

ORIGINAL ARTICLE

## **New distribution record of *Hormogaster redii* (Rosa, 1887) and *Octodrilus maghrebinus* (Omodeo and Martinucci, 1987) in the south integral reserve of El-Kala National Park (Algeria)**

**M.E.H. El-Okki<sup>1,2\*</sup>, F. Khelfaoui<sup>3</sup>, L. Sahli<sup>2</sup>**

<sup>1</sup>Nutrition, Food and Agri-Food Institute, Mentouri Brothers Constantine 1 University, Constantine, Algeria

<sup>2</sup>Biology and Environment Laboratory, Mentouri Brothers Constantine 1 University, Constantine, Algeria

<sup>3</sup>Department of Natural and Life Sciences, Badji Mokhtar Annaba University, Annaba, Algeria

\*Corresponding author E-mail: elhade-elokki.mohamed@umc.edu.dz

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A recent survey of earthworms carried out in El-Kala National Park (North East Algeria) resulted in collecting two species *Hormogaster redii* and *Octodrilus maghrebinus* belonging to Hormogastridae and Lumbricidae families, respectively. This is the first record of these species from the Park in El-Ghorra Mountain near Algerian Tunisian border. Specific variations have not been observed.

**Keywords:** *Hormogaster redii*, *Octodrilus maghrebinus*, Oligochaeta, New record, El-Ghorra.

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### **Introduction**

According Omodeo and Rota (2008) and (Reynolds, 2018), the history of earthworms in Algeria can be found in the following articles: Michaelsen (1900), (1937), (Beddard, 1912), Cernovitov (1933), Bouché (1972), Martinucci and Omodeo (1987), (Omodeo and Martinucci, 1987). From 1997, Algerian researchers took an interest in this population in order to determine its biodiversity (Ababsa et al., 2017; Baha, 1997; Baha and Berra, 2001; Bazri et al., 2013; Bouazdia and Habes, 2017; El Hade El Okki et al., 2014; Zeriri et al., 2013). About 35 species belonging to 22 genera and 6 families have been described or recorded from Algeria (Reynolds, 2018). Among these species, 8 species are endemic: *Criodrilus ghaniae* (Qiu and Bouché, 1998), *Haplotaxis gordioides* (Hartmann, 1821), *Hormogaster redii* (Rosa, 1887), *Microscolex algeriensis* (Beddard, 1892), *Murchieona minuscula* (Rosa, 1906), *Octodrilus kabylianus*, *O. maghrebinus* (Omodeo and Martinucci, 1987) and *Proselodrilus doumandjii* (Baha and Berra, 2001). Lumbricidae is the most represented family with 27 species. Despite this, Algerian earthworm inventory is far from complete. More detailed investigations are needed because large areas in the country have not been explored yet for earthworms.

El-Kala National Park (EKNP), a portion of biodiversity hotspot in north-east Algeria (Fig. 1), has not been investigated for earthworm diversity. EKNP is created in 1983 and covering an area of 76,438 hectares (26% of the area of El-Tarf wilaya) (IUCN, 1990). It is made up of a mosaic of forests, lakes, dunes and marine ecosystems, giving it high biological and ecological values in the Mediterranean basin. It was classified as a biosphere reserve under the Man and Biosphere program by UNESCO in 1990. In Bougous district, the southern integral reserve of the park shelters the most beautiful pure zeen oak forest of North Africa in the El-

