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A study on the abundance and the diversity of soil arthropods in turmeric fields of Jagityal, erstwhile Karimnagar District, Telangana

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Abstract
Insects are one of the most successful organisms. They represent almost 50% of the world's biodiversity. The present study was carried out to know the abundance, seasonal variation, evenness and richness of the arthropods in turmeric fields of Dharoor, a village situated at 18.76 N, 78.90 E in the erstwhile Karimnagar by using pitfall traps. A total of 310 insects from 13 orders were recorded during the study period from 5 plots of the study site. The abundant insect orders were Hemiptera, Collumbola, Aranea, Thysanura, Coleopteran, Orthoptera, Carrabidae, Dermaptera, Millipede and Isoptera. The hemiptera was found to occupy the highest proportion of the insect community (24%), followed by collumbola (23.22%), Coleopteran (12.25%) Thysanura (10%), Orthoptera (3.81%), Carrabidae (3.87%), Dermaptera (1.60%), Millipeda (1. 6%), Isoptera (2.90%) Lepidoptera (2.58), Araenia (9.35%) and Mantidae (1.12%). The data obtained was statistically analysed by Simpson's and Shannon- Weiner's diversity indices.

Keywords: Arthropod, pitfall, Simpson's and Shannon- Weiner's diversity indices

Introduction
Biodiversity constitutes working component of a natural ecosystem. It is a component in ecological processes such as paedogenesis, recycling of nutrients, has a moderating effect on the climate, degradation of waste, and above all, provides an index of health of an ecosystem. In addition to the repertoire of innumerable resources like food, medicines and a wide range of other useful products.

Arthropods are one of the most successful with high reproductive rate and most abundant organisms on the planet Earth with astronomical number and diversity. Arthropods are highly diversified and evolved group of organisms. Arthropods comprise the major proportion (85%) of soil food web [1]. They increase the aeration and porosity of soil; enhance plant root penetration [2]. They are good bio-indicators [3]. Insects are the most species group of animals, representing over 50% of the world's biodiversity. Ground-dwelling arthropods are better habitat predictors than arboreal arthropods.

Soil is the primary nutrient base in addition to habitat of terrestrial organisms [4]. Soil biodiversity regulates terrestrial ecosystem [5]. Soil arthropods are soil-inhabitants belonging to the classes of Crustacea, Arachnida, Myriapoda, and Insecta. They plays a major role in the above and below ground processes [6].

Since soil arthropods are susceptible to land management practices and can be used in studying environmental changes [7]. Physico-chemical factors like pH, organic matter content, texture, temperature, humidity, rainfall influence the abundance and dispersion of soil arthropods [8].

However, some of the anthropogenic activities related to land use led to the loss of biodiversity of the soil organisms either by altering the soil structure or by changing chemo-edaphic factors and that exerts negative influences on the soil fauna.

Turmeric has been used in Indian culture since the Vedic period as a spice and for various rituals. India is the highest producer and consumer of it. Its significance in India extends far beyond its role as a spice. Its cultural, medicinal, and economic importance has made it an integral part of Indian traditions and daily life. As a symbol of purity and prosperity, turmeric plays a significant role in religious and cultural ceremonies. India stands first in area and production of Turmeric, The study site Jagityal is the second most region in cultivation

followed by Nizamabad.

Materials and Methods

The present study was carried out at Turmeric fields of Dharoor village of Jagityal district (Erstwhile Karimnagar) for two years from July 2020 to February 2022. It is situated at 18.76 N, 78.90 E in the erstwhile Karimnagar district of Telangana, a state in Southern India.

The present study was carried out to know the abundance and diversity of soil arthropods in Turmeric crops by using pitfall traps. Five pitfall traps were set in selected habitats under study using a plastic glass (10 cm long, 5cm diameter) 10 meters apart from each other). The soil was dug about 10 cm deep by using a spade and the glass container filled with water of about 150 mL and 1 mL of detergent fit into the hole and the trap was placed at the same level as the surface of the soil.

