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Earthworms of the Central Elburz Mountains, Iran

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In this study species richness of earthworms in the Central Elburz Mountains is reported for the first time based on samples collected from 33 localities along the Haraz and Chalus rivers. Twelve species were identified representing seven genera from family Lumbricidae (Rafinesque-Schmaltz 1815): *Aporrectodea caliginosa* (Savigny 1826), *A. rosea* (Savigny 1826), *A. jassyensis* (Michaelsen 1891), *Dendrobaena byblica* complex (Rosa 1893), *D. octaedra* (Savigny 1826), *D. hortensis* (Michaelsen 1890), *D. veneta* (Rosa 1886), *Dendrodrilus rubidus* (Savigny 1826), *Eisenia fetida* (Savigny 1826), *Eiseniella tetraedra* (Savigny 1826), *Octolasion lacteum* (Orley 1881), *Perelia kaznakovi* (Michaelsen 1910). All the reported species were common, with *Eiseniella tetraedra* being dominant in both areas

Key words: Earthworm, Lumbricidae, Iran, Central Elburz Mountains

INTRODUCTION

Earthworms are major soil invertebrates in terms of both biomass and activity, and one of the most important soil-inhabiting animal groups. Several species may be considered to be ecosystem engineers (Darwin, 1881). They strongly affect both the structure and the chemical properties of the soil (Zicsi, 1975) and so play a central role in maintaining soil quality and fertility. The first authoritative account of the earthworm's role in soil formation, quality, and fertility dates to Charles Darwin well over 100 years ago (Edwards, 1994). Despite this, the biology, taxonomy, and ecology of earthworms in Iran are little understood. Research on earthworms in Iran has focused on taxonomy (Omrani, 1973), composting (Alidadi and Parvaresh 2005; Omrani et al., 2005), and ecotoxicology (Shahmansouri et al., 2005). In the present study, the taxonomy and geographical distribution of earthworms from Central Elburz Mountains are described.

MATERIAL AND METHODS

Specimens were collected from the Haraz and Chalus basins in the Central Elburz Mountains. The climate of the region is arid to humid. Specimens were collected from 33 locations (FIG.1), including along rivers, forests, under stones and other wet soil during 2007 and 2008. Methods used were sifting through soil samples by hand to collect worms, and application of 0.6% formalin solution (25 ml of 40% formalin in 4.6 liters of water) to 0.4 m² of soil (Edwards & Bohlen, 1997). Earthworms were transferred to the laboratory and washed to remove soil. The adult specimens were anaesthetized in 15% and 75% ethanol. Samples were placed in 4% formalin and after several days preserved in 70% ethanol and examined by stereomicroscope. Identification of adult earthworms was mainly based on the position and shape of the clitellum, setae, and internal organs such as nephridial bladders and spermathecae, according to Csuzdi & Zicsi (2003). Verification of provisional identification was provided by Dr. Csuzdi, Natural History Museum, Hungary.

