

## BIODIVERSITY OF EARTHWORM SPECIES RELATIVE TO DIFFERENT FLORA

MUHAMAD SARWAR, AMANA NADEEM, M. KHALID IQBAL AND TAHIRA SHAFIQ

*G C University Faisalabad (MS,AN), PCSIR labs,Ferozpur Road, Lahore (MKI, TS), Pakistan*

**Abstract:** To study the effect of different flora on earthworms diversity, the specimens were collected from Guava, Mango, Citrus, Date palm and Mulberry fields. Total 480 sampling sites, 30 sampling sites a week (6 for each fruit tree) were selected randomly by replacement sampling method. Mango field harbored the maximum number (14) of species (*Pheretima posthuma*, *P. taprobanae*, *P. minima*, *P. lignicola*, *P. anomala*, *P. californica*, *P. carinensis*, *P. differenges*, *P. suctoria*, *P. bourna*, *P. hawayana*, *Eutyphous ineammodus*, *Apporectodea longa*, *Apporectodea caliginosa*) where as Mulberry field harbored minimum number of earthworms species (6) (*P.posthuma*, *P. minima*, *P. lignicola*, *P. morrissi*, *P. suctoria*, *P. birmanica*, *P. differenges*, *P. californica* and *M.mouritici*) during the study period. Ranking of earthworm communities inhabiting different fruit tree fields was found to be mango (14), guava (11), date palm (10), citrus (10), and mulberry (6) regarding their species complexity.

**Key words:** Earthworm species, diversity, flora.

### INTRODUCTION

Earthworms are very important soil creatures as they make up a large portion of the total biomass of invertebrates of the soil. Earthworms though well studied organisms all over the world are badly neglected in Pakistan. Even the work on their taxonomy is far beyond completion. The work available on the systematics of earthworms is mostly by Stephenson, (1923), who provided massive taxonomic information on oligochaeta in his book, "Fauna of British India". According to current estimation the number of existing species is far from complete. The most recent account of earthworm diversity comprises 3627 earthworm species described worldwide, with an average annual addition of 68 species

(Reynolds, 1994). More than 3000 species of earthworms are known. In one hectare of soil, rich in organic matter and good moisture content, one can expect a population of 50,000 to 400,000 earthworms and which are able to produce 25-30 tones of castings. Earthworms are hermaphrodites and they can double their population in one month in ideal conditions of temperature, moisture, and food, which is organic, matter. (Harender and Bhardwaj, 2001).

Earthworms play a versatile role in soil biology and fertility. As natural bioreactor they convert organic waste into organic manure. They are useful in land reclamation, soil improvement and organic waste management (Harender and Bhardwaj, 2001). Earthworm casts are sources of nutrients for plants. They increase the amount of nitrogen mineralized from organic matter in soil (Syers *et al.*, 1979, Ruz Jerez *et al.*, 1988). Nitrogen-fixing bacteria are found in the gut of earthworms and in earthworm casts, they increase nitrogenase activity, meaning greater rates of N-fixation, are found in casts when compared with soil (Simek and Pizl, 1989). Beside above mention role some earthworm species have nutritional importance. The West-African night crawler and the brandling worm also known as the English red worm, have been used in North America as food for bait since the 1940 and as a dietary supplement for ornamental fish and other difficult-to-raise fish species (William *et al.*, 2006)

Earthworms provide a major potential source of alternative food for polyphagous predators, such as carabid beetles, that are natural enemies of slugs, aphids and other agricultural pests (Symondson, 2000). Earthworms secrete enzymes, proteases, lipases, amylases, cellulases and chitinases which bring about rapid biochemical conversion of the cellulosic and the proteinaceous materials in the variety of organic wastes which originate from homes, gardens, dairies and farms (Rajiv *et al.*, 2004). The present study was aimed at knowing diversity of earthworms in the fields of guava, mango, citrus, date palm and mulberry field at Post Graduate Agriculture Research Station (PARS), Jhang Road, Faisalabad. The present study is actually an attempt to study some aspects of biodiversity of earthworm's fauna with respect to specified flora.

## MATERIALS AND METHODS

### *Site of Study*

The specimens were collected from the fields of Mango, citrus, date palm, guava and Mulberry by the digging method (Lewis *et al.*, 1979) and identified in the research lab of Department of Zoology, G.C. University, Faisalabad.

### *Collection*

A total 480 sampling sites were selected for study by the replacement sampling method every week. A hole of one square feet was dug with the help of spade and scraper in each selected site and earthworms were collected.

