



# Impact Of Soil Microfauna On Human Nutrition In The Flood Plains Area Of Chapra Bihar

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The present work is done in the two blocks (Manjhi, and Rivilganj) of floodplain area of Chapra, Bihar. In this study various types of microfauna were found. In floodplain, soil microfauna's can be left an effective impact on human nutrition. Microfauna's are major factor in soil structure that can maintain the effectiveness of agriculture. So soil microfauna are treated as a key factor for the agriculture, ecosystem, soil fertility as well as crop productivity. In this study various types of soil microfauna like Nematodes (*Aphelenchoides besseyi*, *A. ritzemabosi*, and *A. arachidis*), Arthropods (bugs, millipedes, centipedes, mites and ticks), fungi and algae were found. Some of them are very beneficial to the soil for maintaining fertility. More fungi like mycorrhizosphere (Arbuscular mycorrhiza) were found Rivilganj than Manjhi. This paper examines how these micro faunal communities indirectly influence human nutrition by affecting soil fertility, crop quality, micronutrient density and agricultural sustainability.

**Keywords: - Microfauna, soil, floodplain, fertility Agriculture.**

## 1. Introduction

The floodplains of Chapra represent one of the agriculturally productive zones of the Indo-Gangetic basin. The region's farming systems rely heavily on natural soil processes supported by diverse groups of soil microfauna. Although these organisms are microscopic and hidden, they significantly regulate soil health, which ultimately shapes the nutritional profile of crops consumed by humans.

However, high population pressure, chemical fertilizer overuse, and flood induced soil disturbances threaten micro faunal diversity. Understanding how microfauna influence soil functioning and human nutrition is essential for designing sustainable agricultural strategies in Chapra.

## 2. Soil microfauna in chapra's floodplain ecosystem

- Major microfauna Group
  - Nematodes (*Aphelenchoides besseyi*, *A. ritzemabosi*, and *A. arachidis*)
  - Arthropods (bugs, millipedes, centipedes, mites and ticks)
  - Fungi and
  - Algae
  - Protozoa

- Environmental Characteristics Favoring Diversity
  - High soil moisture due to Ganga-Ghaghara river flooding.
  - Nutrient-rich alluvium deposition.
  - Temperature and pH conducive to biological activity.
  - Presence of organic matter from crop residues and slit deposits.

## REVIEW OF LITERATURE

There are many works on soil and soil microfauna not only in India but also other countries like Austria, U.K., China, U.S.A. etc. but few works occur on the soil microfauna in Bihar. Researched by Bardgett & Vander Putten (2014) states that microfauna regulate nitrogen and phosphorous mineralization. Protozoa stimulate microbial turnover while nematodes accelerate nutrient release Ferris, 2010). Micro arthropods improve soil structure, aggregation, and organic matter decomposition. According to Yadav et al. (2000) floodplains receive annual deposition of fertile silt. In North Bihar, flooding shapes biological activity, soil moisture, and nutrient recycling (Sinha & Kumar, 2016). According to Smith & Mayer (2018), Soil nutrient cycling determines micronutrient content of crops. Healthy soils improve Fe, Zn, and protein in cereals and pulses. Soil degradation leads to poor –quality food (Lal, 2009).

## Materials & Methods

### 1. Study Area

Research was conducted at four different floodplain sites of Chapra, Bihar, which are followings:-

1. Site A- Newaji Tola, Chapra
2. Site B -Rewari, Jalalpur, Chapra
3. Site C- Karu Dharu, Manjhi, Chapra
4. Site D -Devaria, Rivilganj, Chapra

Soil samples were collected as required during the period from Oct. 2022 to Sep. 2024.

- Climate: Humid Subtropical, annual floods, Ganga-Ghaghara influence.
- **Materials**
  - Followings materials used for soil sampling, which are:-
    1. Spade or auger(screw or tube or post hole type)
    2. Khurpi or Trowel.
    3. Core sampler.
    4. Sampling bags.
    5. Plastic tray or bucket.
    6. Microscope (compound microscope)
    7. Staining chemical
    8. Slide
    9. Bulb lamp
    10. Conical glass (preferably) or plastic funnel, at least 100 mm in diameter
    11. Ring stand (to hold funnel)??

- 12. Flexible rubber or plastic tubing
- 13. Spring-action hose clamp
- 14. Circular piece of wire screen to fit inside top of funnel
- 15. 2-Ply facial tissue (without moisturizing lotion)
- 16. Pasteur pipettes and bulbs
- 17. Petri plate or watch glass
- 18. Microscope slides and cover slips
- 19. Clear nail polish
- 20. Alcohol lamp
- 21. Stereomicroscope (dissecting microscope)