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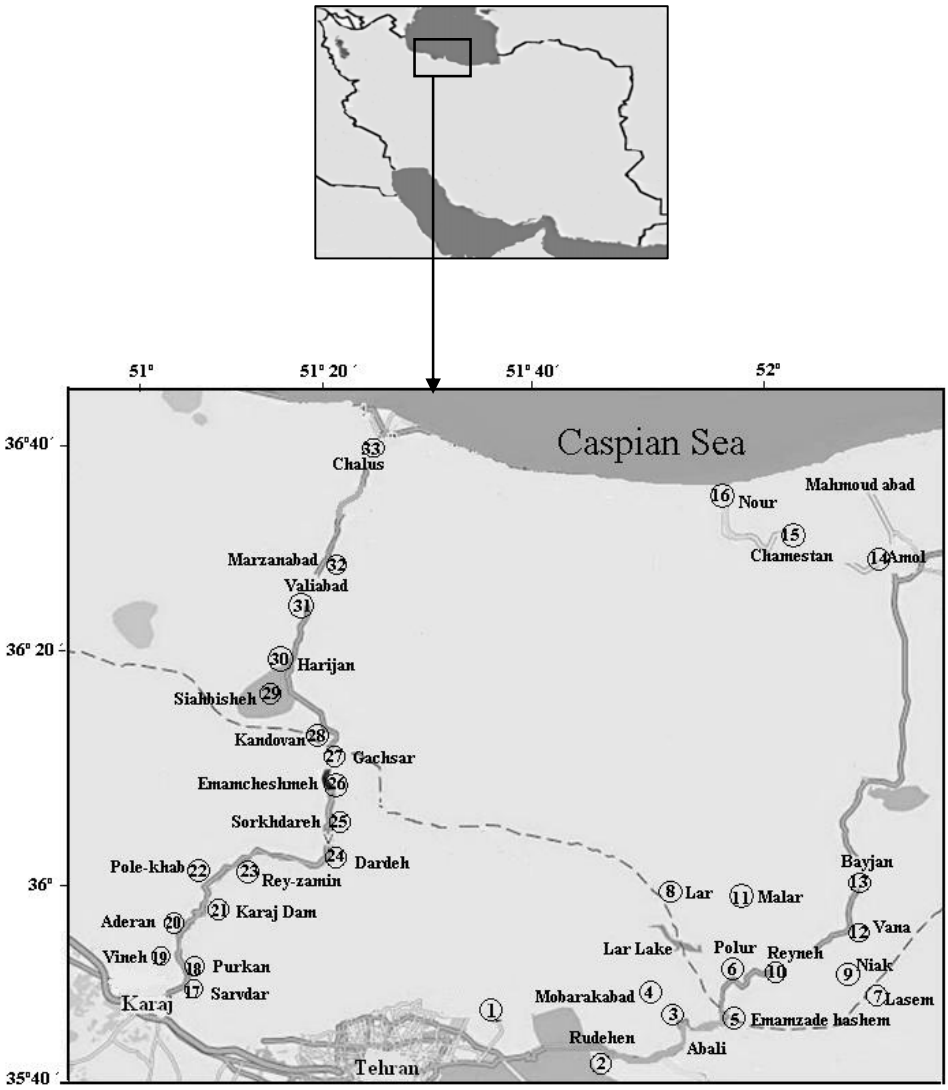

FIGURE 1.- Sampling sites of earthworms in the Central Elburz Mountains.

RESULTS

Twelve lumbricid species belonging to seven genera were identified: *Aporrectodea caliginosa*, *A. rosea, A. jassyensis, Dendrobaena byblica* complex, *D. octaedra, D. hortensis, D. veneta, Dendrodrilus rubidus, Eisenia fetida, Eiseniella tetraedra,* and *Octolasion lacteum, Perelia kaznakovi.* Species richness was not equally distributed among the genera. The four species of *Dendrobaena* were the most for any genus.

Systematics

Family: Lumbricidae (Rafinesque-Schmaltz 1815)

Genus: *Aporrectodea* (Orley 1885)

***Aporrectodea caliginosa* (Savigny 1826)** (FIG.2A,B)

Enterion caliginosum Savigny 1826: 180.

Allolobophora (*Allolobophora*) Rosa 1893: 7.

Allolobophora caliginosa f. *trapezoides* Omodeo 1956: 335.
Allolobophora caliginosa trapezoides Zicsi 1985:330.
Allolobophora caliginosa Pavlicek et al. 1997: 2
Aporrectodea caliginosa Csuzdi & Zicsi 2003: 75 (for complete synonym).

Material examined: 2 ex. ZUTC Ann.1086. Abali: 9.6.2007; 3 ex. ZUTC Ann.1088. Lar: 11.5.2007; 1 ex. ZUTC Ann.1090. Abali: 14.4.2008; 1 ex. ZUTC Ann.1096. Rudehen: 9.6.2007; 2 ex. ZUTC Ann.1106. Latyan Dam: 9.6.2007; 2 ex. ZUTC Ann.1048. Vineh: 8.7.2007; 1 ex. ZUTC Ann. 1054. Gachsar: 8.7.2007; 2 ex. ZUTC Ann.1060. Marzanabad: 10.6.2007.

Distribution: Native in Palearctic.

Distribution in Central Elburz Mountains: Abali (N 35º 45'; E 51º 58'), Lar (N 35º 51'; E 52º 03') Rudehen (N 35º 43'; E 51º 40'), Latyan Dam (N 35º 48'; E 51º 42), Vineh (N 35º 53'; E 51º 02'), Gachsar (N 36º 07'; E 51º 19') and Marzanabad (N 36º 30'; E 51º 19').

Remarks: Clitellum extends on segments 25, 26, (29)-34, 35 saddle-shaped, tubercles on 31-33, length 60-130 mm, diameter 2-3 mm, 100-160 segments, setae closely paired. Male pores on 15 and head epilobous (FIG.2A).

