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Checklist of earthworm species (Annelida, Oligochaeta) in Algeria

CHOUROUK NEBATTI CHERGUI[1]*, NADJIA SAIDI OUAHRANI[1] & CELINE PELOSI[2]
[1]*Laboratory of Toxicology, Environment, and Health (LATES). University of Science and Technology of Oran-Mohammed Boudiaf. Algeria. Bir El Djir 31000, Oran, Algeria.*
saidi.ouahrani@gmail.com; https://orcid.org/0009-0001-6765-8646
[2] *INRAE, Avignon University, UMR EMMAH, F-84000, Avignon, France.*
Celine.pelosi@inrae.fr; https://orcid.org/0000-0002-7100-5760
**Corresponding author. chourouk.nebattichergui@univ-usto.dz; https://orcid.org/0009-0006-8347-0471*

Abstract

Earthworms are soil engineers that provide key functions and contribute to numerous ecosystem services including plant production. Little is known about the diversity, ecology, distribution and habitats of earthworm populations in Algeria. In this review article, all scientific studies on earthworms (Annelida, Oligochaeta) in Algeria were collected in order to provide a comprehensive inventory of knowledge on earthworm populations (i.e., occurrence, distribution and habitats) in the country. Among 24 studies and 346 earthworm sampling sites, a total of 40 earthworm species, 20 genera and 8 families (Lumbricidae, Acanthodrilidae, Criodrilidae, Glossoscolecidae, Haplotaxidae, Hormogastridae, Megascolecidae, Ocnerodrilidae) were recorded. The most frequently collected species were the endogeics *Aporrectodea rosea* and *Aporrectodea caliginosa*, with occurrences of 41% and 37%, respectively which could be misleading due to nomenclatorial issues. The species were mostly found in arable lands although listed in a wide range of habitats. Arable lands were the most frequently sampled habitats (19% of the samples) in Algeria followed by inland water borders (11%). This exhaustive review of the literature may be used as a basis for further monitoring studies of earthworm diversity and abundance under different land uses and climate zones in Algeria.

Key words: Catalogue, Clitellata, Zoogeography, Mediterranean

Introduction

Soil is the habitat of many living organisms, housing 59% of the species on Earth (Anthony *et al.* 2023). Over the last few years, the need for actions to protect soil biodiversity has become increasingly relevant (Orgiazzi 2022). Among soil macrofauna, earthworms (Annelida, Oligochaeta) are known as the intestines of Earth (Akhila & Entoori 2022) and as ecosystem engineers because *“they can directly or indirectly modulate the availability of resources to other species by causing physical state changes in biotic or abiotic materials”* (Jones *et al*. 1994) . Earthworms are often used as biological indicators of land use (Li *et al.* 2021; Anuja *et al.* 2023) and agricultural practices (Paoletti *et al.* 1998; Pelosi *et al.* 2024). They are known to provide key functions and contribute to numerous ecosystem services including plant production worldwide (Bertrand *et al.* 2015). More precisely, through their feeding and burrowing behavior, they are involved in organic matter degradation processes, the provision of available nutrients to plants and other soil organisms (Akhila & Entoori 2022; Edwards & Arancon 2022), and the improvement of soil aggregation, porosity and hydraulic conductivity (Hallam & Hodson 2020; Li *et al.* 2021; Etesami & Jin 2025). Fonte *et al.* (2023) showed that earthworms contribute to approximately 6.5% of global cereal production and 2.3% of legume production, equivalent to over 140 million metric tons annually.

Earthworms are traditionally classified into three ecological categories: epigeic, anecic and endogeic (Bouché 1972). Epigeic earthworms live near the soil surface and feed on decaying organic matter; endogeic species stay deeper in the soil and consume soil organic compounds; finally, anecic earthworms dig vertical burrows and pull organic material from the surface into their underground tunnels to feed (Bouché 1972), Reynolds (1977) added two additional categories: corticole (under bark) and limicolous (saturated sol). This classification has evolved and

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intermediate categories (i.e., positioned between two or three ecological categories) are used, e.g., epi-endogeic, epi-anecic, endo-anecic, or intermediate (Bottinelli *et al.* 2020).

Currently, approximately 5700 earthworm species have been described worldwide, but this likely represents less than 20% of the global earthworm diversity (Decaëns *et al.* 2024). In France, thanks to earthworm specialists, about 200 earthworm species were recorded and thoroughly described (e.g., Bouché 1972; Decaëns *et al.* 2024). Similarly, earthworm monitoring has been promoted in numerous European research programs, resulting in a rapid increase in the availability of earthworm data (e.g., Gérard *et al.* 2025). Contrarily, research on earthworms in North Africa particularly in Algeria are still very limited, primarily due to the lack of specialists and the challenges associated with earthworm identification and classification.

Given the persistent taxonomic uncertainties affecting certain earthworm species in Algeria, several questions remain regarding species delimitation and the systematic status of specific taxa. For instance, *Aporrectodea caliginosa* and *Aporrectodea trapezoides* are now recognized as biologically distinct species based on extensive molecular studies, (e.g., Fernández *et al.* 2012; Marchán *et al.* 2023). *A. caliginosa* is a Eurosiberian species associated with humid climates and endogeic behavior, while *A. trapezoides* is predominantly Mediterranean origin and primarily anecic, epianecic, or endoanecic. In the Algerian literature, several studies refer only to *A. caliginosa* without separating it from *A. trapezoides*. Some authors mention only *A. trapezoides* while others cite both species simultaneously. Given Algeria biogeographic context, *A. caliginosa* is likely to be rare and many such records may instead correspond to *A. trapezoides*. The latter is a parthenogenetic form that appears to have multiple independent origins, several authors (e.g.,Fernández *et al.* 2012; Latif *et al.* 2020) have suggested that *Aporrectodea tetrammamalis*, *Aporrectodea carochensis*, *Aporrectodea monticola* should not be treated as separate species but rather as synonyms or sexual morphs of *A. trapezoides*.

Similarly, according to Trigo *et al.* (1989, 1990) and Barros *et al.* (1992), *Aporrectodea molleri* and *Allolobophora moebii* should not be placed in separate genera, as molecular data indicate that these species, along with others (e.g., *A. fernandae* and *A. dubiosa monchicana*), form a single species complex under the name *Allolobophora molleri*. This interpretation contrasts with the more fragmented classification proposed by Qiu & Bouché (1998), who created the genus *Heraclescolex* and recognized numerous species and subspecies. In the same vein, the phylogenetic analyses of Navarro *et al.* (2023) also suggested a possible synonymy between *Allolobophora* and *Heraclescolex*, while identifying the Maghreb as a potential hotspot for Lumbricidae diversification. These ongoing taxonomic debates may thus affect the current estimates of species and genera reported from Algeria.

