CHAPTER – 2

EARTHWORM DISTRIBUTION WITH SPECIAL REFERENCE TO PHYSICOCHEMICAL PARAMETERS IN KALABURAGI REGION.
INTRODUCTION

Earthworms, the member of class Oligochaeta in the phylum Annelida are one of the major macro fauna of soil. The Greek philosopher, Aristotle, named them the ‘Intestine of Earth’, but till now they are actually considered as the ‘unheraled soliders of the soil’. Earthworms have great ability to improve soil structure, to breakdown organic matter and release plant nutrients (Edwards C. A. and Bohlen P. J. 1996).

Around 4000 species of earthworms are known to occur globally and from India so far 418 species, referable to 67 genera and 10 families, have been reported (Kale R. 1991).

The earthworms are widely distributed throughout the world and their population contributes about 80 % of total biomass of the soil ecosystem. The distribution of Earthworms not only depends on physicochemical factors of the soil but also their reproductive potential and dispersive power (Edwards and Lofty 1997).
The information on the ecology of earthworms from natural ecosystems of Indian tropics is limited (Bhadauria and Ramakrishnan 1991), however, there are some comprehensive faunastic studies on earthworms in India (e.g. Dash and Patra 1977, Bhadauria and Ramakrishnan 1991). These studies showed the influence of various edaphic factors; temperature, moisture, organic matter, pH etc. on the population of earthworms.

Earthworms are long thread-like, cylindrical, soft-bodied, segmented invertebrate worms with uniform ring-like structures all along the length of their body. They belong to class Clitellate of order Oligochaeta of phylum Annelida. Oligochaetes can be aquatic or terrestrial. The terrestrial Oligochaete belonging to 10 families and 1800 species of earthworms are distributed all over the world. The earthworms vary in size, colour and behavior. The soil, moisture content, salinity, temperature and the type of organic matter they like to feed and the depth to which they can go in the soil vary from species to species (Govindan, 1998).
Research has shown that earthworm species composition and distribution is dependent upon the properties of the soil, including soil moisture, texture, depth, pH, and organic matter content (Curry 2004).

Earthworms that can survive in captivity under semi natural conditions, tolerant to wide ranges of substrates and to other physical parameters like pH, temperature, moisture and physical disturbances can only be maintained as cultures. They should show good population growth for culture propagation. These characters are found in very few species of earthworms and hence, successful culturing is possible only with these earthworms irrespective of the place of their origin.

A detailed study of biology of fifteen out of sixty species of earthworms collected from different places in Karnataka has shown the inability of majority of species to propagate in captivity (Kale, 1991).

In majority of the temperate regions, though large number of species are organic matter or litter feeders, *Eisenia fetida* for its ability to adapt to different organic
decomposable wastes, short life cycle, high fecundity and tolerance to density pressure is the preferred earthworm for culturing (Edwards, 1995; Hartenstein and Bisesi, 1989; Hand and Hayes, 1983; Hartenstein et al., 1989).

Epigeic earthworms are absent in agricultural lands subjected to disturbances. They are found in patches in places where the organic matter is stored above the ground throughout the year. It is very essential to identify the suitable earthworm and to create appropriate conditions for its survival in the organic material to be used as substrate.

Soil fauna is considered as the most important factor in assessing the soil health that its abundance and biomass are influenced by ecological conditions of the site (Moghimian and Kooch, 2013). Moreover, soil fauna is considered as the important component in forest ecosystems due its significant role on decomposing the organic matter and transporting the nutrients (Yang and Chen, 2009).

Soil fauna such as earthworms accelerates the decomposition of organic matter and mineralization of
nutrients (Rashid et al., 2014). The earthworms are introduced as soil ecosystem engineers because they affect the physical, chemical, and biological properties of the soil (Uchida et al., 2004) and also are one of the important components of soil formation, structure, and fertility (Edwards, 1994).

