Occurrence of Earthworms in Relation to Soil TC, TOC, TIC in Benghazi, Libya

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**ABSTRACT**

Benghazi city is the second biggest city in Libya and getting bigger promptly. The city surrounded by farms. However, urban invasion has decreased the agriculture area a lot. In this study, survey on earthworm and TOC around the city has been done. Existing of earthworm is highly related to TOC around the city. Earthworms around the city were in Bouatni ≥ Jarotha ≥ El-Guarsha ≥ Hawari soil. The study show decline in the species in Hawari area. Four species of earthworm were identified around Benghazi city. These were *Aporrectodeatrapezoides*, *Aporrectodearosea*, *Eiseniaandrei*, and *Microsolex dubius*. *A. trapezoids* formed the dominant and most widespread species of Benghazi. *E. Andrei* was new record in the area. This can lead to using earthworms as bioindicators, which appears to be a useful way to classify soil quality. Harsh environmental conditions and low organic matter may not only limit reproduction but the survival of adult earthworms from year to year.

**Keywords:** Benghazi, Earthworm, Soil, TOC.

**INTRODUCTION**

Benghazi (32_10εN, 20_06εE), the second largest city in Libya, is colonized by some invertebrates such as earthworms, which contribute much to the soil fertility. Moderate information is available on their distribution and ecology around Benghazi city (Nair et al., 2005). Soil is the region on the earth’s crust where geology and biology meet, it is the land surface that provides a home to plant and microbial as well as invertebrates (Pelzer et al., 1993). Soil samples differ in their content depending on climate, soil origin, composition and human activities (Hashem and Al-Obaid, 1996).

Soil organisms are among the major components of soil biomass and play important roles in maintaining the structure and fertility of soil. Invertebrate-mediated processes such as drainage, aeration, and incorporating and degrading organic matter are important in improving soil quality (Barber et al., 1998). There are billions of organisms that make up the soil food web. These include bacteria, fungi, protozoa, nematode, and invertebrates. Each
type of organism plays an important role in keeping the soil healthy. Earthworm is considered as a domain soil organism widely distribution worldwide. Earthworm constitute 60-80% of the terrestrial invertebrate’s biomass and play a critical ecological role in soil specially in structuring and increasing the nutrient content of the soil (Connor, 1988). Earthworms are known to play important roles in soil profile development, nutrient cycling, and plant productivity where their population densities are high. Play an important role in decomposition processes by the fragmentation of litter material and stimulating and/or ingesting fungi and bacteria that are very important in the cycling of nutrients (Culyand Berry, 1995). Our aims were to survey earthworm distribution around Benghazi city and compared earthworm distribution with TC (includes both organic and inorganic sample constituents).

MATERIAL AND METHODS

Four stations located within the municipality of Benghazi were selected for the study (Fig.1). These stations were (1) Bouatni., (2) El-Guarsha, (3) Jarotha, and Hawari (4), they were categorized into three different habitats of earthworms and Isopoda. These were (i) Clayey loam soil, lemon, olive, guava and orange farm (stations 1), (ii) Loamy sand soil, rose and flower garden (station 2), (iii) Silt clay soil, plain landscape with wild grasses and Pomegranate and olive plants having medium-sized trees forming canopy (station 3), (iv) rose and flower garden (station 4). Soil, Earthworms and Isopoda were sampled during in March 2012, following these steps a plot of 20 x 20 cm replicates ten times were measured within the survey site 10 x 10 m, of each station with two substations. A ditch of 10 cm deep was dug in the plot and the soil organisms were removed and spread on a white plastic tray, and hand-sorted removing earthworms, Isopoda as they were found. The earthworm and isopods were rinsed in distilled water for a few seconds to remove particles of soil from the body surface and placed in Petri. “Identification and taxonomic assignment was performed using the available detailed studies on earthworm taxonomy and distribution for the whole of France (Bouché, 1972), Hungary (Csuzdi and Zicsi, 2003) and Great Britain (Sims and Gerard, 1999).”