### Soil sampling

**Depth:** 0-15 cm

**Sample Size:** 24 composite soil sampling

**Preservation:** sampling stored at 4 degree Celsius for micro faunal analysis.

### Microfauna Extraction

**Nematodes:** Baermann Funnel technique

**Arthropods:** Tullgren or Berlese funnel method

**Protozoa:** Soil dilution plating

### Laboratory Analysis

- **Diversity indices:** Shannon –Wiener index
- **Soil Nutrients:**
  1. Nitrogen (Kjeldahl method)
  2. Phosphorous (olsen method)
  3. Organic carbon(Walkley- Black)
  4. Micronutrients (Zn, Fe, Mn via AAS)

### Crop Nutrients Analysis

- Fe, Zn
- Protein
- Carbohydrates
- Ca and Mg

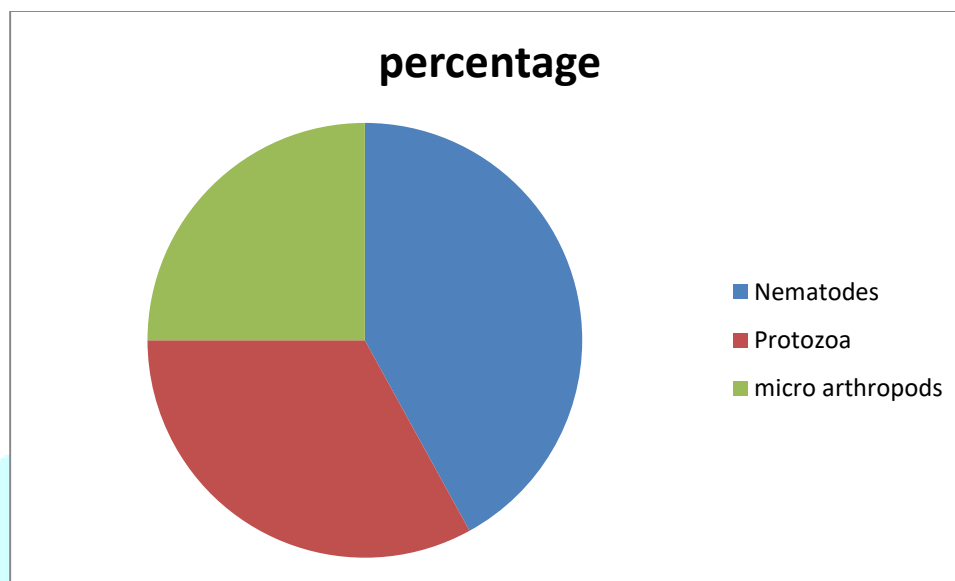
### Data Analysis

- Correlation between microfauna abundance and soil nutrients.
- Correlation between soil nutrients and crop nutrient density.
- Statistical tools: Excel, SPSS

## RESULTS

### Diversity and Abundance of Soil Microfauna

- Total microfauna recorded: **56 species** (nematodes 42%, protozoa 33%, and micro arthropods 25%).
- Shannon Diversity Index ranged from **2.1 to 3.4** depending on village and season.
- Post flood soils showed **35% higher microfauna abundance** due to increased organic matter.



### Soil Chemical Properties

- pssH ranged **6.3–7.8**, ideal for microbial activity.
- SOC (Soil Organic Carbon): **0.89%–1.42%**.
- Nitrogen and phosphorus levels were significantly higher in villages with dense microfauna's populations.

### Nutritional Composition of Major Crops

- Rice protein increased by **12–18%** in microfauna-rich soils.
- Wheat zinc concentration was **1.4× higher** in high diversity plots.
- Pulses showed increased iron content (**2.1–3.3 mg/100g**) in microfauna-active soils.

### Relationship between Soil Microfauna and Crop Nutrition

- Pearson correlation between nematode abundance and soil nitrogen:  **$r = 0.78$** .
- Protozoa density strongly correlated with micronutrient content ( **$r = 0.69$**  for Zn,  **$r = 0.64$**  for Fe).

Regression model showed microfauna accounted for **32% variance in crop protein** and **29% variance in micronutrient levels**

## DISCUSSION

The study demonstrates that soil microfauna significantly influence soil fertility and crop nutrient quality in the flood plains of Chapra. High microfauna diversity enhances nutrient mineralization, especially nitrogen cycling through nematode bacteria interactions. Protozoa increased micronutrient bioavailability, improving Zn and Fe concentration in cereals. Flood plains, despite being nutrient rich, are prone to erosion and nutrient loss. However, post-flood organic deposition appears to support microfauna resurgence, leading to improved soil health. Enhanced nutrient density in staple crops directly contributes to improved household nutrition. Dietary surveys indicated reduced micronutrient deficiencies in villages with healthier soils, suggesting a clear soil-nutrition pathway.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

Soil microfauna play a vital role in enhancing nutrient availability and improving nutritional quality of crops in Chapra's flood plains. Their abundance is closely linked with soil organic carbon, flood related sediment deposition, and sustainable agricultural practices.

### Recommendations

- Promote organic farming to enhance microfauna habitats.
- Encourage reduced tillage and crop rotation.
- Implement flood resilient soil conservation plans.
- Introduce community awareness programs on soil nutrition linkages.

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