The traps were removed after the third day of installation and the samples were collected and kept in insect collection bottles with 10% formalin. They were sorted and preserved in the glass vials containing the alcohol (70%) and glycerin (30%) and identification was done up to the family level with the help of taxonomic keys and scientific literature. The numbers of insects of each family were recorded.

Data analysis

The diversity was calculated by using diversity indices namely: Simpson's index (D) [9], and Shannon-Wiener index (H') and Equitability index (E) [10]. The number of Arthropod species (S), the number of individuals for each species (N), α- and β-diversity indexes were calculated. The α-diversity was calculated from various indices including the Shannon-Wiener diversity index (H) that measures the species diversity within the community of an ecosystem. Simpson index (D) that gives the species dominance. As the D index increases, the diversity decreases.

Results and Discussion

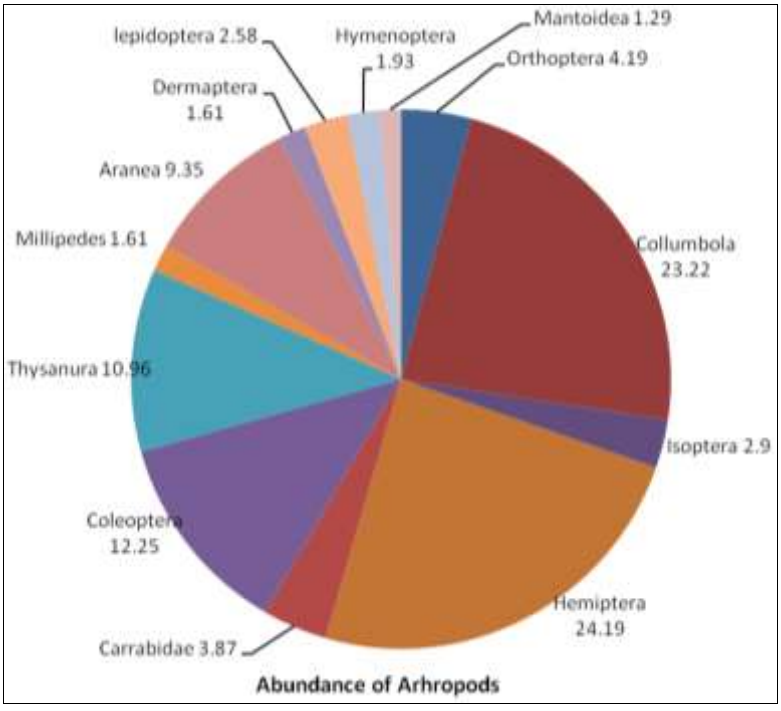
A total of 310 soil arthropods were obtained by using pitfall traps during July, 2021 to February, 2022. Twenty six species that belonged to 13 different orders were recorded. Four species of insects from order Orthroptera five Collumbola, Two species of Lepidoptera, one species of isoptera, one species of Carrabidae, one species of Thysanura, Hymenoptera,Millipeda, three species of Hemiptera, four species of coleoptera, one species in Dermaptera and one species Millipeds and one species of Aranea were obtained (Table-1).

Analysis of community structure was carried out for all arthropods collected in pitfall traps. Species richness, i,e number of species observed (2) evenness, the equitability of abundance across species, (3) diversity index, that integrate both richness and evenness.

Climatic factors, soil pollution, tillage, usage of herbicides and pesticides etc. effect soil Arthropods. Many studies have demonstrated the habitat disturbance role in richness, diversity and abundance of soil arthropods [11].The Collembola is the most abundant followed by Orthoptera and Coleoptera. Collembola and Orthoptera contain nearly all soil arthropods, as they flourish in all tropic levels of the soils below ground detritus food web [12]. The present findings are in accordance with the previous reports [13].

