

The Morphological Identification of Earthworms in Baghdad Governate.

Sura Kamal^{1,*}; Nebrass Chachain¹; Majeed Sabbah²

¹Mustansiriyah University/Collage of Science/Biology Department/Baghdad/Iraq; science @uomustansiriyah.edu.iq

²Alnahrain University/ Forensic DNA for research and training center; FDNA-center@nahrainuniv.edu.iq

*Correspondence: szsk@uomustansiriyah.edu.iq

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ABSTRACT

This sporadic survey mainly focused on parts of north, central, and south Baghdad. Earthworms were collected from damp habitats in orchards and agricultural fields using hand-sorting and digging methods from January 2021 to December 2021 in the three regions (Rashdeyah, Jadriyah and Zafaraniyah). Identification and description were done based on several external morphological structures.

Keywords: Earthworms; Morphology; Lumricidae; Megascolecidae; Baghdad governate; Iraq.

INTRODUCTION

Earthworms with over 6500 described species worldwide are the most common members of the order Oligochetea, class Clitellata under the phylum Annelida, a group of segmented worms distinguished by the presence of small setae in all body segments, except the first and last segments ^{1,2}.

The morphological identification of adult earthworms is principally based on the type of prostomium, arrangement of the setae, genital tumescence, position and form of the clitellum, tubercle pubertal, and male pores. So, these characteristics are important for identification down to species level ^{3,4}.

In general, the morphological study of earthworms in Iraq was neglected until the last few years, when interest in studying this group grew, and only a few studies on Iraqi earthworms have been conducted. At the first identification study on earthworms of Iraq that was carried out by Al-Khafaji ⁵, five species were recorded in a survey mainly focused on four sites in Baghdad. Another work on earthworms from three locations in south Baghdad identified the species *Aporrectodea rosea* ³. Then, a recent study on earthworms in Iraq included four provinces in the Kurdistan region and identified six species that belong to three genera of two families ⁶.

The present study aimed to identify and record species of earthworm in Baghdad, for which a confident knowledge on species occurrence will be available and gap-filling information that could lead to publishing a key for the East Mediterranean earthworms.

MATERIALS AND METHODS

Samples were collected during an entire year from January 2021 to December 2021 from three different locations (Rashdeyah, Jadriyah and Zafaraniyah) in Baghdad governate Figure 1,