The estimation of earthworm diversity, distribution and habitat preference in this sub-Mediterranean country is central for ecology and conservation biology purpose. In the current context of climate change, to which the Mediterranean zone is particularly vulnerable (MedECC 2020), the determination of sub-Mediterranean earthworm diversity may help better protecting soil biodiversity in this area, and better understanding the occurrence of earthworm species in South-Europe.

The aim of this article was to conduct a comprehensive literature review on earthworms in Algeria in order to provide insightful information on the diversity in the country, the occurrence of the different species, the geographical distribution of the sampled sites, and the habitats where the different species were found.

Materials and methods

1. Literature search

A systematic literature review was conducted until April 2025 to find publications dealing with earthworms in Algeria. The literature search was carried out using keywords in ISI Web of Knowledge, with "All Databases" option, using the keywords "Earthworm* and Alger*" in Topics. The 26 obtained articles were read and reviewed. Only 15 articles were selected because they provided information on earthworm species. To complete the search, starting from the previously selected references, authors who had written on the subject, as well as relevant books, journals and thesis were identified and examined. Among conference papers, only those with a DOI were included. A total of 24 publications were used for this review.

2. Article selection

Only studies providing information on earthworm species, repartition and/or occurrence were included. Therefore, studies with total earthworm abundance without species name were not considered. Earthworm inventory studies were included even if they did not provide precise geographic coordinates. Reviews covering the entire Maghreb region were also included to ensure that all relevant data for Algeria, as part of this region, were considered. All earthworm sampling protocols were considered, without restriction to a specific method.

3. Data extraction and analysis

Data were extracted from the selected publications and the following variables were included in a database (Table S1): author(s), publication year, study area, earthworm species, habitat where the species was sampled, and geographic coordinates of the sampling sites. Data were collected from both text and tables within the articles.

A total of 398 sites were sampled among all the articles. After reviewing the studies by Kherbouche *et al.* (2012) (49 sites) and Ababsa *et al.* (2020) (3 sites), it was found that they did not provide precise information on the sampling locations/ sampling sites locations or details on the distribution and occurrence of the identified species in relation to the sampled sites. Consequently, these studies were excluded from mapping and occurrence calculations. However, we checked before excluding them that the species they reported were already included in our dataset to avoid missing any species present in Algeria. Similarly, Beddard (1892) mentioned the presence of certain species in Algeria without indicating the precise location of the sampling sites but his study was kept as it is the only one to report the species *Microscolex algeriensis* in Algeria. Following the previously mentioned exclusions, the dataset was reduced to 346 sites. Among these sites, when precise geographic coordinates were not provided, the sampling locations mentioned by the authors (e.g., cities) were used to determine the coordinates. These locations were entered into Google Earth, which directly provided the latitude, longitude, and altitude of each site (i.e., Michaelsen 1900; Michaelsen 1903; Ċernosvitov 1933; Michaelsen 1938; Gagneur *et al.* 1986; Omodeo & Martinucci 1987; Baha 1997; Rouabah & Descamps 2001; Omodeo *et al.* 2003; Sekhara 2008; Zeriri *et al.* (2013); Ababsa *et al.* 2017). For the sites for which the results on earthworms species were not reported, we considered that the authors did not find any earthworm (i.e., Qiu & Bouché 1998, for 8 sites ; Bazri *et al.* 2013, for 6 sites). Therefore, this information was considered for calculating the occurrence of each species (Table 1) but logically not for the map (Figure 1). For instance, Omodeo & Martinucci (1987) provided earthworm species occurrence at 55 sampled sites in Algeria but they did give location only for 20 sites (i.e. coordinates or cities). In that case, the information was kept for calculating the occurrences (Table 1), but only the 20 located sites appear on the map (Figure 1) and in Table S1. In Gagneur *et al.* (1986), the samples were collected from 44 sites in the Tafna region. However, earthworms were only found at 6 of these sites. These data were used to calculate occurrence, but only the sites where earthworms were detected were included in the map (Figure 1) and in Table S1. Černosvitov (1933) specified that the samples were taken in "*region d'Alger*", so we considered the point Algiers on the map (i.e. 33.967228°N 3.058756° E).

In total, 273 sites are geolocated in Table S1 and appear on Figure 1. For studies that did not specify the altitude of the sampling locations, we obtained it by inputting the geographic coordinates into Google Earth. For each species, we noted the minimum and maximum altitudes where the species was found over the different sampling sites, and we calculated mean and standard deviation (Table 1).

The synonyms were primarily extracted from DriloBASE-Taxo. We selected the most frequently used synonyms in the scientific literature. Among them, those that also appeared in the 24 studies reviewed on Algerian earthworms were highlighted in bold and followed by the references that cited them. The ecological categories were determined using Bouché (1972) and Bottinelli *et al*. (2020). For species not covered in these studies, we used DriloBASE-Taxo and additional scientific articles (see Table 2).

Based on the explanations given by the authors about the sampled habitats, we determined the Corine Land Cover at the 3rd level. CLC at the 2nd level was used to discuss the results, in order to have broader categories (Table 1).

The percentage occurrence of each species was calculated using the following formula:

$$Occurence\,(\%) = \frac{Number\ of\ sites\ where\ the\ species\ was\ found}{Total\ number\ of\ sites} \times 100$$

Using the Table S1, the sites where each genus was observed were grouped and divided by the total number of sites to obtain the occurrence percentage of the most represented genera in Algeria.

To map the samples sites in Algeria, the geographic coordinates (X, Y) of the sampling locations were imported into QGIS. After verifying the accuracy of the projection system (i.e., WGS84), the points were converted into a vector layer. Additional contextual layers, such as administrative boundaries were added to enhance the readability and spatial understanding of the spatial distribution.

Information on species abundance and soil characteristics provided in some articles of our bibliographic corpus could have been interesting for this manuscript. Unfortunately, too few articles provided this information, so it was not included in this study.

Results

The 24 studies considered in this review were published between 1892 and 2025, for a total of 346 sites sampled in Algeria, especially in the East and the center of the country, and around the major cities (Algiers, Bejaia, Annaba, Constantine, Sétif, Tebessa) (Figure 1).