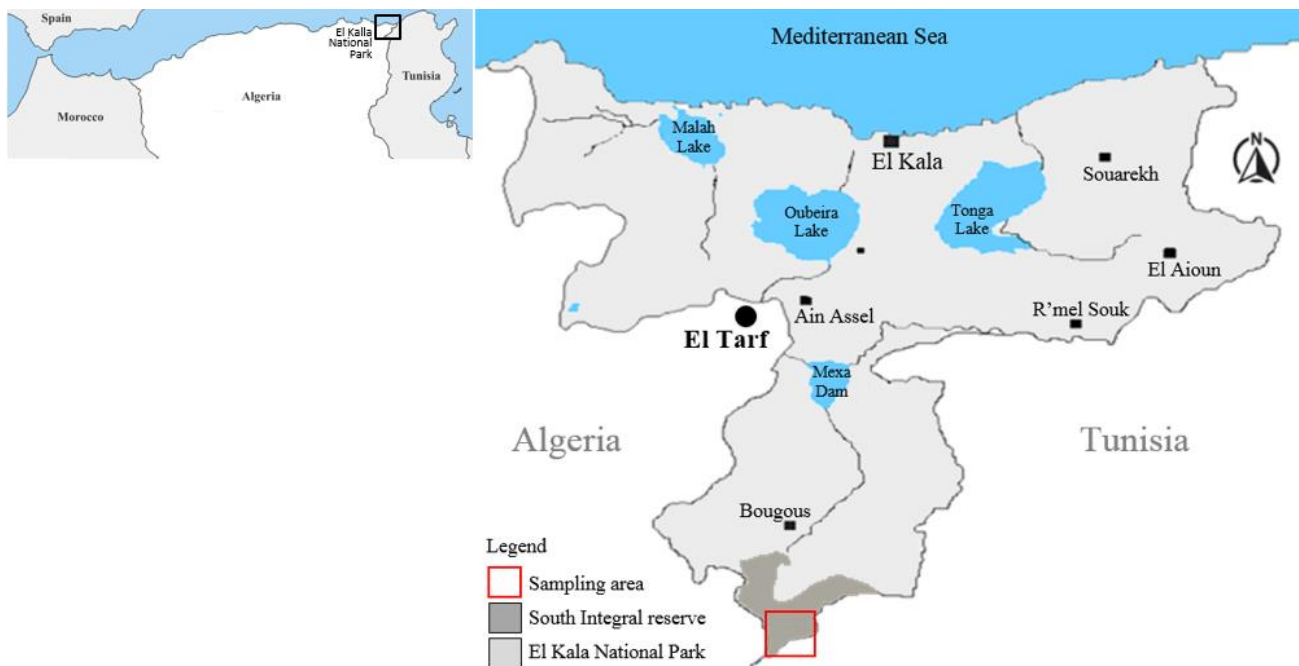
Ghorra Mountain, above 700 m asl. Below, we find mixed oak groves with Zeen oak stands confined to northern and humid exposures and cork groves on the driest substrates (Sarri et al., 2014).

In this study, we report new species records from El-Ghorra Mt at the Algerian-Tunisian borders. The recorded species were collected during an investigation conducted in the south integral reserve of El-Kala National Park (Northeastern of Algeria), during April 2021.

## Materials and Methods

### Study area

In its Algerian part, El-Ghorra Mountain is located in the southern edge of EKNP (Fig. 1) on the border between Algeria and Tunisia, between the wilaya of El-Tarf and the governorate of Jendouba, respectively. Culminating at 1,202 m asl, it is the highest peak in the park and belongs to the upper humid bioclimatic level. The annual rainfall often exceeds 1000 mm to sometimes reach 1200 mm with heavy fog and cloudiness and an average temperature of the coldest months between 3 and 4.5°C (Hoenisch et al., 1970). The area is marked by the presence of Numidian clays and sandstones (Sarri et al., 2014). Clays are spread in valley bottoms and plain edges, while sandstones, dating from upper Eocene, rest on the previous clays forming the main mass of El-Ghorra Mt hills and ridges. This sandstone and clay alternation favor the development of forests of cork oaks (*Quercus suber*) and olive (*Olea europaea*) groves up to 900 m asl which is replaced by by zeen oak (*Q. canariensis*) from 750 to 1000 m asl in pure or mixed stands. Therefore, El Ghorra forest is part of Oued Bougous forest which shelters 416 species, of which 11 are endemic, 24 protected by Algerian law (Yahi et al., 2012).



**Fig. 1.** Sampling area localization in south integral reserve of EKNP.

### Methods

The field investigation was done during April 2021 at the level of 4 sites form an altitudinal transect from low to high elevations. Earthworms were collected by digging and hand-sorting method. Digging was done to a depth of about 30 cm. Specimens were killed in 70% ethanol. The worms were washed in fresh water and conserved in 96% ethanol in labelled bottles. The earthworms were examined with the help of microscope. The external morphology of all adults was studied and 7 adults were dissected and studied under a microscope. Identification of species was done in accordance with Blakemore (2009) and Reynolds (2018).

The specimen examined for this study was deposited in private earthworm collection in Biology and Environment Laboratory of Mentouri Brothers Constantine 1 University.

## Results

The present investigation revealed the presence of two species: *Hormogaster redii* Rosa, 1887 and *Octodrilus maghrebinus* Omodeo and Martinucci, 1987 belonging the families of Hormogastridae and Lumbricidae, respectively. In total, 21 specimens were collected, including both adult and juvenile worms.