### *Preservation*

The collected specimens were preserved by the following method suggested by (Stephenson, 1923). The earthworms were washed with tap water, kept in 10% ethyl alcohol for ten minutes for dehydration, hardened by keeping in 10% formalin for about 24 hours and finally preserved in 5% formalin. After identification the specimens were kept in separate jars with the inscribed species name and were kept in museum of Department of Zoology, G.C. University, Faisalabad.

## RESULTS AND DISCUSSION

Earthworm communities nearly always include species that pursue different ecological strategies and a familiarity with these strategies is essential to an understanding of the structure of earthworms communities. 493 earthworms were collected and identified. Twenty species were present in the study area. Out of these twenty species *P. posthuma* was the dominant (n=164), *A. caliginosa* and *M. mouritici* were the rare ones, *P. posthuma* (n=78) and *P. lignicola* (n=74) were in second and third in ranking order respectively. (table-1) This finding was in line with the work Rafiq (2000) who demonstrated that in Faisalabad region the soil was mostly sandy loam harboring *P. posthuma* and its congeners in most of

cultivated crops. These findings were also in line with Mannan *et al.* (1994) who studied the effect of different environmental factors and vegetation on abundance, morphometry and distribution of *P. posthuma*. He investigated that the season, soil type, moisture contents, day time temperature and vegetation significantly effected population density of the worm

**Table I: Earthworms diversity and their relative abundance in different habitats.**

Name of Earthworms species	Mango field	Citrus field	Guava field	Mulberry field	Date Palm field	Total
<i>P. posthuma</i>	42	66	23	10	23	164
<i>P. taprobanae</i>	2	-	-	-	2	4
<i>P. minima</i>	2	3	3	2	2	12
<i>P. lignicola</i>	8	36	22	2	4	74
<i>A. longa</i>	2	3	-	-	2	7
<i>P. anomala</i>	8	-	3	-	2	13
<i>P. californica</i>	3	-	4	-	2	9
<i>A. caliginosa</i>	2	-	-	-	-	2
<i>P. carinensis</i>	5	-	6	-	3	14
<i>P. diffrenes</i>	4	3	6	-	2	15
<i>P. suctoria</i>	4	-	6	3	-	13
<i>P. bourna</i>	2	-	-	-	4	6
<i>E. ineammodus</i>	3	-	-	-	-	3
<i>P. hawayana</i>	1	18	-	-	-	19
<i>P. morrisi</i>		-	4	2	-	6
<i>P. birmanica</i>		9	22	5	-	36
<i>M. mouritici</i>		-	2	-	-	2
<i>P. osmastonia</i>		78	-	-	-	78
<i>P. houletti</i>		9	-	-	-	9
<i>P. heterochaeta</i>		9	-	-	-	9
	88	234	101	24	46	493

**Table II: Simpson Diversity indices of earthworm's species in five different habitats.**

Field	No of species	D-values
Mango	14	0.25
Citrus	10	0.221
Guava	11	0.127
Mulberry	6	0.221
Date palm	10	0.26

Simpson's Diversity Index=  $D = \sum n(n-1) / N(N-1)$

*P. posthuma* *P. minima* and *P. lignicola* were the inhabitants of all the five habitates i.e., guava, mango, citrus, date palm and mulberry fields. *A. caliginosa* *E. ineammodus* showed exclusive inhabitation in mango field while *P. osmastonia* *P.houlleti* *P. heterochaeta* were restricted to citrus field and *M. mouritici* was present only in Guava field. *P. posthuma* was most common species in all the five field except citrus where as *P. osmastonia* was the most common and *P. posthuma* was second in ranking in citrus field. Didden (2001) also studied the different farm sites, comprising grassland and two types of horticultural farms (growing vegetables or flower bulbs). He reported that the abundance, biomass and species richness were significantly higher in grassland soils than in horticultural soils, and within the horticultural farms significantly higher in vegetable than in flower-bulb farms.

*A. longa* was confined in mango citrus and date palm while *P. californica*, *P. carinensis* and *P. anomala* were present in mango, guava and date palm. *P. diffrenge*s was inhabitant of mango citrus guava while *P. suctoria* was restricted to mango, guava and mulberry. *P. bourna* was limited to mango and date palm while *P. hawayana* to mango and citrus. *P. morrisi* harbored guava and mulberry while *P. birmanica* citrus guava and mulberry. Bano (2000) reported the 11 and 8 species from Bamboo and poplar trees, respectively and Khanum (1999) explored 7 species from wheat field. In the present study the diversity is calculated by using Simpson Diversity index (DI) which showed that the highest earthworms diversity was found in date palm field (DI = 0.26), higher in mango (DI = 0.25), high in citrus and mulberry (DI = 0.221) and the lowest in guava with DI value 0.127 (Table-II).

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