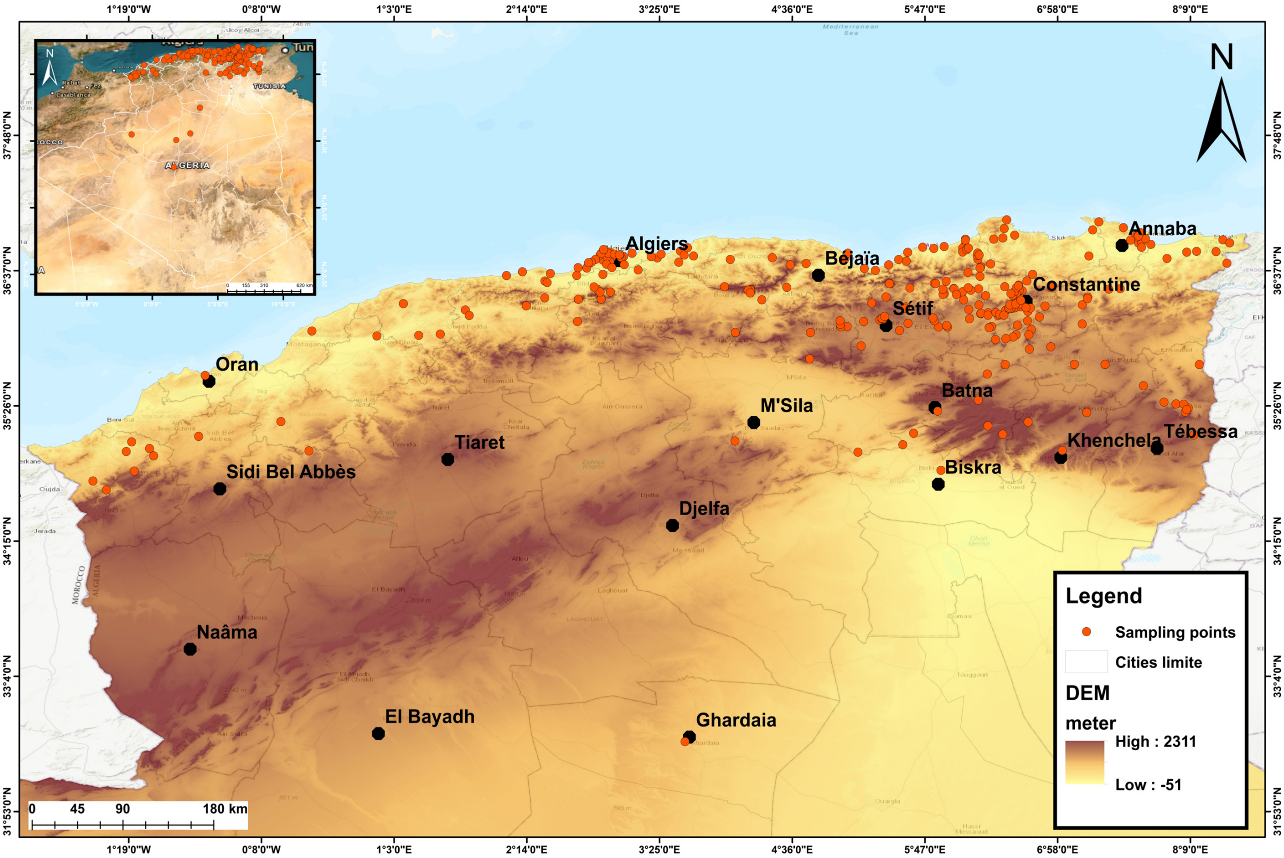

FIGURE 1. Geographical distribution of the 273 earthworm sampling locations in Algeria (STRM. DEM 30m, QGIS).

Among the 346 sites, 19 % were classified as arable lands, where the dominant crops were cereals, forages, and legumes. Inland water borders represented 11% of the sites with the water-courses borders being the predominant habitat. Shrub and herbaceous vegetation represented 10 % with transitional woodlands as well as shrubs and natural grasslands being the main features of this category. Forests accounted for 10 % of the sites, with broad-leaved forests being the predominant type. Other sites were sampled included permanent crops (5%), predominantly represented by olive groves and fruit trees, pastures (5 %), mines dumps and construction sites (4%), industrial zones (4%), heterogeneous agricultural areas (2%), artificial non-agricultural vegetated areas and open spaces with little or no vegetation (1%).

TABLE 1. List of all earthworm species recorded in Algeria since 1892, with occurrence, family, habitats, altitudes and the corresponding references that cited each species. For habitats, the numbers between brackets indicate the number of times the species has been recorded in the habitat. NA mean information not assigned.SD for standard deviation.

Familly	Species	Occurrence (%)	CORINE Land Cover (CLC3)	Habitat (CLC2)	Altitude min-max (m)	Mean altitude ± SD (m)	Studies reporting the species
LUMBRICIDAE (Rafinesque-Schmaltz, 1815)	***Aporrectodea rosea*** (Savigny, 1826)	41	211, 511, 324, 222, 21, 231, 313, 121, 132, 212, 31, 512, 321, 242, 322, 241, 244	Arable lands (26), Inland water borders (23), Shrub and/or herbaceous vegetation associations (13), Permanent crops (10), Forests (8), Mine dump and construction sites (5), Pastures (5), Industrial commercial and transport units (4), Heterogeneous agricultural areas (2).	8 - 1550	555 ± 410	Omodeo & Martinucci (1987), Baha (1997), Qiu & Bouché (1998), Ouahrani (2003), Omodeo *et al*. (2003), Sekhara (2008), Bazri *et al*. (2013), El-Okki (2016), Bouazdia & Dahbia (2017), Esserhane & Baha (2017), Ababsa *et al*. (2017), Zerrouki *et al*. (2022), Ababsa *et al*. (2023).
	Aporrectodea caliginosa (Savigny, 1826)	37	211 ,222, 511, 324, 231, 132, 242, 121, 311, 512, 31, 243, 321, 412, 223, 131	Arable lands (33), Inland water borders (11), Permanent crops (11), Shrub and/or herbaceous vegetation associations (9), Forests (5), Pastures (5), Industrial commercial and transport units (2), Open spaces with little or no vegetation (2), Heterogeneous agricultural areas (1), Mine, dump and construction sites (1).	0 - 1541	428 ± 431	Michaelsen (1938), Omodeo & Martinucci (1987), Baha (1997), Ouahrani (2003), Omodeo *et al*. (2003), Sekhara (2008), Zeriri et al. (2013), Bazri *et al*. (2013), Bouazdia & Dahbia (2017), Esserhane & Baha (2017), Zerrouki *et al*. (2022), Ababsa *et al*. (2023), Bengrid et al. (2024).
	Aporrectodea trapezoides (Duges, 1828)	23	324, 322, 243, 511, 311, 212, 231, 211, 21, 122, 312, 223	Shrub and/or herbaceous vegetation associations (16), Arable lands (13), Inland water borders (13), Forests (8) Heterogeneous agricultural areas (7), Mine, dump and construction sites (4), Pastures (3), Permanent crops (3), Industrial commercial and transport units (2), Artificial non-agricultural vegetated areas (2).	3 – 1541	502 ± 357	Michaelsen (1938), Qiu & Bouché (1998), Ouahrani (2003), Bazri *et al*. (2013), Okki (2016), Zerrouki *et al*. (2022), Bengrid et al. (2024).
	Octodrilus complanatus (Duges, 1828)	22	211, 21, 324, 222, 31, 322, 242, 231, 241, 511, 223, 121, 221, 243, 312	Arable lands (22), Inland water borders (11), Shrub and/or herbaceous vegetation associations (8), Permanent crops (7), Forests (5), Heterogeneous agricultural areas (4), Pastures (2), Industrial commercial and transport units (2).	14 -1550	423 ± 464	Michaelsen (1903), Michaelsen (1938), Omodeo & Martinucci (1987), Baha (1997), Qiu & Bouché (1998), Omodeo *et al*. (2003), Sekhara (2008), Zeriri et al. (2013), Bazri *et al*. (2013), El-Okki (2016), Esserhane & Baha (2017), Ababsa *et al*. (2017), Zerrouki *et al*. (2022), Ababsa *et al*. (2023), Bengrid et al. (2024).

