Estuarine, Coastal and Shelf Science, 58:93-104.

Dangerfield, J.M. (1993). Characterization of soil fauna communities. Report on Characterization of an Experimental Field in KARI Farm, Muguga, Kenya. ICRAF, Nairobi, Kenya, pp:51-67.

Fraj, M. (2008). Biodiversité des isopodes terrestres dans la region de Kébili. Éco-éthologie de Porcellio albinus (Crustacea, Isopoda). Mémoire du Master. Université de Tunis El Manar. Facultés des Sciences de Tunis, p:110.

Fraj, M., Cheikhrouha, F.C., Grosset, C.S. (2010). Terrestrial isopods diversity related to irrigation and agricultural practices in North-East of Tunisia. Anadolu Tarım Bilimleri Dergisi, 25:217-223.

Fraj-Lara, M. (2013). Biodiversity of arthropods in agroecosystems. Application at the scale of the lower Majerda valley in Tunisia.

Ghilarov, M.S. (1977). Why so many species and so many individuals can coexist in the soil. Ecological Bulletins, pp:593-597.

Giller, P.S. (1996). The diversity of soil communities, the 'poor man's tropical rainforest'. Biodiversity and Conservation, 5:135-168.

Goudard, A. (2007). Functioning of ecosystems and biological invasions: importance of biodiversity and interspecific interactions. Doctoral thesis, University of Paris VI, p:216.

Hamaïed, S., Charfi-Cheikhrouha, F. (2007). Description d'une nouvelle espèce du genre Armadillidium (Isopoda, Oniscidea) de Tunisie. Crustaceana, 80:523-532.

Habitat, D. (2013). Terrestrial isopod diversity in the Wadi Tahaddart catchment area (NW Morocco). Vie et milieu-Life and Environment, 63:1-10.

Hamaïed-Melki, S., Achouri, M.S., Aroui, O.E., Bohli, D., Charfi-Cheikhrouha, F. (2011). Terrestrial isopod diversity in the wadi Moula-Bouterfess catchment area (Kroumirie, north-west of Tunisia). African Journal of Ecology, 49:31-39.

Hassall, M., Jones, D.T., Taiti, S., Latipi, Z., Sutton, S.L., Mohammed, M. (2006). Biodiversity and abundance of terrestrial isopods along a gradient of disturbance in Sabah, East Malaysia. European Journal of Soil Biology, 42:S197-S207.

Herrick, J.E. (2000). Soil quality: an indicator of sustainable land management?. Applied Soil Ecology, 15:75-83.

Hopkin, S.P., Read, H. (1992). The Biology of Millipedes. Oxford University Press, p:233.

Hornung, E. (2011). Evolutionary adaptation of oniscidean isopods to terrestrial life: structure, physiology and behavior. Terrestrial Arthropod Reviews, 4:95.

Hornung, E., Warburg, M.R. (1995). Isopod distribution at different scaling levels. Crustacean Issues, 9:83-95.

Hornung, E., Tóthmérész, B., Magura, T., Vilisics, F. (2007). Changes of isopod assemblages along an urban–suburban–rural gradient in Hungary. European Journal of Soil Biology, 43:158-165.

Hornung, E., Szlavecz, K., Dombos, M. (2015). Demography of some non-native isopods (Crustacea, Isopoda, Oniscidea) in a Mid-Atlantic forest, USA. ZooKeys, 515:127.

Newbery, D.M. (1995). MA Huston, Biological Diversity: the coexistence of species on changing landscapes. Cambridge University Press. ISBN 0-521-36930-4 (pbk). 681+xix. pages.£ 24.95. Journal of Tropical Ecology, 11:568-568.

Jebri, A. (2016). Characterization of Oniscoides populations in Ichkeul National Park. Master in Functional Biology, Evolutionary Ecology, p:78.

Jones, D.T., Hopkin, S.P. (1998). Reduced survival and body size in the terrestrial isopod Porcellio scaber from a metal-polluted environment. Environmental Pollution, 99:215-223.