Depending on the environment type and ecosystem function, earthworms are split into three classes, Litterfall, subsoil, and soil fauna. The effective degree of earthworms depends on their ecological group, size, parent soil material and climate (Shen and Yang, 2008). Physical, chemical and biological features of soil are essential for soil fertility and ecological classification (Schoenholtz et al., 2000).

The present study is to investigate the distribution of the earthworms in the north Karnataka region correlating their distribution to physcio-chemical factors of soils they inhabit.
STUDY AREA

The Study area includes different regions of Gulbarga district i.e. Afzalpur, Chittapur, Sedam, Aland and chincholi taluka (Figure 1) Survey was conducted in the study area from Feb 2013 to Jan 2014.

Gulbarga district has the geographical area of 16224 Sq Km. District is located in the northern part of Karnataka State and lies between North latitude 17.10° and 17.45° and between east longitude 76.10° and 77.45°. The district is the biggest district in the state covering 8.49 % of the area, and 5.9 % of population of the state. It is bounded by Bidar district of Karnataka and Sholapur district of Maharashtra in the North; Hyderabad and Mehaboobnagar districts of Andhra Pradesh State in the East; Raichur district in the South; and Bijapur district in the West. Earlier, there were ten talukas in the districts, but after creation of a new district Yadgir, only seven talukas remain in the present Gulbarga district. They are Afzalpur, Aland, Chincholi, Chittapur, Gulbarga, Jevargi, and Sedam.
The climate of the district is generally dry and healthy. With an annual rainfall of about 750 mm. The entire district is situated in Deccan and the general elevation ranges from 300 to 700 meters above mean sea level, main rivers, are namely Krishna and Bhima. Black soil is predominant soil type in the district. In this district, there are a large number of tanks, in addition to the river irrigated land.

The Upper Krishna Project is major irrigation venture in the district. bajra, sunflower, tur, sugarcane, groundnut, sesame, castor, bean, black gram, jowar, wheat, cotton, and linseed are grown in the district.

The weather in Gulbarga district consists of three main seasons. The summer spans from late February to mid-June. It is followed by the south west monsoon, which spans from late June to late September. Temperature during the different season: varies from 11° c in winter to 46° c in summer and 27 to 37° c monsoon, and the winter season is from December to February. During this period the weather is generally mild and not oppressive.
Geographical area of Aland, Chincholi, Afzalpur, Sedam, Chittapur and climatic factors.

1. Aland is located at 17.57°N 76.57°E. It has an average elevation of 480 meters (1574 feet). The town is spread over an area of 8 km². Summer Temp. 44°C Winter Temp. 22°C.

2. Chincholi taluk (84 km distance from Gulbarga) itself represents 50% (77 25' 48º E and Latitude of 17 28' 12º N.) of the forest and possess teak, rosewood and nallamadri tress. The forest area is also host to many medicinal plants and wildlife. Having a rich biodiversity, the forest has dry deciduous and moist deciduous forest with acacia and teak plantations on the fringes Chincholi is located at 17.47°N 77.43°E. It has an average elevation of 462 meters (1515 feet).

3. Sedam in ancient times was known Sedimba. Sedam is famous for its Shahabad Stones. A lot of quarries around Sedam mine these stones to sell. Three cement factories are also present in this taluk: Birla Shakti, also called as seram, town is spread over an area of 5.5
square kilometers. It also borders Tandur taluk of Rangareddy district of Andhra Pradesh.

4. Afzalpur is located at 17.2°N 76.35°E. It has an average elevation of 408 metres (1338 feet). The town is spread over an area of 3 km².

5. Chittapur is located at 17.12°N 77.08°E. It has an average elevation of 403 metres (1322 feet). The town is spread over an area of 3.5 km².
MATERIALS AND METHODS

Soil samples collected from various study sites were analyzed for soil texture by international Pipette method (Piper, 1996), moisture by oven drying method (Santhanam et al., 1989), pH by Digital meter (Mishra, 1968). Percentage of organic carbon (OC %), Phosphorus (P) Kg/acre, Potash (K) Kg/acre were in the Agriculture Soil Testing Centre, Gulbarga.