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TABLE 1. (Continued)

Familly	Species	Occurrence (%)	CORINE Land Cover (CLC3)	Habitat (CLC2)	Altitude min-max (m)	Mean altitude ± SD (m)	Studies reporting the species
	Eiseniella tetraedra (Savigny, 1826)	14	211, 324, 511, 222, 121, 21	Inland water borders (16), Arable lands (7), Shrub and/or herbaceous vegetation associations (4), Permanent crops (2), Mine, dump and construction sites (1).	25- 1250	538 ± 412	Gagneur et al. (1986), Omodeo & Martinucci (1987), Baha (1997), Qiu & Bouché (1998), Omodeo *et al*. (2003), Ouahrani (2003), Sekhara (2008), Bazri *et al*. (2013), Esserhane & Baha (2017), Zerrouki *et al*. (2022).
	Aporrectodea molleri (Rosa, 1889)	14	211, 322, 231, 212, 511, 31, 242, 221, 222, 324	Arable lands (16), Inland water borders (10), Shrub and/or herbaceous vegetation associations (6), Pastures (4), Forests (4), Permanent crops (4), Heterogeneous agricultural areas (1).	0 – 1500	399 ± 415	Omodeo & Martinucci (1987), Baha (1997), Omodeo *et al*. (2003), Sekhara (2008), Bazri *et al*. (2013), Okki (2016), Bengrid et al. (2024).
	Allolobophora moebii (Michaelsen, 1895)	8	211, 132, 511, 121, 131, 222, 242	Inland water borders (8), Arable lands (5), Industrial commercial and transport units (4), Mine dump and construction sites (3), Permanent crops (2), Forest (2), Heterogeneous agricultural areas (1).	14 - 965	422 ± 240	Omodeo & Martinucci (1987), Qiu & Bouché (1998), Ouahrani (2003), Sekhara (2008), Okki (2016).
	Octodrilus maghrebinus(Omodeo and Martinucci, 1987)	12	324, 211, 311, 223, 242, 511, 313, 31	Forests (16), Shrub and/or herbaceous vegetation associations (8), Arable lands (5), Permanent crops (4), Heterogeneous agricultural areas (2), Industrial commercial and transport units (2), Inland water borders (1).	0 - 1541	667 ± 495	Omodeo & Martinucci (1987), Omodeo *et al*. (2003), Sekhara (2008), Bazri *et al*. (2013), Esserhane & Baha (2017), Zerrouki *et al*. (2022), El-Okki et al. (2022), Bengrid et al. (2024).
	Eisenia fetida (Savigny, 1826)	10	211, 21, 322, 511, 222, 221, 223, 512, 231	Arable lands (14), Inland water borders (10), Pastures (3), Industrial commercial and transport units (2), Permanent crops (1), Shrub and/or herbaceous vegetation associations (1), Heterogeneous agricultural areas (1) Mine dump and construction sites (1).	0 - 1007	346 ± 351	Omodeo ***et al***. (2003), Ouahrani (2003), Sekhara (2008), Zeriri et al. (2013), Bazri ***et al***. (2013), El-Okki (2016), Bouazdia & Dahbia (2017), Ababsa ***et al***. (2023), Bengrid et al. (2024).
	Proctodrilus antipae (Michaelsen, 1891)	10	211, 324, 511, 121, 132, 313	Arable land (5), Permanent crops (5), Industrial commercial and transport units (3), Shrub and/or herbaceous vegetation associations (2), Inland water borders (2), Mine dump and construction sites (2), Forests (1).	0 - 1230	339 ± 401	Omodeo & Martinucci (1987), Qiu & Bouché (1998), Baha (1997), Omodeo ***et al***. (2003), Sekhara (2008), Okki (2016), Esserhane & Baha (2017), Zerrouki ***et al***. (2022).

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TABLE 1. (Continued)

Familly	Species	Occurrence (%)	CORINE Land Cover (CLC3)	Habitat (CLC2)	Altitude min-max (m)	Mean altitude ± SD (m)	Studies reporting the species
	Murchieona minuscula (Rosa, 1906)	7	222, 211, 324, 32, 121	Shrub and/or herbaceous vegetation associations (5), Arable lands (5), Permanent crops (5), Industrial commercial and transport units (1).	12 – 1333	329 ± 425	Omodeo & Martinucci (1987), Baha (1997), Omodeo ***et al***. (2003), Sekhara (2008), Zerrouki ***et al***. (2022).
	Allolobophora chlorotica (Savigny, 1826)	5	222, 211, 324, 231, 412	Permanent crops (5), Arable lands (4), Shrub and/or herbaceous vegetation associations (4), Pastures (2), Inland water borders (1), Forest (1)	0 - 900	267 ± 337	Baha (1997), Rouabah & Descamps (2001), Sekhara (2008), Zeriri et al. (2013), Zerrouki ***et al***. (2022), Ababsa ***et al***. (2023).
	Eisenia xylophila (Omodeo and Martinucci, 1987)	5	211, 223, 222, 324, 311, 121	Forests (8), Arable lands (5), Permanent crops (3), Shrub and/or herbaceous vegetation associations (1).	20 - 1230	631 ± 490	Omodeo & Martinucci (1987), Omodeo ***et al***. (2003), Sekhara (2008), Zerrouki ***et al***. (2022).
	Dendrobaena lusitana (Graff, 1957)	3	31, 324, 231	Forests (7), Shrub and/or herbaceous vegetation associations (4).	12 - 1550	759 ± 633	Omodeo & Martinucci (1987), Omodeo ***et al***. (2003), Zerrouki ***et al***. (2022).
	Octodrilus transpadanus (Rosa, 1884)	3	121, 132, 141, 131, 515, 222	Mine, dump and construction sites (3), Heterogenous agricultural areas (2), Forests (2), Industrial commercial and transport units (2), Permanent crops (1),	322 - 907	559 ± 170	Ouahrani (2003).
	Koinodrilus georgii (Michaelsen, 1890)	3	21, 211, 223, 121, 322	Arable lands (5), Industrial commercial and transport units (2), Shrub and/or herbaceous vegetation associations (1), Permanent crops (1).	16 - 748	305 ± 311	Omodeo ***et al***. (2003), Sekhara (2008).
	Dendrobaena byblica (Rosa, 1893)	3	311, 231	Forests (1), Pastures (1).	na		Omodeo & Martinucci (1987), Bazri ***et al***. (2013).
	Prosellodrilus doumandjii (Baha and Berra, 2001)	2	211, 121, 242	Arable lands (3), Industrial commercial and transport units (1), Heterogeneous agricultural areas (1), Permanent crops (1).	25- 198	100 ± 74	Baha & Berra (2001), Sekhara (2008).
	Bimastos parvus (Bouché, 1972)	1	21, 31	Arable lands (3).	16- 253	102 ± 131	Omodeo ***et al***. (2003), Sekhara (2008).
	Aporrectodea longa (Ude, 1885)	1	511, 231, 21	Pastures (2), Arable lands (1), Inland water borders (1).	518-1007	797 ± 178	Michaelsen (1938), Bouazdia & Dahbia (2017), Ababsa ***et al***. (2023).
	Lumbricus terrestris (Linnaeus, 1758)	1	211, 231,121	Arable lands (2), Pastures (1), Industrial, commercial and transport units (1).	na	Na	Rouabah & Descamps (2001).
	Bimastos rubidus (Savigny, 1826)	1	511, 31	Forests (2), Inland water borders (1).	518 - 1200	973 ± 394	Michaelsen (1938), Omodeo & Martinucci (1987).