***Aporrectodea jassyensis* (Michaelsen 1891)** (FIG.2C,D)
Allolobophora jassyensis Michaelsen 1891: 15
Allolobophora jassyensis orientalis Michaelsen 1891: 69
Allolobophora (Allolobophora) jassyensis Rosa 1893: 8.
Allolobophora jassyensis forma *orientalis* Omodeo 1956: 333.
Aporrectodea jassyensis Csuzdi & Zicsi 2003: 87 (for complete synonym list).

Material Examined: 2 ex. ZUTC Ann.1111. Amol: 29.7.2007; 1 ex. ZUTC Ann.1112. Chamestan: 29.7.2007; 2 ex. ZUTC Ann.1062. Chalus: 21.4.2007.

Distribution: Native in the Palearctic and widely distributed in Central Europe, Italy, the Balkan, East Mediterranean, Central Asia, Afghanistan, Iran, and North Africa.

Distribution in Central Elburz Mountains: Amol (N 36º 12'; E 52º 22'), Chamestan (N 36º 34'; E 51º 47'), Chalus (N 36º 38'; E 51º 24').

Remarks: Clitellum extends on segments 28, 29-30 saddle-shaped, tubercles on 1/n31, 32-34, body length 60-90 mm, diameter 2-4 mm, 100-120 segments. Pale, pigmentation lacking, head epilobous, Setae closely paired. Male pores on 15 with obvious seminal grooves (FIG.2D). Behind the clitellum, there is a section with obvious grooves (Fig 2C).

***Aporrectodea rosea* (Savigny 1826)** (FIG.2E,F)
Enterion roseum Savigny 1826: 182.
Allolobophora (Notogama) rosea Rosa 1893: 2.
Allolobophora rosea Omodeo 1956: 334.
Aporrectodea rosea Csuzdi & Zicsi 2003: 92 (for complete synonym list).

Material Examined: 2 ex. ZUTC Ann.1089. Emamzadeh Hashem: 14.4.2008; 2 ex. ZUTC Ann.1099. Niak: 15.5.2007; 2 ex. ZUTC Ann.1098. Mobarakabad: 11.5.2008; 2 ex. ZUTC Ann.1046. Siahbisheh: 8.7.2007.

Distribution: Native in the Palearctic but widely introduced extratropically by humans.

Distribution in Central Elburz Mountains: Niak (N 35º 52'; E 52º 12'), Mobarakabad (N 35º 48'; E 52º 01), Emamzadeh Hashem (N 35º 47'; E 52º 2'), Siahbisheh (N 36º 12'; E 51º 19').

Remarks: Clitellum extends on segments (23), 24, 25, (26)-32, 33 saddle-shaped, tubercles usually on 29-31 sometimes on 29-30, 1/2 31, body length 20-110 mm, diameter 2-4 mm, 100 -150 segments. Usually pale sometimes reddish, head epilobous, with dorsal pores surrounded by a dark pigmented zone (FIG.2F).

Genus: *Dendrobaena* (Eisen 1874)

***Dendrobaena byblica* (Rosa 1893)** (FIG.2G,H,I)

Allolobophora (Dendrobaena) byblica Rosa 1893:4
Dendrobaena ganglbaueri var. *byblica* Cernosvitov 1940: 446.
Dendrobaena ganglbaueri var. *byblica* Cernosvitov 1942: 225
Dendrobaena byblica Zicsi 1985: 328.
Dendrobaena byblica Csuzdi & Pavlicek 1999: 474
Dendrobaena byblica Csuzdi & Pavlicek 2002: 110

Material Examined: 2 ex. ZUTC Ann.1045. Nour: 8.10.2008; 2 ex. ZUTC Ann.1046. Nour: 8.10.2008; 2 ex. ZUTC Ann.1113. Amol: 8.10.2008; 1 ex. ZUTC Ann.1052. Gachsar: 2.9.2007; 1 ex. ZUTC Ann.1065. Chalus: 21.4.2007; 2 ex. ZUTC Ann.1069. Karaj Dam: 8.7.2007.

Distribution: Holo-mediterranean, but according to Zicsi (1982) *D. byblica* may be a species complex.

Distribution in Central Elburz Mountains: Nour (N 36º 35'; E 52º 03'), Amol (N 36º 12'; E 52º 22'), Chalus (N 36º 38'; E 51º 24'), Gachsar (N 36º 07'; E 51º 19'), Karaj Dam (N 36º 00; E 51º 06').

Remarks: Clitellum extends on segments (23), 24-29 saddle-shaped, tubercles on 25-27, length 22-42 mm, diameter 4 mm, segments 57-103, red-violet, head epilobous or in some species head tanylobic, *D. byblica* is widely distributed in the Mediterranean basin and is a heterogenous complex species (FIG.2G).