RESULTS AND DISCUSSION

Four species of earthworm were identified around Benghazi city (Fig.1). These were Aporrectodea trapezoides, Aporrectodea rosea, and Eisenia andrei belonging to the family Lumbricidae, and Microscolex dubius belonging to the family Microscoleidae (Table 1). Out
of the four species, *Aporrectodea trapezoides* formed the dominant and most widespread species of Benghazi and this earthworm was present in all stations.

| Table 1. Earthworm species sampled from different stations around Benghazi |
|-----------------------------|-----------------------------|
| stations | Our samples | Nair et al., 2005, samples |
| Bouatni | Aporrectodea trapezoides, Microscolex dubius, *A. trapezoides*, *M. dubius* | A. rosea |
| El-Guarsha | *A. trapezoides* | A. caliginosa trapezoides |
| Jarotha | Aporrectodea trapezoides, *Microscolex dubius*, *A. trapezoides*, *M. dubius* | Non |
| Hawari | Non | *A. caliginosa trapezoides* |

This was followed by *A. rosea* sampled from two stations (Bouatni and Jarotha). Meanwhile, *Eisenia andrei* were sampled from just one station (Bouatni) as well as *M. dubius* were sampled from one station Jarotha. *A. caliginosa* trapezoides formed the dominant and most widespread species of Benghazi. This was followed by *A. rosea* sampled from two and *M. dubius* from one and *E. andrei* from one stations. Earthworm diversity tended to be low with one to three species present within location. Low earthworm species diversity within a site is not uncommon. Most earthworm diversity studies report the presence of between two and five species at any one location (Lee, 1985). This survey highly agreed with previous survey which done in 2002 by (Nair et al., 2005).

However, *E. andrei* was new record in the area. Also, three species of earthworm *A. trapezoides*, *M. scoloredubius*, *Aporrectodearosea* were recorded in Jarotha area, this area was not included in the previous study. In the Hawari stations no earthworm were found. However, Nair and his group found the *A. trapezoides* in the area which was not confirmed by our survey, this could mean decline in the earthworm population in the area. Bouatni soil seem to be more suite soil to earthworm species and biodiversity were higher than other soil followed be Jarotha station, these two stations are remain in agriculture use and far from urban invasion, so, they are rich of nutrient. This due to high concentration of TOC compared to other location. Exist of the earthworm highly related to TOC concentration (Fig.2).

![Figure 2. Correspondence analysis plot for. A significant difference exists between the three analyses within the areas.](image)

Higher numbers of species were found in Bouatni than in other sites, this appeared to be related to higher organic matter content in site resulting from fertilizer additions and leaf litter inputs, which improve earthworm food quality, quantity, and soil environmental conditions.

This is consistent with previous research that established correlations between earthworm diversity and soil litter quality (Sinha et al., 2003). These species play a paramount role in the decomposition of soil litter and their distribution correlates with that of the TOC. Organic
matter contains nutrients necessary for earthworm survival, and soils lacking organic matter do not typically support large earthworm populations (Lee, 1985; Edwards and Bohlen, 1996). Jordan et al., (2000) found that earthworm density decreased in El-Guarsha as well as Hawari where organic matter had been decreased due to reduction in the agriculture area and invasion of urban, and attributed the population decline to decreased nutrient availability. The low organic C content in El-Guarsha as well as Hawari soils did not appear to provide sufficient nutrients to support earthworm populations similar in density to those in Bouatni Jarothasites. This can lead to using earthworms as bioindicators, which appears to be a useful way to classify soil quality. Our recommendation to use soil around Benghazi city in agriculture purpose can be Bouatni ≥ Jarotha ≥ El-Guarsha ≥ Hawari soil. This study was put more emphasis on the pervious study which done in 2002, and Aporrectodea trapezoids were domain species and Eisenia Andrei were recorded as new species. Moreover, Jarotha area, has not been considered in earthworm survey, and was rich of some species that not found on other area. Also, put indication about decline of earthworm in Hawari area. Finally, harsh environmental conditions and low organic matter may not only limit reproduction but the survival of adult earthworms from year to year.

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REFERENCE