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TABLE 1. (Continued)

Familly	Species	Occurrence (%)	CORINE Land Cover (CLC3)	Habitat (CLC2)	Altitude min-max (m)	Mean altitude ± SD (m)	Studies reporting the species
	Dendrobaena pygmaea (Friend, 1923)	1	211, 231,121	Arable lands (2), Pastures (1) Industrial, commercial and transport units (1).	na	Na	Rouabah & Descamps (2001).
	Octodrilus kabylianus (Omodeo and Martinucci, 1987)	1	21, 231	Arable lands (1), Pastures (1).	68 - 2150	1356 ± 1125	Sekhara (2008).
	Helodrilus oculatus (Hoffmeister, 1845)	1	21, 324	Arable lands (2), Shrub and/or herbaceous vegetation associations (1).	52 - 1541	615 ± 808	Omodeo & Martinucci (1987), Omodeo ***et al***. (2003).
	Eiseniella neapolitana (Orley, 1885)	1	321	Shrub and/or herbaceous vegetation associations (1)	na	Na	Omodeo ***et al***. (2003), Zerrouki ***et al***. (2022).
	Octolasion lacteum (Orley, 1885)	1	324, 411	Inland water borders (1), Shrub and/or herbaceous vegetation associations (1).	25 - 690	358 ± 470	Michaelsen (1900), Bazri ***et al***. (2013), El-Okki (2016).
	Lumbricus rubellus (Hoffmeister, 1843)	1	Na	na	120 - 130	125 ± 7	Omodeo ***et al***. (2003), Sekhara (2008).
	Octodrilus lissaensis (Michaelsen, 1891)	1	211, 511,	Arable lands (1), Inland water borders (1).	na	Na	Sekhara (2008).
	Orodrilus doderoi (Cognetti de Martiis, 1904)	0,2	121	Industrial commercial and transport units (1).	na	Na	Ouahrani (2003).
	Eisenia andrei (Bouche, 1972)	1	324	Shrub and/or herbaceous vegetation associations (3).	750-1541	930 ± 543	Zerrouki ***et al***. (2022).
ACANTHODRILIDAE (Claus, 1880)	***Microscolex phosphoreus*** (Duges, 1837)	11	211, 324, 21, 222, 242, 31, 511	Arable lands (13), Shrub and/or herbaceous vegetation associations (7), Permanent crops (6), Forests (2), Heterogeneous agricultural areas (3), Inland water borders (1).	3 - 1541	322± 500	Omodeo & Martinucci (1987), Omodeo ***et al***. (2003), Baha (1997), Sekhara (2008), Bazri ***et al***. (2013), Zerrouki ***et al***. (2022), Bengrid et al. (2024).
	Microscolex dubius (Fletcher, 1887)	8	211, 21, 324, 311, 121, 242, 223, 511, 241	Arable lands (15), Inland water borders (3), Shrub and/or herbaceous vegetation associations (2), Permanent crops (1), Forests (1), Heterogeneous agricultural areas (1), Industrial commercial and transport units (1), Mine, dump and construction sites (1).	3 - 1083	340 ± 334	Omodeo & Martinucci (1987), Qiu & Bouché (1998), Omodeo ***et al***. (2003), Sekhara (2008), Ouahrani (2003), Bazri ***et al***. (2013), Bengrid et al. (2024).

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TABLE 1. (Continued)

Familly	Species	Occurrence (%)	CORINE Land Cover (CLC3)	Habitat (CLC2)	Altitude min-max (m)	Mean altitude ± SD (m)	Studies reporting the species
	Dichogaster sp	1	21	Arable lands (2).	52 - 253	153 ± 142	Omodeo ***et al***. (2003).
	Microscolex algeriensis (Beddard, 1892)	0,2	Na	na	na	Na	Beddard (1892).
MEGASCOLECIDAE (Rosa, 1891)	***Amynthas sp***	5	211, 21, 222, 324, 231	Arable lands (8), Shrub and/or herbaceous vegetation associations (5), Permanent crops (3), Pastures (1).	45 - 1230	531 ± 448	Baha (1997), Omodeo ***et al***. (2003), Sekhara (2008), Zerrouki ***et al***. (2022), Esserhane & Baha (2017), Ababsa ***et al***. (2023).
	Amynthas californica (Kinberg, 1867)	2	324, 223, 222	Shrub and/or herbaceous vegetation associations (3), Permanent crops (2).	27 - 750	342 ± 305	Sekhara (2008), Zerrouki ***et al***. (2022).
CRIODRILIDAE (Vejdovský, 1884)	***Criodrilus lacuum*** (Hoffmeister, 1845)	2	324, 211, 242, 511	Shrub and/or herbaceous vegetation associations (3), Arable lands (2), Heterogeneous agricultural areas (1), Inland water borders (1).	373 - 1150	767 ± 291	Omodeo & Martinucci (1987), Omodeo ***et al***. (2003), Sekhara (2008), Zerrouki ***et al***. (2022).
	Criodrilus ghaniae (Qiu and Bouché, 1998)	1	121, 132, 411	Mine dump and construction sites (3), Inland water borders (1), Industrial commercial and transport units (1).	544 - 602	578± 24	Qiu & Bouché (1998), Omodeo ***et al***. (2003), Okki (2016).
HORMOGASTRIDAE (Michaelsen, 1928)	***Hormogaster redii*** (Rosa, 1887)	2	311	Forests (1)	729 - 849	789 ± 85	Omodeo & Martinucci (1987), Bazri ***et al***. (2013).
HAPLOTAXIDAE (Michaelsen, 1900)	***Haplotaxis gordioides*** (Hartmann, 1821)	1	Na	na	535 - 470	578 ± 75	Gagneur et al. (1986).
OCNERODRILIDAE (Eisen, 1878)	***Ocnerodrilus sp***	2	324, 223, 222	Shrub and/or herbaceous vegetation associations (4), Inland water borders (01), Arable lands (1).	373 - 1333	822 ± 373	Omodeo & Martinucci (1987), Omodeo ***et al***. (2003), Zerrouki ***et al***. (2022).
GLOSSOSCOLECIDAE (Vejdovský, 1884)	***Pontoscolex corethrurus*** (Müller, 1856)	0.2	Na	na	na	na	Michaelsen (1938).