***Dendrobaena hortensis* (Michaelsen 1890)** (FIG.2J,K)

Allolobophora subricunda var. *hortensis* Michaelsen 1890: 15.
Eisenis veneta var. *hortensis* Michaelsen 1900: 447.
Dendrobaena hortensis Zicsi 1982: 430 (for complete synonym list)

Material Examined: 2 ex. ZUTC Ann.1087. Amol: 29.7.2007; 2 ex. ZUTC Ann.1068. Vineh: 8.7.2007.

Distribution: Origin unknown, in central and western Europe It has extensively been introduced all over Europe in connection with vermicomposting industry.

Distribution in Central Elburz Mountains: Amol (N 36º 12'; E 52º 22'), Vineh (N 35º 53'; E 51º 02').

Remarks: Clitellum extends on segments 27-33 saddle-shaped, tubercles on 30-1/2 32, body length 10–35 mm, diameter 2–3 mm, 50–100 segments, Color reddish and head epilobous, setae moderately paired, nephridial bladders are sausage-shaped; spermatheca two pairs in 9/10, 10/11 (FIG.2K).

***Dendrobaena veneta* (Rosa 1886)** (FIG.2L,M)
Allolobophora veneta Rosa 1886:674.
Allolobophora (Notogama) veneta Rosa 1893: 2
Dendrobaena veneta Zicsi 1985: 328.
Dendrobaena veneta veneta Csuzdi & Pavlicek 1999: 478
Dendrobaena veneta veneta Csuzdi & Zicsi 2003:127 (for complete synonym list)

Material Examined: 2 ex. ZUTC Ann.1082. Mobarakabad: 9.6.2007; 1 ex. ZUTC Ann.1107. Lar: 9.6.2007; 2 ex. ZUTC Ann.1045. Vineh: 8.7.2007.
Distribution: *D. veneta* has been extensively introduced throughout Europe, and is probably of Caucasian origin.
Distribution in Central Elburz Mountains: Mobarakabad (N 35º 48'; E 52º 01'), Lar (N 35º 51'; E 52º 03'), Vineh (N 35º 53'; E 51º 02').
Remarks: Clitellum extends on segments 26, 27, (28)-32, 33 saddle-shaped, tubercles on 30-31, length 30–110 mm, diameter 4–8 mm, 50–150 segments. Striped red-violet dorsally (FIG.2L) and paler ventrally. Head epilobous**,** *D. veneta* has high morphological variability.

***Dendrobaena octaedra* (Savigny 1826)** (FIG.2N,O)
Enterion octaedrum Savigny 1826:183.
Dendrobaena octaedra Pop 1949: 486.
Dendrobaena octaedra Csuzdi & Zicsi 2003: 121.

Material Examined: 2 ex. ZUTC Ann.1126. Abali: 9.6.2007; 2 ex. ZUTC Ann.1057. Gachsar: 8.7.2007; 2 ex. ZUTC Ann.1064. Dardeh: 8.7.2007.

Distribution: This is a widespread Palearctic species, distributed as far north as Greenland and Novaya Zemlya and has been introduced world-wide.

Distribution in Central Elburz Mountains: Abali (N 35º 45'; E 51º 58'), Gachsar (N 36º 07'; E 51º 19'), Dardeh (N 36º 01'; E 51º 14').

Remarks: Clitellum extends on segments 28, 29, (30)-33, 1/n 34 saddle-shaped, tubercles on 31-33, body length 20-60mm, diameter 3-4mm, red-violet, male pores on 15 (FIG.2O); widely distributed peregrine species with varying polyploid and parthenogenetic races.

***Dendrodrilus rubidus* (Savigny 1826)** (FIG.2P,Q)
Enterion rubidium Savigny 1826: 182
Dendrobaena (Dendrodrilus) rubida f. *tenuis*: Omodeo 1956: 175
Dendrobaena rudida rubida Zicsi 1982: 443

Dendrodrilus rubidus rubidus Zicsi 1991 Opusc.Zool.Budapest, 24: 174

Material Examined: 2 ex. ZUTC Ann.1083. Mobarakabad: 9.6.2007; 2 ex. ZUTC Ann.1101. Abali: 14.4.2008.

Distribution: Native in the Palearctic.

Distribution in Central Elburz Mountains: Mobarakabad (N 36º 30'; E 51º 19'), Abali (N 35º 45'; E 51º 58).'

Remarks: Clitellum extends on segments 26, (27)-31, (32) saddle-shaped, tubercles on 29-30, body length 30-50 mm, diameter 2-3 mm, setae moderately paired, red-violet (FIG.2P).