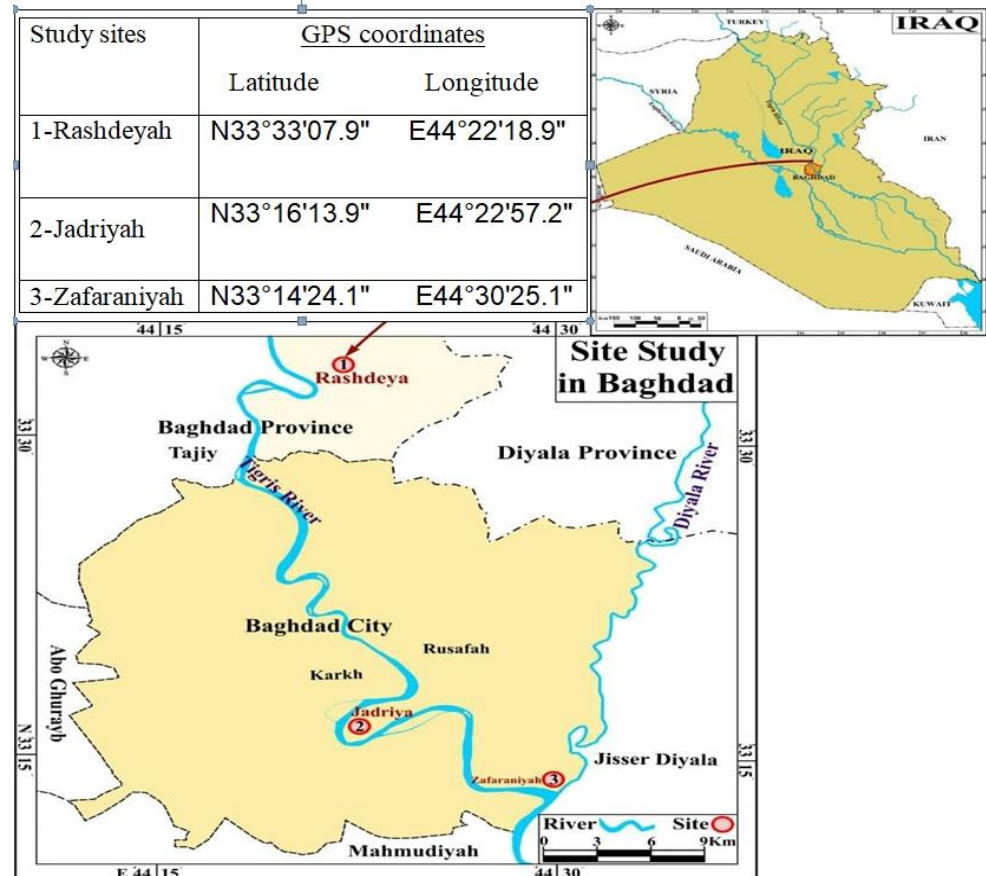


Figure 1. Maps of Iraq and Baghdad showing the sampling sites. Maps scale 1/1000. Source: Ministry of Water Resources/General Authority of Survey/2021

Pits of soil (40× 40 and 40 cm depth) were dug using a spade from five replicates from each location every month. The adult worms were collected by forceps from different sites in each location. Adult earthworms were placed in glass jars containing the soil of the exact site where the earthworms were found and returned to the laboratory for morphological identification^{7,8}. In the laboratory, earthworms were placed in bigger plastic jars with leaf litter and manure for feeding the worms, and the humidity was maintained between 70% and 80% by spraying water on the jars daily. Each jar was covered with a piece of pored cloth to avoid escaping worms^{9,10}. The worms were washed with water to remove mud and were anesthetized in diluted ethanol 10% and then 30% for 10 min and examined under the dissecting microscope objective oriented lens 40X.

Morphological identification of earthworm species depends on the external features for this purpose; numerous available identification keys were used¹¹⁻¹⁷. Earthworm identifications were confirmed by Prof.Dr.Nebrass Faleh Biology Department /College of Science/Al-Mustansiriyah University.

The external features for the identification of earthworms included body color, body length and weight, number of segments, the shape of prostomium, setae arrangement, shape and segments of clitellum, location and shape of tubercula

pubertatis (TP), location of male pores, Glandular tumescences (GT) and Spermathecal pores.

Specimens selected for photography were dried on filter papers and left for some time until they were completely dried.

Photographs for lived and fixed specimens were done by the Sony A7rii camera (18 Megapixels, Focus stacking technique using the Zerene stacker program).

RESULTS

In the present study, five species of earthworms belonging to two genera were identified from the north, middle and south of Baghdad governate; three species belonged to the family Lumbricidae *Aporrectodea rosea* (Savigny, 1826), *Ap. Trapezoides*²⁴ and *Ap. Tuberculata* (Eisen, 1874). Two species *Amyntas grasilis* (Kinberg, 1867) and *Amyntas corticis* (Kingberg, 1867), belonged to the family Megascolecidae.

List of species

Aporrectodea rosea (Savigny 1826).

For complete synonymy, see Csuzdi and Zicsi 2003:92

Material examined: Jadriyah gardens N33°16'13.9"; E44°22'57.2" Zafaraniyah orchids N33°14'24.1" E44°30'25.1" Rashdeyah N33°33'07.9"; E44°22'18.9"

Diagnosis: The color is usually pale pink or sometimes reddish in the anterior and posterior parts. The body length is 2.5-10.8 cm, the number of segments 100-155, and the weight is 0.192-0.5g. Clitellum is saddle-shaped, occupies seven segments extended from xxvi-xxxi (26-31), and may be orange or pale yellow. Prostomium epilobous. Setae is closely paired. The first dorsal pore is between 4/5-5/6, but two pairs of spermathecae pores are present in furrows 9/10/11. Tubercles pubertatis usually on segments xxix-xxxi (29-31). Male pore on segment xv (15).