Soil Analysis:

Soil pH was measured by electrometrically in a solution by using distilled water (1 g in 20 ml). Soil moisture content was estimated by keeping fresh soils samples in an oven drying at 105°C until content weight. Water holding capacity was measured by using sintered crucibles filled with oven dried and sieved through 2mm mesh soil samples kept over a container filled water and kept for 24hr. The soil organic matter was determined as loss-on-ignition of oven dry soil 24hr. in a muffle furnace at 550°C (Allen et al., 1976).
RESULT AND DISCUSSIONS

Results of the soil analysis shows that, the pH ranges from 6.8±0.11 to 8.0±0.11. Salts content varies from 0.27±0.02 to 0.85±0.11. OC ranged from 0.29±0.01 to 0.60±0.02. P kg/acre ranges between 11±1.01 to 12.90±0.6. K kg/acre varies from 200±14.30 to 220.0±41.16. Moisture content ranges from 67.9% to 83.5% (Table 1). (Figure 2-a, b).

A number of ecological factors often inter-correlated, are known to play a vital role in the distribution and abundance of earthworms. The most important among them are temperature, moisture, organic matter and hydrogen ion concentration.

The distribution of earthworms was mainly dependent on the physicochemical characteristics of the soil. Each habitat of this region mainly comprise of coarse loamy soil. Soil moisture, Organic carbon and nitrogen was found to be significantly correlated with the distribution of the worms. This is in accordance with various studies done in different parts of India (Ismail and Murthy, 1985; Ganihar, 1996).
Soil pH in this region varied from slightly neutral to alkaline (6.8-8).

Several studies showed the effect of earthworms on available mineral nutrients and documents that soil with many earthworms generally have more exchangeable mineral nutrients than soils without earthworms. This is because worms play an important role in litter decomposition and incorporation of plant residues into the soil by their burrowing, feeding and casting activities. This topic has been reviewed comprehensively by Edwards and lofty (1997) and Lee (1985). Edwards and lofty (1997) suggest that earthworm species generally have narrow range in pH, very few being restricted to highly acidic soils (pH<4).

A review of the studies sites show variation with reference to physico-chemical factors, and they strongly relate the earthworm distribution and the study also reveals that probably the forest habitats rich in organic matter and optimal conditions support larger population of earthworms than the wasteland and garden soils. However, a detailed study on seasonal basis is likely to give some more
information regarding the earth-worm distribution of this region.
Figure 1 Study area map of Kalaburagi region.
Table 1. Physicochemical factors of soil in earthworm habitats.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Habitat of earthworms</th>
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<tbody>
<tr>
<td>Soil Factors</td>
<td>Afzalpur</td>
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<tr>
<td>pH 6.8 ±0.11</td>
<td>6.85 ±0.11</td>
</tr>
<tr>
<td>Salt 0.29 ±0.04</td>
<td>0.29 ±0.11</td>
</tr>
<tr>
<td>OC % 0.33 ±0.04</td>
<td>0.33 ±0.07</td>
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<tr>
<td>P kg/acre phosphorus 12 ±1.02</td>
<td>12.16 ±1.11</td>
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<tr>
<td>K kg/acre potash 200 ±14.30</td>
<td>220.0 ±41.16</td>
</tr>
<tr>
<td>Moisture content of the soil 73.2 %</td>
<td>82.8 %</td>
</tr>
<tr>
<td>N Kg/acre Nitrogen 233.6±9.37</td>
<td>198.0±10.94</td>
</tr>
</tbody>
</table>

M ± SE = mean ± standard error.
Figure 2a. Physico-chemical Parameters of pH, Salt, OC, EC in the soil.
Figure 2b. Physico-chemical Parameters of N,P,K and Moisture in the soil.