***Eisenia fetida* (Savigny 1826)** (FIG.2R,S)
Enterion fetidum Savigny 1826: 182
Eisenia foetida Omodeo 1956: 329
Eisenia fetida Pavlicek et al. 2003: 456
Eisenia fetida Csuzdi & Zicsi 2003: 143(for complete synonymy).

Material Examined: 1 ex. ZUTC Ann.1081. Mobarakabad: 9.6.2007; 2 ex. ZUTC Ann.1091. Abali: 9.6.2007; 2 ex. ZUTC Ann.1093. Rudehen: 9.6.2007; 1 ex. ZUTC Ann.1102. Abali: 14.4.2008; 2 ex. ZUTC Ann.1104. Latyan Dam: 9.6.2007; 1 ex. ZUTC Ann.1105. Lar: 11.5.200; 1 ex. ZUTC Ann.1050. Harjan: 18.8.2007.

Distribution: The original range of this species was Central Asia where it was an epigeic species. Its present range extends to Europe, North America, South America, Africa, Asia, and Australia.
Distribution in Central Elburz Mountains: Mobarakabad (N 35º 48'; E 52º 01'), Abali (N 35º 45'; E 51º 58'), Rudehen (N 35º 43'; E 51º 40'), Latyan Dam (N 35º 48'; E 51º 42'), Lar (N 35º 51'; E 52º 03'), Harjan (N 36º 13'; E 51º 18').

Remarks: Clitellum extends over segments (24), 25, 26, 27-31, 32, (33) saddle-shaped, tubercles usually on 1/2 28, 28-30, 31. Body length 26–130 mm, diameter 2–4 mm, 60–120 segments. Dark violet sometimes alternating stripes of darker segments with paler intersegmental areas. Head epilobous. Spermathecae two pairs in 9/10, 10/11 open in the mid-dorsal line. (FIG.2S).

***Eiseniella tetraedra* (Savigny 1826)** (FIG.2T,U)
Enterion tetraedrum Savigny 1826: 184
Allurus tetraedrus Rosa 1893:10
Eiseniella tetraedra f. *typical* Michaelsen 1926: 351.
Eiseniella tetraedra Pavlicek et al. 1997: 2.
Eiseniella tetraedra Csuzdi & Zicsi 2003: 153 (for complete synonym list).

Material Examined: 4 ex. ZUTC Ann.1080. Abali: 9.6.2007; 2 ex. ZUTC Ann.1100. Mobarakabad: 14.4.2008; 2 ex., ZUTC Ann.1047. Pole-khab: 7.10.2007.

Distribution: Of Palaearctic origin, widely introduced world-wide.

Distribution in Central Elburz Mountains: Abali (N 35º 45'; E 51º 58'), Mobarakabad (N 35º 48'; E 52º 01'), Pole-khab (N 36º 00'; E 51º 08').

Remarks: Clitellum extends on segments 22, 23-26, 27, annular, tubercles on 23, 24-25, 26. Body length 20–80 mm, diameter 1.5–2.5 mm, 65–100 segments. Brown or yellowish–brown. Head epilobous, body has a characteristic quadrangular shape behind the clitellum with setae on the edges (FIG.2U).

***Octolasion lacteum* (Orley 1881)** (FIG.2V,W)
Lumbricus terrestris var. *lacteus* Orley 1881: 584
Octolasium lacteum Pop 1943a: 17.
Octolasion lacteum Pop 1949: 464
Octolasion lacteum Csuzdi & Zicsi 2003: 197.

Material Examined: 4 ex. ZUTC Ann.1110. Emamzadeh Hashem: 9.6.2007; 2 ex. ZUTC Ann.1051. Siahbisheh: 8.7.2007.

Distribution: Native in Palearctic but it has been widely introduced by man and its present range comprises Europe, North America, South America, Africa and Australia.

Distribution in Central Elburz Mountains: Emamzadeh Hashem (N 35º 47'; E 52º 2'), Siahbisheh (N 36º 12'; E 51º 19').

Remarks: Clitellum extends on segments 20-35 saddle-shaped, tubercles on 31-34, body length 30–170 mm, diameter 2–8 mm, 50–220 segments. Male pore on 15 (FIG.1W), Nephridial bladders ocarina-shaped, usually whitish, head epilobous (FIG.2W).