Family Hormogastridae Michaelsen, 1900

Genus *Hormogaster* Rosa, 1887

*Hormogaster redii* Rosa, 1887

*Hormogaster redii redii*: Rosa, 1887: 1

*Hormogaster redii* Michaelsen, 1903: 134

*Hormogaster redii* Omodeo and Rota 1987: 202

**Material examined:** Gh214003-4, two specimens, El-Ghorra Mt, site 3, from mixed cork zeen oak forest with underbrush, near a stream litter, 36°36'17"N, 8°22'14"E, 849 m asl.

**Ecology:** Endemic/Palaeartic, endogeic

**Remarks:** The two samples of this species are similar for most characteristics described by Rosa (1887). Large-sized (length: 9,7-14,4 mm, width: 6-9 mm, weight: 7.3-11.6 g), number of segments: 312-347, brown to dark brown, prostomium prolobic, dorsal pore absent, male pores in 15/16, female pores small in 14, spermathecae pores 9/10-11/12, clitellum occupies segments 14 to 27 (orangish-brown), Tubercula pubertatis 21 to 27, widely paired setae, Morren's glands absent, three strongly muscular gizzards in 6-8. Seminal vesicles two pairs in 11-12. Spermathecae two pairs in 9/10-10/11.

**Earlier Records:** Omodeo and Martinucci (1987) recorded this species from Algeria.

**Distribution:** Italy: Corsica, Roma, Sardinia, Sicily, Tuscany; Tunisia: Tunis, Zaghouan Mt; Algeria: Edough Mt, El-Ghorra Mt (Newly recorded distribution).

Family Lumbricidae Rafinesque-Schmaltz, 1815

Genus *Octodrilus* Omodeo, 1956

*Octodrilus maghrebinus* Omodeo and Martinucci, 1987

*Octodrilus maghrebinus* Omodeo and Martinucci, 1987: 243.

**Material examined:** Gh214007-11, five specimens, El-Ghorra Mt, site 1, from a cleared holm-oak wood, 36°36'50"N, 8°21'51"E, 667 m asl; Gh214016-18, three specimens, El-Ghorra Mt, site 4, between cork trees and wasteland, 36°36'37"N, 8°22'7"E, 721 m asl; Gh214023, one specimen, El-Ghorra Mt, site 4, pure cork oak forest, 36°36'23"N, 8°22'5"E, 773 m asl.

**Ecology:** Endemic, epigeic

**Remarks:** The four samples of this species are similar in size, segment number, pigmentation, segment number of clitellum to the specimens described by Omodeo and Martinucci (1987). Small-size (length: 42-61 mm, width: 3-4 mm, weight: 485-668 mg), number of segments: 98-136, reddish skin pigmentation, prostomium ½ open epilobic, first dorsal pores in 21/22, male pores in 15, female pores small in 14, spermathecae pores 6/7-10/11, clitellum and tubercles respectively extend on segments 29-37 and 30-34, Morren's glands in 10-14 with diverticula in 10, crop in 15-16, gizzard in 17-18, seminal vesicles four pairs in 9-12, spermathecae five pairs in 6-12.

**Earlier Records:** Omodeo and Martinucci (1987) recorded this species from Algeria.

**Distribution:** Algeria: Greate and Little Kabylie, Collo, Edough Mt, El-Ghorra Mt (Newly recorded distribution).

## Discussion and Conclusion

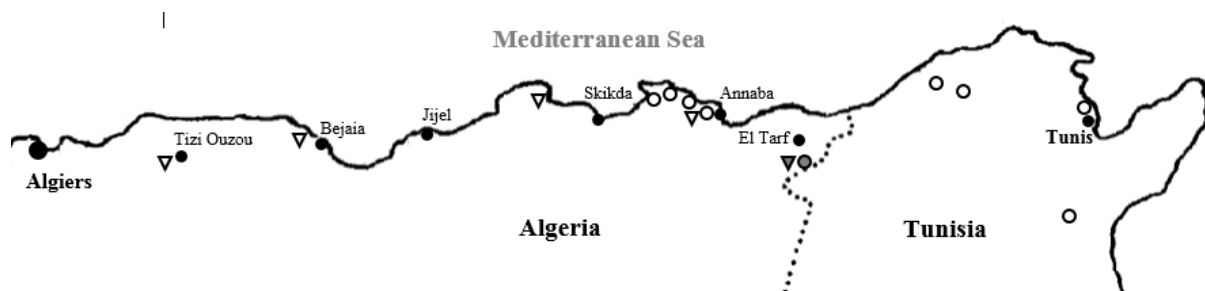
In the present study, a total of 2 species, *H. redii* and *O. maghrebinus*, have been collected from new locality of El-Ghorra Mt (wilaya of El Tarf). They are newly-recorded for the EKNP fauna which contribute to earthworm biodiversity of this park. These species which was recorded only once in 1987 by Omodeo and Martinucci just from a few localities in the center and East of Algeria.