A total of 40 species have been recorded in Algeria, belonging to 18 different genera (Table 1). The most represented genera were *Aporrectodea* and *Octodrilus*, found in 53% and 32% of the sites, respectively. Moreover, two genera (*Dichogaster sp*, and *Ocnerodrilus sp*) were recorded but the sampled individuals were not identified at the species level. These genera were not included in the total number of identified species but they are listed in Table 1 to acknowledge the presence of 20 genera in Algeria.

The species belonged to seven different families: Lumbricidae (31 species), Acanthodrilidae (3 species), Criodrilidae (2 species), Megascolecidae (1 species), Glossoscolecidae (1 species), Haplotaxidae (1 species), Hormogastridae (1 species). The family of Ocnerodrilidae represented in Table 1 the genera *Ocnerodrilus* sp.

The most abundant species recorded in Algeria was *Aporrectodea rosea* (= *Allolobophora rosea*)

with an occurrence of 41% (Table 1). This species was classified as endogeic by both Bouché (1972) and Bottinelli *et al.* (2020) (Table 2). It was found in the whole country, mostly in arable lands (19 %) although listed in a wide range of habitats (Table 1). The species was found at the highest altitude studied in Algeria (i.e., 1550 meters). The second most occurring earthworm species in Algeria was *Aporrectodea caliginosa* (= *Nicodrilus caliginosus caliginosus*), this species was found in 37 % of the sites, it was reported to be widespread in arable lands (Table 1). It was also classified as an endogeic species (Table 2). *Aporrectodea trapezoides* (= *Nicodrilus caliginosus meridionalis*) was the third species with the highest occurrence (i.e., 23%) (Table 1). It was classified as an anecic species by Bouché (1972), but as epi-anecic by Bottinelli *et al.* (2020) (Table 2). *A. trapezoides* was found approximately in the same habitats as *A. rosea* and *A. caliginosa*, and generally at the same study sites. Contrarily to the two first most occurring species, *A. trapezoides* has never been recorded in the Western region of Algeria. These three most occurring species, along with others recorded in Algeria were found within a wide range of altitudes (i.e., between 0 and 1550m) (Table 1).

Some species remained rarely recorded in Algeria (i.e., *Eisenia andrei*, *Lumbricus terrestris*, *Eiseniella neapolitana, Helodrilus oculatus*), while others have been observed only once. For instance, *Microscolex algeriensis* was identified only by Beddard in 1892. Similarly *Pontoscolex corethrurus* was reported once by Michaelsen (1938). *Haplotaxis gordioides* appeared only in the findings of Gagneur *et al.* (1986). *Dendrobaena pygmaea* was only recorded by Rouabah & Descamps (2001) and *Orodrilus doderoi* was observed once by Ouahrani in 2003 (**Table S1**).

TABLE 2. Frequently reported synonyms of earthworm species in Algeria (from DriloBase), with ecological categories from Bouché (1972), Bottinelli *et al*. (2020), and other bibliography sources. Those found in reviewed studies are shown in bold. "na" = information not assigned. "/" = no synonyms found.

Species	Synonyms	Ecological category Bottinelli *et al*. (2020)	Ecological category Bouche (1972)	Ecological category (Bibliography)
Aporrectodea rosea (Savigny, 1826)	***Allolobophora rosea* (Baha 1997)** *Eisenia rosea rosea* (Huang et al. 2006) ***Koinodrilus rosea* (Qiu & Bouche 1998)**	Endogeic	Endogeic	Endogeic (DriloBASE)
Aporrectodea caliginosa (Savigny, 1826)	***Allolobophora borellii* (Baha 1997, Omodeo *et al*. 2003) *Nicodrilus caliginosus caliginosus* (Ouahrani 2003)**	Endogeic	Endogeic	Endogeic (DriloBASE)
Aporrectodea trapézoïdes (Duges, 1828)	***Aporrectodea tetramammalis, Aporrectodea monticola,*** ***Aporrectodea carochensis* (Bazri *et al*. 2013)** ***Nicodrilus caliginosus meridionalis* (Bouche 1972)**	Epi-anecic	Anecic	Endogeic, Aquatic (DriloBASE)
Octodrilus complanatus (Duges, 1828)	*Lumbricus complanatum* (Duges 1928) *Allolobophora complanata* (Rosa1893) ***Octolasium complanatum* (Michaelsen 1938)**	Anecic	Anecic	Endogeic, Anecic (DriloBASE)
Eiseniella tetraedra (Savigny, 1826)	*Enterion tetraedrum* (Savigny 1826) *Lumbricus tetraedrus* (Duges 1837)	Epigeic	Partial-epigeic	Aquatic, Epigeic (DriloBASE)

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TABLE 2. (Continued)