***Perelia kaznakovi* (Michaelsen 1910**) (FIG.2X,Y)
Helodrilus (Eophila) kaznakovi Michaelsen 1910: 65.
Eophila asiatica Malevic 1949: 398.
Allolobophora (Svetlovia) kaznakovi Perel 1976: 833.
Perelia kaznakovi Easton 1983: 484.
Perelia kaznakovi Csuzdi & Pavlíček 2005: 79.

Material Examined: 2 ex. ZUTC Ann.1088. Emamzadeh Hashem: 14.4.2008; 2 ex. ZUTC Ann.1114. Amol: 8.10.2008.

Distribution in Central Elburz Mountains: Amol, Emamzadeh Hashem (N 35º 47'; E 52º 2'), Amol (N 36º 12'; E 52º 22').

Distribution: Distributed only in Central Asia. It has been recorded in the Asiatic part (Uzbekistan, Kazakhistan etc) of the former Soviet Union and Iran.
Remarks: Clitellum extends on segments 27-35, tubercles on 32-34, Body length 55–70 mm, diameter 5–6 mm, pigmentation lacking (FIG.2Y), nephridial bladders S shaped, Setae closely paired.

DISCUSSION

The biodiversity of earthworms has been little studied, and available information is limited and incomplete. This report details earthworm species richness in Iran. According to Omrani (1973) 19 species of earthworms belonging to six genera and two families are known to be present in Iran.

The habitats of earthworms comprise forests, park forests, grasslands, and aquatic habitats such as the banks of rivers, ponds and springs. Species are divided into two groups, one associated with special soils and a second found in a wide range of habitats, e.g., *Aporrectodea caliginosa* found in every soil type, even in the most arid sandy soils. This was confirmed by Csuzdi & Zicsi (2003).

Eiseniella tetraedra prefers damp habitats. This species has spread within the boundaries of water systems and was the dominant species with a new record in the study area. Other species such as *Octolasion lacteum* occupy the mineral soil layer and occur in almost every habitat. *Perelia kaznakovi* was collected from forests, gardens, and woody areas with high moisture content. *Aporrectodea jassyensis* prefers steppe soils. In general, *Aporrectodea rosea* were found in wooded areas. *Eisenia fetida* is widespread and is reported under decaying leaves and in soils that contain abundant organic material. Its wide distribution and presence in organic matter suggests a use for waste decomposition. This supports results reported by Csuzdi & Zicsi (2003).

Of the 12 species recorded along the Haraz and Chalus basins, some are abundant and widely distributed, while others, such as *Dendrodrilus* spp. are rare. It seems that *Dendrobaena* Eisen, 1874, with 4 species, is the dominant genus and constitutes the predominant component of earthworms in this area. (The name *Dendrobaena* refers to the association with a woodland habitat.) Not all the species of this genus reported in this study (*D. byblica, D. hortensis, D. octaedra, D. veneta*) were equally distributed. For example, *D. veneta* (Rosa, 1886) and *D. hortensis* were found in many localities, but *Dendrobaena octaedra* and *D. byblica* were only collected from surface layers of forest soils.

Large disjunctions in the distribution of earthworm families were observed in the past century (Michaelsen, 1921). Earthworms are one of the more valuable groups in reconstructing the biogeographic history of regions (Edward & Bohlen, 1996). Relatively few studies deal with the biogeography of earthworms, and little work has been done to understand the distribution of lumbricids (Pop 1949; Omodeo, 1961; Omodeo & Rota, 1999). Earthworm species were described by Michaelsen based on transmittal potency as peregrine (found widely throughout the world) and endemic species (unable to spread to other areas). Taking these into account Michaelsen (1902, 1903) demonstrated that endemic species of lumbricids are found south of the Quarternary glaciation border. The territory of endemic earthworms can be divided into the following regions (Csuzdi & Zicsi, 2003):

I. Franco–Iberian domain (Iberian Peninsula, France west of the Alps, Sardinia, Corsica, Southwest Italy, Atlas Mts.)

II. Aegean domain (Europe from the Alps to the Ural Mts., Anatolia, Levant, and Mesopotamia).

III. Turanian–Far-Eastern domain (from the Turanic Basin to the Sajan Mts., Korean Peninsula, and Japan.

IV. North-America

Iran has a transitory position between the Aegean and Turanian domains; hence northern Iran is characterized by the species from both regions.