Judas, M., Hauser, H. (1998). Patterns of isopod distribution: From small to large scale. Israel Journal of Ecology and Evolution, 44:333-343.

Kheirallah, A.M. (1979). The ecology of the isopod Periscyphis granai (Arcangeli) in the western highlands of Saudi Arabia. Journal of Arid Environments, 2:51-59.

Khemaissia, H., Jelassi, R., Souty-Grosset, C., Nasri-Ammar, K. (2013). Diversity of terrestrial isopods in the supralittoral zone of G har E l M elh lagoon (Tunisia). African Journal of Ecology, 51:348-357.

ZoNE, S.L., ZoNE, B. (2012). A preliminary study of terrestrial isopod diversity in coastal wetlands of Tunisia. Vie et milieu-Life and Environment, 62:203-211.

Khemaissia, H., Jelassi, R., Touihri, M., Souty-Grosset, C., Nasri-Ammar, K. (2017). Diversity of terrestrial isopods in the northern Tunisian wetlands. African Journal of Ecology, 55:176-187.

Kremen, C., Colwell, R.K., Erwin, T.L., Murphy, D.D., Noss, R.A., Sanjayan, M.A. (1993). Terrestrial arthropod assemblages: their use in conservation planning. Conservation Biology, pp:796-808.

de Carvalho Lopes, E.R., de Souza Mendonça Jr.M., Bond-Buckup, G., Araujo, P.B. (2005). Oniscidea diversity across three environments in an altitudinal gradient in northeastern Rio Grande do Sul, Brazil. European Journal of Soil Biology, 41:99-107.

Magura, T., Tóthmérész, B., Elek, Z. (2003). Diversity and composition of carabids during a forestry cycle. Biodiversity and Conservation, 12:73-85.

Massa, R., Ingegnoli, V. (1999). Biodiversity, estination, conservation. UTET, Torino, pp:518.

McQueen, D.J., Carnio, J.S. (1974). A laboratory study of the effects of some climatic factors on the demography of the terrestrial isopod Porcellio spinicornis Say. Canadian Journal of Zoology, 52:599-611.

Messina, G., Montesanto, G., Pezzino, E., Caruso, D., Lombardo, B.M. (2011). Diversity of terrestrial isopods in a protected area characterized by salty coastal ponds (Vendicari, Sicily). Journal of Natural History, 45:2145-2158.

Messina, G., Pezzino, E., Montesanto, G., Caruso, D., Lombardo, B.M. (2012). The diversity of terrestrial isopods in the natural reserve "Saline di Trapani e Paceco"(Crustacea, Isopoda, Oniscidea) in northwestern Sicily. ZooKeys, 176:215-230.

Messina, G., Montesanto, G., Pezzino, E., Sciandrello, S., Caruso, D., Lombardo, B.M. (2014). Plant communities preferences of terrestrial crustaceans (Isopoda: Oniscidea) in a protected coastal area of southeastern Sicily (Italy). Biologia, 69:354-362.

Noël, F., Séchet, E. (2014). Practical guide for the research, collection and storage of terrestrial isopods for identification purposes. Methodological Document within the Framework of the National Inventory of Terrestrial Isopod Crustaceans of Metropolitan France (I232). Version V1. National Inventory of Natural Heritage, National Museum of Natural History of Paris, p:13.

Noss, R.F. (1990). Indicators for monitoring biodiversity: a hierarchical approach. Conservation Biology, 4:355-364.

Paoletti, M.G., Hassall, M. (1999). Woodlice (Isopoda: Oniscidea): their potential for assessing sustainability and use as bioindicators. Agriculture, Ecosystems and Environment, 74:157-165.

Paris, O.H. (1963). The ecology of Armadillidium vulgare (Isopoda: Oniscoidea) in California grassland: food, enemies, and weather. Ecological Monographs, 33:1-22.