Species	Synonyms	Ecological category Bottinelli *et al.* (2020)	Ecological category Bouche (1972)	Ecological category (Bibliography)
Allolobophora moebii (Michaelsen, 1895)	***Aporrectodea moebii* (Ouahrani 2003)** ***Heraclescolex moebii michaelseni* (Qiu & Bouche 1998)** *Eophila moebii* (Michaelsen 1895)	na	na	Epi-endogeic, Endogeic (Reynolds, 2018)
Allolobophora molleri (Omodeo & Martinucci 1987)	***Aporrectodea molleri* (Bengrid *et al.* 2024)** *Heraclescolex molleri* (Qiu et Bouche 1998) *Eophila molleri molleri* (Blakemore 2008)	na	na	Endogeic (DriloBASE)
Octodrilus maghrebinus (Omodeo and Martinucci, 1987)	/	na	na	Epigiec (Reynolds, 2018)
Microscolex dubius (Fletcher, 1887)	*Eudrilus dubius* (Fletcher 1887)	Epigeic	Epi-endogeic	Epiendogeic, Endogeic (DriloBASE)
Microscolex phosphoreus (Duges, 1837)	*Lumbricus phosphoreus* (Duges 1837)	Epi-endogeic	Epi-endogeic	Epiendogeic (DriloBASE)
Proctodrilus antipae (Zicsi, 1985)	***Allolobophora antipae* (zerrouki *et al.* 2022)** ***Helodrilus antipae* (Baha 1997)**	na	Endogeic	Endogeic (DriloBASE)
Eisenia fetida (Savigny, 1826)	*Enterion fetidum* (Savigny 1826) *Lumbricus foetidus* (Duges 1837) *Allolobophora foetida* (Eisen 1874)	Epi-Endo-Anecic	Epigeic	Epigeic, Epiendogeic, Corticolous (DriloBASE)
Murchieona minuscula (Omodeo *et al.* 2003)	***Allolobophora minuscula* (Zerrouki *et al.* 2022)** *Bimastos minusculus* (Omodeo et Martinucci 1987)	na	na	Endogeic (DriloBASE)
Allolobophora chlorotica (Savigny, 1826)	*Enterion chloroticum* (Savigny 1826) *Helodrilus chloroticus* (Michaelsen 1900)	na	Epigeic-endogeic-Anecic	Endogeic (DriloBASE)
Amynthas sp	/	na	na	Epi-endogeic (Bouché, 1977)
Eisenia xylophila (Omodeo et Martinucci 1987)	***Allolobophora xylophila* (Omodeo and Martinucci, 1987)**	Endogeic	na	Epigeic, Corticolous (Reynolds, 2018)
Dendrobaena lusitana (Graff, 1957)	*Dendrobaena carusoi* (Omodeo et Martinucci 1987)	na	na	Epigeic (Reynolds, 2018)
Criodrilus lacuum (Hoffmeister, 1845)	*Guarani camaqua* (Lima et Rodriguez 2007)	na	na	Anecic, Limicolous (Reynolds, 2018)
Octodrilus transpadanus (Rosa, 1884)	*Allolobophora transpadana* (Rosa, 1884) *Octolasium transpadanum* (Zicsi 1973)	na	na	Endogeic (DriloBASE)
Koinodrilus georgii (Qiu et Bouche 1998)	*Nicodrilus georgii* (Perel 1979) ***Aporrectodea georgii* (Sekhara 2008)** ***Allolobophora georgii* (Omodeo *et al.* 2003)**	Epi-anecic	Epi-endogeic	Endogeic, Aquatic (DriloBASE)
Ocnerodrilus sp	/	Epi-anecic	na	na
Dendrobaena byblica (Rosa, 1893)	*Allolobophora byblica* (Rosa 1893) *Helodrilus lacustris* (Stephenson 1913)	Epigeic	na	Epigeic (DriloBASE)
Prosellodrilus doumandjii (Baha and Berra, 2001)	/	Epigeic	na	Endogeic (Reynolds, 2018)

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TABLE 2. (Continued)

Species	Synonyms	Ecological category Bottinelli *et al.* (2020)	Ecological category Bouche (1972)	Ecological category (Bibliography)
Bimastos parvus (Eisen, 1874)	***Eisenia parva* (Bouché, 1972)** *Allolobophora parva* (Eisen 1874) *Bimastus parvus* (Zicsi 1959)	na	na	Epigeic, Corticolous (DriloBASE)
Amynthas californica (Kinberg, 1867)	/	Endogeic	na	Anecic (Christina Papazlatani, 2024)
Hormogaster redii (Rosa, 1887)	*Hormogaster redii insularis* (Bouche 1970)	na	na	Endogeic (Reynolds, 2018)
Aporrectodea longa (Ude, 1885)	***Allolobophora longa* (Michaelsen 1938)** *Nicodrilus longus longus* (Bouche 1972)	Endo-anecic	Anecic	Anecic (DriloBASE)
Lumbricus terrestris (Linnaeus, 1758)	*Allolobophora terrestris* (Paoletti et al. 2013) *Lumbricus agricola* (Hoffmeister 1842)	Epigeic	Anecic	Anecic (DriloBASE)
Hydrilus ghaniae (Qiu et Bouche 1998)	***Criodrilus ghaniae* (Qiu & Bouche 1998)**	na	na	Anecic (DriloBASE)
Bimastos rubidus (Eisen, 1874)	***Dendrobaena subrubicunda* (Michaelsen 1938)** *Helodrilus rubida* (Michaelsen 1900) *Dendrobaena rubida* (Pop 1949)	Epigeic	Epigeic	Epigeic (DriloBASE)
Dendrobaena pygmaea (Friend, 1923)	*Allolobophora minima* (Rosa 1884) *Dendrobaena pygmea pygmea* (Bouche 1972)	Epigeic	na	Epigeic (DriloBASE)
Octodrilus kabylianus (Omodeo and Martinucci, 1987)	/	Epi-endogeic	na	Epigeic (Reynolds, 2018)
Helodrilus oculatus (Hoffmeister, 1845)	*Allolobophora oculata oculata* (Bouche 1972) *Allolobophora oculatus* (Zicsi 1981)	Epi-endogeic	Endogeic	Epigeic (DriloBASE)
Haplotaxis gordioides (Hartmann, 1821)	*Lumbricus gordioides* (Hartmann 1821) *Phreoryctes gordioides* (Hartmann 1821)	na	Endogeic	Endogeic (Reynolds, 2018)
Octolasion lacteum (Orley, 1885)	*Allolobophora profuga* (Rosa 1884) *Octolasium lacteum* (Cernosvitov 1932)	na	Endogeic	Endogeic (DriloBASE)
Eisenia andrei (Bouche, 1972)	*Eisenia fetida andrei* (Bouche 1972)	na	Epigeic	Epigeic (DriloBASE)
Eiseniella neapolitana (Orley, 1885)	*Allurus neapolitanus* (Orley 1885) *Helodrilus rifensis* (Qiu and Bouche 1998)	na	na	Epigeic, Limicolous (Reynolds, 2018)
Dichogaster sp	/	na	na	Endogeic (Bouché, 1977)
Lumbricus rubellus (Hoffmeister, 1843)	*Allolobophora rubellus* (Smith 1894) *Lumbricus rubellus rubellus* (Bouche 1972) *Helodrilus relictus* (Reynolds and Cook 1976)	na	Epigeic	Epigeic, Epiendogeic (DriloBASE)
Octodrilus lissaensis (Michaelsen, 1891)	*Allolobophora lissaensis* (Michaelsen 1891) *Octolasion lissaensis* (Michaelsen 1891)	na	na	Endogeic (DriloBASE)
Microscolex algeriensis (Beddard, 1892)	/	na	na	Epi-endogeic, Limicolous (Rynolds, 2018)
Pontoscolex corethrurus (Muller, 1856)	*Lumbricus corethrurus* (Muller 1857) *Pontoscolex hawaiensis* (Beddard 1895)	na	na	Anecic, Limicolous (Reynolds, 2018)
Orodrilus doderoi (Cognetti de Martiis, 1904)	*Helodrilus doderoi* (Cognetti de Martiis 1904)	na	na	Epigeic, Epi-endogeic (Ouahrani, 2003)

Discussion

This study provides a comprehensive inventory of the earthworm species found in Algeria, specifying their occurrence, listing the habitats where they were sampled, and mapping the most abundant species in the region. The monitoring studies of earthworms in Algeria mainly focused on the Eastern and Central regions, while the Western region of the country remains largely unexplored, with the exception of Gagneur *et al.* (1986) at Tafna, and Sekhara (2008) who examined five stations: El Fouhoul, Sidi Senouci, Sidi Lahssene, Hamoul, and Oued Frouha. It is also worth underlining that most of the sampling were done in agricultural lands and near water-courses. Other habitats such as urban areas, especially gardens and public areas, have not been studied despite the important role of earthworms in urban habitats (Schmidt 2024).