Due to limited information about Iranian earthworm fauna it is difficult to draw any conclusions. However, there is evidence for similarity between the earthworm fauna of Iran and neighboring countries. For example one might expect high similarity of earthworms in northern Iran, eastern Turkey, and the Transcaucasus (Mistriligu et al., 2007), but as indicated by the presence of *D. schmidti*, *H. syriaca*, and *D. byblica* complex, the basic fauna is apparently South Aegean. Among these, *D. byblica* is a heterogenous species complex, and therefore different species might be present in both regions. *Perelia kaznakovi* is present in Iran and the Transcaucasian territories but absent from

Turkey (Omodeo & Rota 1999). However the presence of *P. kaznakovi* clearly shows affinity with the Turanian domain and there may be other *Perelia* or *Eisenia* species yet to be found.
It is remarkable that other species such as *D. octaedra*, which is reported throughout Europe and eastern Siberia to Greenland and Novaja Zemlja, is absent from in the Caucasus, Italy, Greece, and Turkey but present in Iran. The route of migration may have curved north of the Caspian Sea and did not cross the Caucasus. It is probable that *D. octaedra* was introduced into some parts of the present Palearctic area and was definitely introduced to North America.
Most specimens found in this study are classified as peregrine and are distributed throughout the world. Peregrine species have characteristics that include tolerance of environmental variability, opportunism in choice of food, and ecological plasticity (Lee, 1987). For these reasons they are widely dispersed by agricultural and industrial activities.
Based on available information (Mısırlıoglu et al., 2007), only three species observed in this study are thought to be native to Iran, *A. jassyensis*, *D. byblica*, and *D. veneta*. Also *P. kaznakovi* is not a cosmopolitan species. It is known from some regions in Central Asia and also from Iran. To obtain a clearer picture of Iranian earthworm fauna, more studies are needed.

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FIGURE 2.-A, B) *Aporrectodea caliginosa* (mp: male pore, tp: tubercles), C, D) *Aporrectodea jassyensis* (og: obvious grooves, sg: seminal groove), E, F) *Aporrectodea rosea* (dp: dorsal pores), G,H,I) *Dendrobaena byblica* (I: prostomium)
scale = 1 cm.

