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Study of diversity of Earthworm Species in Kota, (Rajasthan) India

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ABSTRACT

Kota is situated in south-eastern plateau of Rajasthan state having warm and humid weather conditions. Maize, Wheat, Mustard and Soyabean are major crops of the region which depend on rain fed, canal or underground water irrigation. In general, pesticides and fertilizers are used to enhance the crop production in the region as is the practice throughout India. Amid worries of numerous negative impacts of these chemicals, organic farming is the ray of hope for a better tomorrow. Vermicomposting is one part of it. To look into this aspect, study of diversity of earthworms was carried out in three different areas around Kota city. Earthworms have been collected and samples were identified as *Eisenia fetida, Lampito mauritii,* and *Perionyx excavtus* earthworm species. Kota region mainly contained *Eisenia fetida* earthworm species. Identification of all samples has been done by Zoological Survey of India, Kolkata (India).

Keywords: *Diversity, Agro-ecosystem, Organic farming, Vermicomposting.*

INTRODUCTION

Rajasthan, the largest state of India, is endowed with diverse soil and weather conditions comprising of several agro-climatic situations that helps the state to adopt a diversified cropping pattern. The state is endowed with warm humid in south-eastern parts to dry cool in western parts of the state. Approximately 65 per cent population of the state is dependent on agriculture and allied activities for their livelihood. Agriculture in Rajasthan is primarily rain fed covering country's 13.27 per cent of available land (ASI 2015, AERC 2015).

To achieve stability and sustainability in the agriculture sector, the most important factor is a sustainable production of crops, particularly food crops, like wheat, rice, jowar, maize, bajra, ragi and pulses formed those food grains which are essential to feed the population.

The concept of organic agriculture builds on the idea of efficient use of locally available resources as well as the usage of adapted technologies (e.g. soil fertility management, closing of nutrient cycles as far as possible, control of pests and diseases through management and natural antagonists). There may be differing management approaches for organic cultivation under different climates, locations and cropping systems but one thing all the systems have in common is the desire to develop a method of production capable of generating safe and healthy food and fibre, with minimum or no adverse effects on the environment and resources. Over the years, it has been scientifically proven, beyond doubt, that organic farming systems are most productive, environment-friendly system of growing crops, promising environmental preservation, protection of variety and species, protecting the soil, keeping the water clean and reducing the impact of agriculture on the atmosphere.

Earthworms are pivotal to achieve the organic farming. They modify soil organic matter both chemically and physically, mix leaf litter with the soil, facilitate the formation and stabilization of soil aggregates and improve soil porosity (Lavelle and Spain, 2001). They are ideal test organisms for soil risk assessment due to their high biomass in soil and frequently observed sensitivity to relatively low concentrations of environmental toxicants (Edwards and Bohlen, 1996). Keeping this fact in mind, biodiversity is the key for conservation and sustainable use of natural resources. Species diversity is one of the central motives for this. In our work, earthworm species diversity has been measured in three different agricultural areas around Kota city and their species has been identified by renowned scientific organization of Government of India.

MATERIALS AND METHODS

Earthworms were collected from three agricultural lands areas of Kota; Bundi road, Rangpur road and Baran road area. For collecting the earthworms, pit was dug (four in each area at different places) by ploughing the farming area. During the collection, earthworms were caught by hand picking then transferred to the jars and were preserved in formaldehyde (formalin). Identification of earthworms was done at Zoological Survey of India, Kolkata (India). Soil samples from these areas were also collected and their physico-chemical parameters have been obtained by sample test at Nanta agricultural farm (office of Project Director, crop) in the Kota district. Sample soil contained the pH range 7.89 – 8.10, conductivity in the range 0.320 – 0.475 m Mhos/cm. and organic carbon content between 0.42 – 0.60 %. Earthworm populations depend on both physical and chemical properties of the soil, such as temperature, moisture, pH, salts, aeration, and texture, as well as available food, and the ability of the species to reproduce and disperse.

RESULTS AND DISCUSSION

A total number of three species of earthworms were identified belonging to two families (Lumbricidae and Megascolecidae). The species identified under family Lumbricidae is *Eisenia fetida* (Savigny, 1826). The numbers of species identified under family Megascolecidae are *Lampito mauritii* Kingberg, 1866 *and Perionyx. Eisenia fetida* was found in abundance in all areas around Kota city. *Lampito mauritii* was found at Bundi road and Rangpur road area and *Perionyx* was found at Rangpur road area.

Eisenia fetida (Fig. 1), also known as the red wiggler, brandling worm, dung worm, or the tiger worm, is found extensively not only in the ground but also in various habitats around the world. This is a common worm to use as fishing bait but has also been associated with garbage and waste. It is probably the most widely used worm for vermicomposting. *Eisenia fetida* is the standard test organism used in terrestrial ecotoxicology, because it can be easily bred on a variety of organic wastes with short generation times (ISO 1998, OECD 1984 and 2004). Sensitivity tests of multiple earthworm species have revealed that *Eisenia fetida* is comparatively less sensitive (Fitzgerald *et al*; 1996, Kula 1995, Ma and Bodt 1993). Although, earthworm species vary in their tolerance, reports have shown a decline in earthworm populations in response to large amounts of organic chemical deposition (Bayer and Foy 1982).

The anecic earthworm, i.e. *Lampito mauritii* (Fig.2), is commonly found in Indian soils, used as an efficient tool for organic waste reduction (Tripathi and Bharadwaj 2004). The composting efficiency and biology of *L. mauritii*, is well documented in literature. Several authors have reported the vermicomposting potential of *L. mauritii* by using a variety of organic wastes (Manivannan 2005, Suthar and Sing 2008). It can withstand wide range of

temperature, soil moisture and various other physical factors (Kale 1988) and with wide choice of habitats and food preferences it has the highest frequency of distribution (Kale and Bano 1992).

Perionyx excavatus (Perrier, 1872), as shown in Fig. 3, is a beautiful worm with an iridescent blue or violet sheen to its skin clearly visible under bright light. This species is mainly found in tropical regions, especially in Asia (Blakemore *et al*; 2006) and is also present in Europe and North America (Edwards *et al*; 1998). Although primarily a compost worm, it is commonly found in the top soil layer (0-15 cm) at temperatures ranging between 20.8^{o}C and 28.8^{o}C and pH of 6.4-7.4 as discussed by Bhattacharjee and Chaudhuri in 2002. Hallatt *et al* 1990, Joshi and Dabral 2008, Reinecke and Hallatt 1989 studied the life cycle and biology of this species extensively. This species makes excellent fishing bait. Like all tropical worm species, this species has a very poor tolerance for low temperatures, fluctuations in their environment or disruption to the system. These are compost worms and often used in waste conversion systems. In nature they are found at the surface in rotting vegetation. They die quickly at temperatures below 45 degrees F. They are useful as home composters, particularly in warm outside conditions and quite at home when wet. As the home dries out, they will depart for a better place and if they don't find it, will quickly dehydrate and die.

Fig. 1: *Eisenia fetida*

Fig. 2: *Lampito mauritii*

Fig.3: *Perionyx excavatus*

CONCLUSION

Results reflect that soil of Kota region mainly contains *Eisenia fetida* species. Other two found species were less in number in comparison to *Eisenia fetida*. The fact of the day is that farmers are using pesticides excessively to enhance crop production but this affects the diversity of Earthworms greatly. Presence of earthworms is beneficial to agro-ecosystems and if serious thinking and concrete implementation has not been done in the coming days, species of the earthworm will soon be extinct

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