The complete list of earthworm populations sampled in Algeria to date comprises 40 species. A recent list of earthworms from Algeria published by Reynolds in 2018 included 34 species. Therefore, six more species were recorded in our literature review: *Octodrilus lissaensis*, *Octodrilus transpadanus*, *Amynthas californica*, *Dendrobaena pygmea*, *Orodrilus doderoi*, and *Eisenia andrei* which is considered a distinct species from *Eisenia fetida* (Csuzdi *et al.* 2022). The species *Lumbricus friendi* was mentioned by Reynolds (2018) as being present in Algeria. However, none of the publications in the corpus recorded this species. The author based this information on DriloBase, which stated that the species was recorded in Algeria by Omodeo *et al.* (2003). In reality, after a careful reading of this article, the species was not recorded by this author.

According to our dataset, the most dominant species *A. rosea* was predominantly observed in arable lands where vegetable crops dominate as a habitat. This observation aligns with the study by Kherbouche *et al.* (2012) conducted in the Soummam region, who found this species to be more abundant in vegetable crop fields than in permanent crops. The second most abundant species found in Algeria, *A. caliginosa* was more frequently observed in orange groves. It is important to note that this species appears to be more dominant than *A. trapezoides,* which may be misleading result. Given the biogeography and bioclimatic conditions of Algeria, it is highly unlikely that *A. caliginosa* is a common species in the country, it is very likely that most records of *A. caliginosa* actually correspond to *A. trapezoides*, due to the failure to distinguish between the former subspecies *A. caliginosa caliginosa* and *A. caliginosa trapezoides*. In line with this observation, in our study *Aporrectodea monticola*, *Aporrectodea tetramammalis* and *Aporrectodea carochensis* were grouped under *A. trapezoides* both when calculating the percentage of occurrence and in the compiled list of earthworm species found in Algeria. As for taxonomic studies conducted in the country, these morphs have been reported by Bazri *et al.* (2013) from four sampling sites (Collo, Ainfekroune, Rouached, Boutelja).

Among the 40 species found in Algeria, 56% were common with France and described by Bouché (1972) in *"Lombriciens de France"*. The difference in earthworm diversity and species between France and Algeria could be due to the climatic conditions of both countries, like temperature, precipitation regime, soil moisture, drought and flood events, which can alter the composition and functioning of communities in the soil. Some earthworm species found in Algeria and relatively common in Europe are known to be relatively tolerant to drought and high temperatures. For example, Bohlen *et al.* (1995) experimentally experienced in Ohio, USA that *L. terrestris* and *Aporrectodea* spp. seemed to be relatively drought-tolerant. Moreover, Briones *et al.*(2009) reported that the earthworm community under a warmer scenario (+3.5°C) was significantly reduced, with only three species collected in the warmed systems *A. chlorotica*, *A. caliginosa* and *Aporrectodea longa*. Only the abundance of this latter species significantly increased in response to warming. It is worth noticing that two morphs of *A. chlorotica* exist, distinct by their pigmentation, the green and the pink one (Kalmus et al. 1955; Dupont et al. 2016). Field observations (e.g. Satchell 1967; Baker 1983) and laboratory-based studies (e.g. Lowe and Butt 2007) showed that soil moisture may be responsible for this speciation, the green morph being adapted to wet soils and the pink morph being found in drier soils. However, the authors generally not specified if they found the green or the pink morph of *A. chlorotica*.

Endogeic earthworms can survive drought periods by burrowing into the soils and entering aestivation (Opute & Maboeta 2022). This was observed by Díaz Cosín *et al.* (2006) for the Mediterranean species *Carpetania matritensis* (formerly *Hormogaster elisae*) in El Molar, Madrid and by McDaniel *et al.* (2013) for *A. caliginosa* in Colorado, USA. In Algeria, the climate ranges from semi-arid to arid depending on the regions, which may lead to communities that are more resistant to drought conditions. For instance, the species *Eisenia xylophila* and *Microscolex algeriensis* have only been found in North-Western Africa (Algeria and Tunisia), and have never been reported in Europe.

The same applies to *Octodrilus maghrebinus*, which is common in Algeria but never found elsewhere to date. It is reasonable to assume that these species are adapted to drought and relatively high temperatures, and do not occur in moister and colder areas.

However, the Mediterranean region is particularly affected by the current climatic disturbances, and the climate of Southern Europe will become more arid in the next decades (MedECC 2020). Similarly, in the following years, a decrease in annual precipitations is likely to occur in Maghreb, with estimates ranging from -4% to -22% depending on the region, the predictions foresee that heat waves will increasingly affect Mediterranean countries, particularly those in the Maghreb and the Middle East (IPCC 2023). Hamed *et al.* (2024) showed that with a temperature increase of 1.5°C in the world, Algeria, Tunisia, Morocco, and other countries in Africa are expected to experience a 25% reduction in precipitation leading to a drier climate. Consequently, earthworms and more generally soil organisms will have to adapt to these conditions. Understanding the species present in the Southern Mediterranean may provide useful information for the assessment of climate change on soil biodiversity in the next decades, and about the populations likely to persist in Southern Europe.

This study revealed a lack of data on earthworms in Algeria as only 24 studies were available for this exhaustive review of the literature. More than 40 species are most probably present in the country, but research have to be reinforced on the monitoring of soil biota and in particular earthworm communities in Africa. The scarcity of experts in the field represents a significant barrier to any study aimed at describing this biodiversity. The development of molecular tools such as DNA barcoding sequencing has the potential to overcome the barriers of traditional taxonomy and facilitate the acquisition of new data, which can then be used to describe the spatial distribution of species and communities quickly and comprehensively (Maggia *et al.* 2021; Cuartero *et al.* 2025). Unlike traditional taxonomic identification methods, this approach allows for the inclusion of morphologically unidentifiable specimens, such as juvenile earthworms or cocoons, as well as cryptic species (Maggia *et al.* 2021; Dupont *et al.* 2023). However, the cost of such method can be an obstacle to its use which can hinder earthworm monitoring in developing countries. Moreover, these methods do not allow to asses properly the abundance of the earthworms present in soils.

Conclusion

This study serves as a valuable tool for those interested in the occurrence of earthworm species, as well as the biology and ecology of these organisms in the Maghreb. It provides knowledge about their diversity and geographical distribution, and is of interest to anyone curious about earthworm communities in the Mediterranean region. This study reveals that Algeria is a territory of relatively high earthworm richness, but to date limited to 40 species due to the low number of studies and monitoring programs. We thus strongly encourage scientists to collaborate with taxonomists and earthworm specialists from other countries to acquire more data on these key soil organisms, because our knowledge on earthworm abundance and diversity in Algeria is for sure far from complete. Considering the important role of earthworms, it is essential to take them into account and intensify research in Algeria and generally in North Africa to complement studies across the entire Mediterranean area.

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