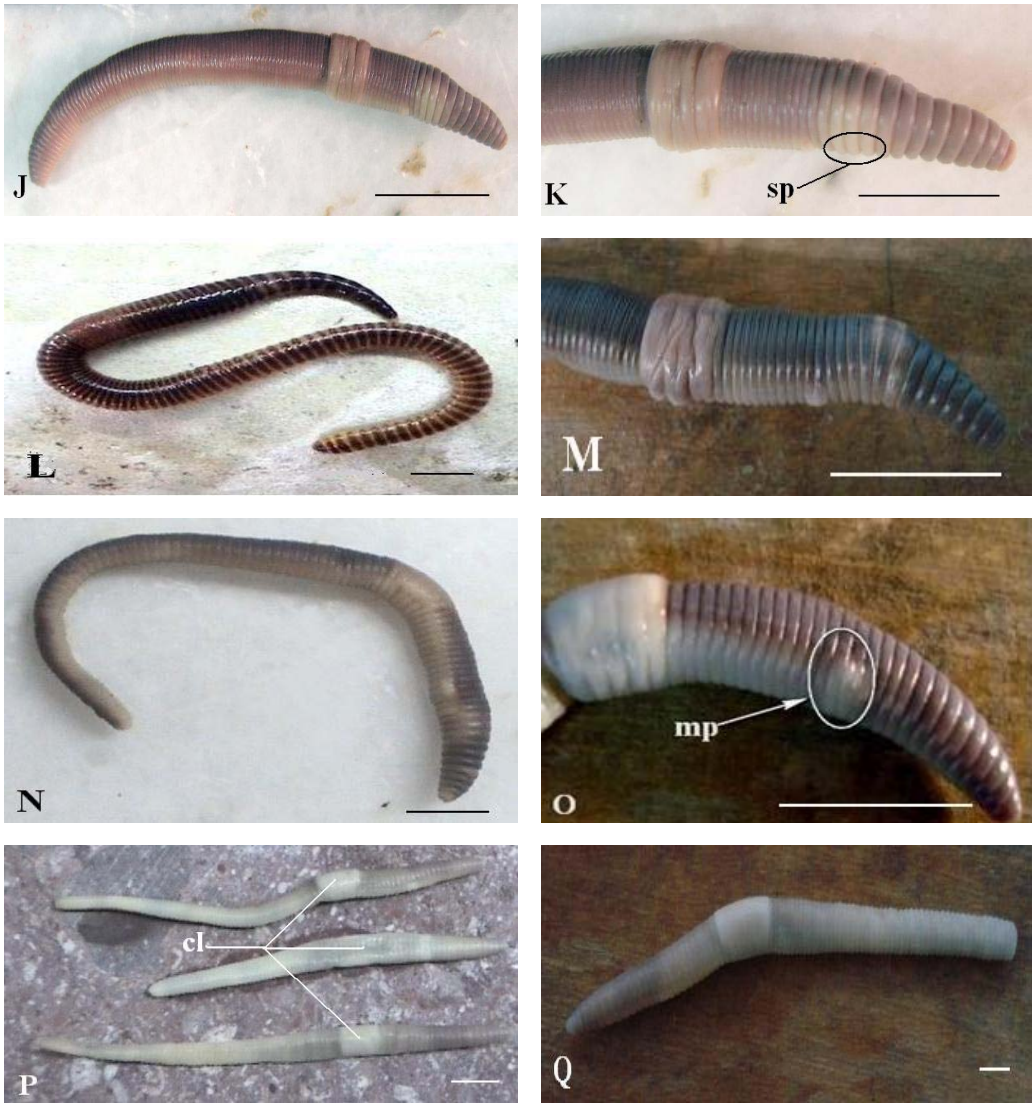

FIGURE 2. - J,K) *Dendrobaena hortens*is (sp: spermathecae pores), L,M) *Dendrobaena veneta*, N,O) *Dendrobaena octaedra (*mp: male pores), P,Q) *Dendrodrilus rubidu*s (cl: clitellum)
scale= 1 cm.

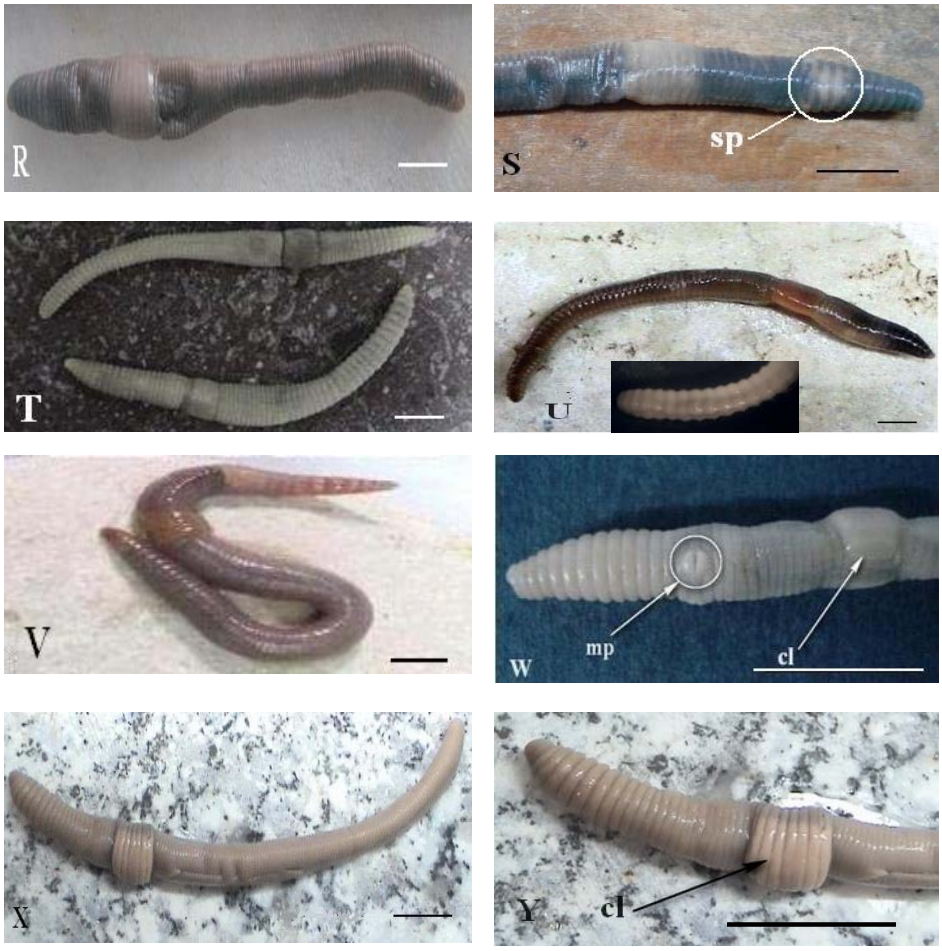

FIGURE 2.- R,S) *Eisenia fetida* (sp: spermatecha pores), T,U) *Eiseniella tetraedra*, V,W) *Octolasion lacteum* (mp: male pore, cl: clitellum) , X,Y) *Perelia kaznakovi* (cl: clitellum)
scale = 1 cm.