Table 1: Showing the abundance and distribution of soil arthropods

Order	No of species	No of individuals	Percentage
Orthoptera	4	13	4.19
Collumbola	5	72	23.22
Isoptera	1	09	2.90
Hemiptera	3	75	24.19
Carrabidae	1	12	3.87
Coleoptera	4	38	12.25
Thysanura	1	34	10.96
Millipedes	1	05	1.61
Aranea	1	29	9.35
Dermaptera	1	05	1.61
Lepidoptera	2	08	2.58
Hymenoptera	1	06	1.93
Mantoidae	1	04	1.29



Pie diagram 1: Showing the relative distribution of different soil arthropods

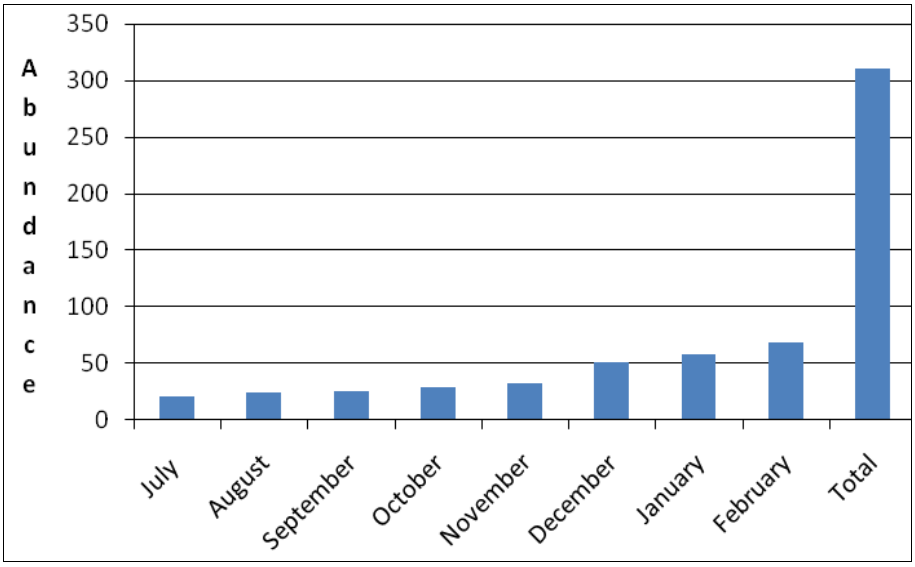


Fig 2: Seasonal Abundance of soil Arthropods

Low abundance and diversity may be linked to land use management and the hottest climatic conditions during March, April and May and the low abundance may be attributed to these conditions. Analysis of community structure was completed for all arthropods collected. Species richness, evenness, and diversity index were studied. The Simpson index D value was calculated as 0.15. Shannon's H value was 2.10 and equitability index was found to be 0.84.

Conclusion

The present investigation revealed that the relative abundance of the insect orders is highly varied with the taxonomic identity. The hemiptera was found to occupy the highest proportion of the insect community (24%), followed by collumbola (23.22%), Coleopteran (12.25%) Thysanura (10%), Orthoptera (3.81%), Carrabidae (3.87%), Dermaptera (1.60%), Millipeda (1. 6%), Isoptera (2.90%) Lepidoptera (2.58), Araenia (9.35%), Mantidae was the least abundant (1.12%) order in collected community. A total of 310 insects from 13 orders were recorded during the study period of 2 years, from July, 2021 to February, 2022, from all the 5 plots of the study site. The present study was concentrated only on 13 orders. The abundant insect orders were Hemiptera, Collumbola, Aranea, Thysanura, Coleopteran, Orthoptera, Carrabidae, Dermaptera, Millipede and Isoptera. These insects were associated with the above-ground vegetation and litter of the crop field. The Simpson index D value was calculated as 0.61. Shannon's H value was 1.61 and equitability index was found to be 0.39. The Simpson index D value was calculated as 0.15. Shannon's H value was 2.10 and equitability index was found to be 0.84.

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