Figure 2. *Aporrectodea rosea* adult live worm

Aporrectodea trapezoides

*Aporrectodea trapezoides*²⁴.

For a complete synonym, see Csuzdi and Zicsi 2003:75

Material examined: Jadriyah gardens N33°16'13.9"; E44°22'57.2", Zafaraniyah orchids N33°14'24.1" ;E44°30'25.1".

Diagnosis: The color variable is mostly brown, sometimes greenish, unpigmented pale pink anteriorly to grey posteriorly, and some individuals are dark reddish brown. The body length is between 8-12 cm, segment number 100-226. Weight 0.8-1.3g, prostomium epilobous. First dorsal pore in the furrow 5/6-9/10. Male pore on the segment xv(15). Clitellum saddle-shape occupies six segments xxix-xxxii (27-32), with Tubercula pubertatis on segments xxxi-xxxiii(31-33) as a pad-shaped organ. Setae is closely paired.



Figure 3. *Aporrectodea trapezoides* adult live worm.

Aporrectodea tuberculata (Eisen, 1874)

Allolobophora turgida f. *tuberculata* Eisen, 1874

Material examined: Rashdeyah gardens and orchids N33°33'07.9"; E44°22'18.9",
Jadriyah gardens N33°16'13.9"; E44°22'57.2", Zafaraniyah orchids N33°14'24.1";
E44°30'25.1".

Diagnosis: Body length 4.5-12cm, weight: 0.2-1.4 g, number of segments 100-180,
prostomium epilobous, color gray or light pigmentation, first dorsal pore: 5/6-
9/10, GT (9) 10-12, setae closely paired, clitellum 25, 26(29)-34-35 saddle-shaped,
Tp 31-33 look like pyramids.



Figure 4. *Aporrectodea tuberculata* live worm

Amyntas gracilis (Kinberg, 1867).

Nitocris gracilis Kinberg, 1866

Perichaeta hawayana Rosa, 1891

Pheretima hawayana (Rosa, 1891)

Material examined: Rashedeyah in agriculture areas N33°33'07.9" ; E44°22'18.9".

Diagnosis: The color of the body is brown, body length between 8-10.7cm with 72-98 body segments, weight 0.9 g, prostomium epilobous. Setae are closely paired (more crowded ventrally and large at the anterior segments). Band shape clitellum covers three segments from xiv-xvi (14-16). Male pore on segment xviii(18) rather than deep in a pocket within the body. Spermathecal pores have three pairs in VI-VIII (6-8), first dorsal pore 10/11.



Figure 5. *Amynthus gracilis* whole adult live worm

Amynthus corticis (Kingberg, 1866)

Perichaeta corticis Kinberg, 1867.

Pheretima diffringens (Baird, 1869)

Amynthus corticis - Sims & Easton 1972. Easton 1981.

Amynthus diffringens - Sims & Easton 1972. Reynolds 1978; 2010;2011.

Reynolds & Wetzel 2004; 2008.

Material examined: Rashdeyah in agriculture areas N33°33'07.9" ; E 44°22'18.9", Jadriyah in Baghdad University/Biology plant garden N33°16'14.2" E44°22'43.4".

Diagnosis: The color of live specimens is greenish brown. Length 4.5–17 cm, no. of segment 79–121, Weight 0.011-0.3 g, prostomium epilobic open, Setae arrangement is perichaetine, Clitellum annular XIV-XVI (14-16), Male pores paired in XVIII (18), simple on circular to oval porophores, Post-clitellar genital markings present or absent, when present, 1–3, small, around each male porophore, confined within concentric circular folds, Spermathecal pores four pairs in 5/6/7/8/9 or in VI–IX(6-9).