The genera *Hormogaster* and *Octodrilus* are part of this fauna described by these authors. The first is represented by a single species *H. redii* Rosa, 1887 while the second is represented by 4 species: *O. complanatus* (Dugès, 1828), *O. kabylanus* (Omodeo and Martinucci, 1987), *O. maghrebinus* (Omodeo and Martinucci, 1987) and *O. triginta* (Omodeo and Martinucci, 1987). *O. complanatus* is a belong to an Alpine-Balkan species, while the three others are endemic species. The group of endemic species, from central and eastern Algeria, which inhabits the decaying logs of cork oak; these species have their nearest relatives in the Balkan Peninsula (Omodeo and Rota, 2008).

For *H. redii*, the species being recorded for the first time from the forest ecosystem of Edough Mt in extreme northern Algeria (Omodeo and Martinucci, 1987) but this study reveals that these species can be also found in interior regions. Its geographical range includes Italy, Algeria and Tunisia (Cobolli Sbordoni et al., 1992; Marchán et al., 2018; Omodeo and Martinucci, 1987; Omodeo and Rota, 2008; Omodeo et al., 2003). *H. redii* is typically Tyrrhenian in its distribution with transgression towards central Italy and Sicily (Holdhaus, 1924). According Omodeo et al. (2003), the origin of this species is from Italy and which outmigrated eastwards to populate the western side of the Italian peninsula and Sicily and southwards from Sardinia to populate northern Tunisia and northeastern Algeria. So, the Algerian population species is perhaps arrived from Tunisia (where it is found in abundance on Zaghuan Mt) or directly from Sardinia. It came to Maghreb from Sardinia during the 5.96-5.33 Mya salinity crisis, possibly with modern type species such as *Allolobophoridella eiseni*, *Murchieona minuscula* and *Proctodrilus antipai* (Omodeo and Rota, 2008). Thereby, its presence in Algeria and Tunisia reveals the existence of a relationship between Corsica-Sardinia-Sicily-Italy and North Africa (Omodeo et al., 2003). The investigation reveals the distribution of this species, ranging from an altitude of 650 to 850 m asl in El-Ghorra Mt. It has also been observed that this species is found to be distributed in the equal altitudinal zone in both of the Northeastern Algerian biodiversity hotspots. Furthermore, the most remarkable aspect of the *Hormogaster* physiology is their tolerance of prolonged periods of drought thanks to a long diapause. *H. redii* combines this aptitude with an exceptionally wide ecological valence: it can inhabit sclerophyll woods, overgrazed pastures, stony lands, coarse granite sand, and even sandy beaches above the shoreline (Omodeo and Rota, 2008). It seems that this species prefers relatively cool places with a pH close to 6.2 (Bouché, 1972).

For *O. maghrebinus*, it she belongs to *Octodrilus* genus described by Michaelsen (1901). This genus is a typical Central Europeanan-Balkan (Palearctic) genus (Misirlioğlu and Reynolds, 2019) with only three species reported in Algeria, two of which are endemic species to Northern Algeria: *O. maghrebinus* and *O. kabylanus* (Omodeo and Martinucci, 1987). The first data of *O. maghrebinus* were published by Omodeo and Martinucci (1987). The species was recorded in oak forest from Kabylie region (wilaya of Bejaia and Tizi Ouezou), Collo (Wilaya of Skikda) and Edough Mt (Wilaya of Annaba) (Bazri et al., 2013; Omodeo and Martinucci, 1987). With oriental affinities, they have their closest relatives in the Balkan Peninsula. This new record represents the southernmost occurrence of this species in Algeria (Fig. 2) and suggests that the species possess a wider range than it was previously thought. It is possible to find this species even in Tunisia (in the Tunisian side of El-Ghorra Mt).

For the 2 species, no appreciable variations observed in studied species from the earlier observations. These new regional records make it possible to outline ecological and biogeographical traits. These species have probably narrow habitats preferences: *H. redii* and *O. maghrebinus* is only found in zeen oak and cork oak forests, respectively.



**Fig. 2.** Geographic distribution of *H. redii* (▽) and *O. maghrebinus* (○) in Algeria and Tunisia (with new records ▽ and ● respectively).

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