Ponge, J.F., Gillet, S., Dubs, F., Fedoroff, E., Haese, L., Sousa, J.P., Lavelle, P. (2003). Collembolan communities as bioindicators of land use intensification. Soil Biology and Biochemistry, 35:813-826.

Quadros, A.F., Araujo, P.B. (2008). An assemblage of terrestrial isopods (Crustacea) in southern Brazil and its contribution to leaf litter processing. Revista Brasileira de Zoologia, 25:58-66.

Scheu, S., Albers, D., Alphei, J., Buryn, R., Klages, U., Migge, S., Salamon, J.A. (2003). The soil fauna community in pure and mixed stands of beech and spruce of different age: trophic structure and structuring forces. Oikos, 101:225-238.

Schmalfuss, H. (1998). Evolutionary strategies of the antennae in terrestrial isopods. Journal of Crustacean Biology, 18:10-24.

Schmalfuss, H. (1998). The terrestrial isopod fauna of the central Near East: composition and biogeography. Israel Journal of Ecology and Evolution, 44:263-271.

Schmalfuss, H., Ferrara, F. (1982). Observations on the distribution and ecology of terrestrial isopods (oniscoidea) in south-west cameroon: publication del centro di studio per la faunistica ed ecologia tropicali del CNR: CCXLVI. Monitore Zoologico Italiano. Supplemento, 17:243-265.

Sfenthourakis, S. (1992). Altitudinal effect on species richness of Oniscidea (Crustacea; Isopoda) on three mountains in Greece. Global Ecology and Biogeography Letters, pp:157-164.

Sfenthourakis, S., Anastasiou, I., Strutenschi, T. (2005). Altitudinal terrestrial isopod diversity. European Journal of Soil Biology, 41:91-98.

Souty-Grosset, C., Badenhausser, I., Reynolds, J.D., Morel, A. (2005). Investigations on the potential of woodlice as bioindicators of grassland habitat quality. European Journal of Soil Biology, 41:109-116.

Sutton, S.L. (1980). Woodlice. Pergamon Press, Oxford.

Tiberghien, G., Sechet, E. (2009). Contribution to the inventory of terrestrial isopods on the island of Groix (Morbihan, France) (Isopoda, Oniscoidea). Armorican Invertebrates, 3:6-10.

Van Sluys, M., Rocha, C.F.D., Souza, M.B. (2001). Diet, reproduction, and density of the leptodactylid litter frog Zachaenus parvulus in an Atlantic rain forest of southeastern Brazil. Journal of Herpetology, pp:322-325.

Wall, D.H., Moore, J.C. (1999). Interactions underground: soil biodiversity, mutualism, and ecosystem processes. BioScience, 49:109-117.

Warburg, M.R. (1987). Isopods and their terrestrial environment. In Advances in Ecological Research, 17:187-242.

Warburg, M.R., Linsenmair, K.E., Bercovitz, K. (1984). The effect of climate on the distribution and abundance of isopods.

Wolters, V. (2001). Biodiversity of soil animals and its function. European Journal of Soil Biology, 37:221-227.

Zimmer, M. (2004). Effects of temperature and precipitation on a flood plain isopod community: a field study. European Journal of Soil Biology, 40:139-146.

Zimmer, M., Brauckmann, H.J., Broll, G., Topp, W. (2000). Correspondence analytical evaluation of factors that influence soil macro-arthropod distribution in abandoned grassland. Pedobiologia, 44:695-704.

Zimmer, M., Kautz, G., Topp, W. (2003). Leaf litter-colonizing microbiota: supplementary food source or indicator of food quality for Porcellio scaber (Isopoda: Oniscidea)?. European Journal of Soil Biology, 39:209-216.

Citation:

Ahmed, F.B., Boukachabia, A., Houhamdi, I., Houhamdi, M., Boutarfa, M. (2023). Identification of some terrestrial isopods at two stations in Algerian East. *Ukrainian Journal of Ecology.* 13:15-21.