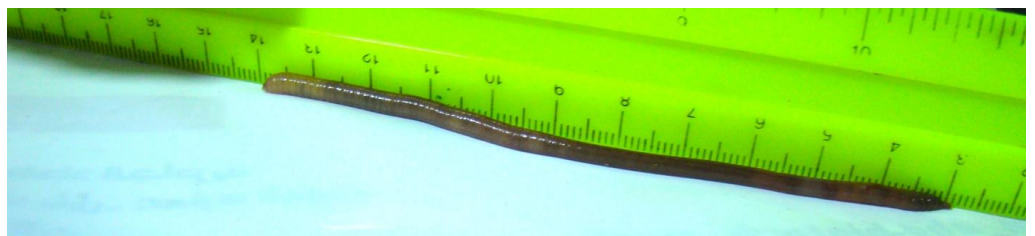


Figure 6. *Amynthus corticis* color photograph of live worm

DISCUSSION

Aporrectodea rosea, *Aporrectodea trapezoids*, *Aporrectodea tuberculata*, *Amynthus gracilis* and *Amynthus corticis* were collected from north middle south Baghdad governate. *Ap.tuberculata* and *Amynthus corticis* are categorized as

introduced species, while *Ap. rosea* and *Ap. trapezoides* are known and found in Iraq³⁻⁵.

Native species exhibit environmental variability tolerance, opportunism in food selection, and ecological plasticity. As a result, agricultural and industrial activities diffuse them widely¹⁸.

Most of the species collected return to the Lumbricidae family, which is widely introduced by human influences all over the world, and two *Amyntas* species of Megascolecidae family may have been brought to tropical areas with plants and other imported horticultural and agricultural materials^{15,19}.

Aporrectodea rosea was collected from Jadriyah gardens in the middle of Baghdad near plants belonging to the Family Oleaceae and Moraceae, while in Zafaraniyah, south of Baghdad, it was collected near an orchard of *Pyrus calleryana* that returns to the Rosaceae family and also was found in another cultivated area with *Ocimum basilicum* which belongs to family Lamiaceae.

Ap. rosea is a widely distributed species that can be found in every type of soil in the temperate and Mediterranean areas under bushes, grassland, gardens and forests and is more abundant in moist soils and in waterways^{15,20}. Additional investigations found this species near plant roots of the family Fabaceae²¹. Others reported woody areas as habitats of this species²².

Since most *Aporrectodea* species are endogeic when they live and feed in the mineral soil, they are thought to have various effects on long-term C storage through both improving soil respiration and producing stable micro aggregates²³. While *Aporrectodea trapezoides* inhabit different ecological groups by living in ventral burrows (anecic)¹¹. This was also observed in the study¹⁹. Othman and Ahmed⁴ found that juveniles of this species live in horizontal burrows under litter or compost and make small casts, while adults live in deep burrows in gardens or cultivated land and can produce large casts. Fernández et al.²⁴ concluded that it could be an intermediate epianecic ecological group because of having some similar features as epigeic species.

This species is present in many countries, including Iraq and its neighboring countries like Iran and Turkey^{4,5}.

Amyntas gracilis is found in tropical and subtropical areas such as Iraq and Turkey among croplands and agriculture areas⁵.

Amyntas corticis was only observed in polhumic (plant-growth regulator) soils.

Amyntas species are thought to have originated in eastern and southeastern Asia, and they are now found in large parts of the tropical and temperate zones¹⁸.

Amyntas species are epi-endogeic, so they are more food selective; their local presence is highly correlated with ecological factors, and the influence of environmental factors, particularly physical and chemical properties of soil, on these earthworms' local assemblage and diversity is visible, particularly in epigeic species²⁵.

So, the presented data provides information on identified earthworms of these three regions of Baghdad governate to obtain better knowledge of the Iraqi earthworms.

CONCLUSIONS

During the course of the study, five earthworm species were identified, including *Aporrectodea rosea*, *Aporrectodea trapezoides*, *Aporrectodea tuberculata*, *Amyntas corticis* and *Amyntas gracilis*. *Aporrectodea rosea* and *Aporrectodea trapezoides* were the dominant species in these regions while

the two species *Amyntas corticis* and *Aporrectodea tuberculata* were a new record for Iraq.

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