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# Importance of Soil Mesofauna in Agriculture Ecosystem

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## Abstract

The soil mesofauna play a significant role to keep our soil healthy and fertile and it may represent as much as 85 percent population. The meso fauna comprises of variety of mites, collembolans, diplurans and proturans. Amongst soil meso arthropods, the Acarina and the Collembolans are the most diverse and abundant group. They play key role in liberating nutrients and increase productivity within the agriculture and forest ecosystem by breakdown process. Worldwide, a total number of 8,600 described species of Collembola and 1,130 individuals belong to 92 species, 47 genera and 16 families of soil mites were noted. Here in this review an effort took to begin and highlight the significance of arthropods as valuable creature of the soil fauna. Such noteworthy appreciation may largely vague from the public knowledge.

## Introduction

Soil arthropods are the most species rich groups in agriculture ecosystems. They play significant role as decomposer, due to their feeding activities; nutrient regeneration and better soil structure took place which have been well documented. Their adaptability and pervasive nature in varied soil conditions of different ecosystems have been reported by several ecologists. These soil dwelling creatures embrace an extensive range of guilds, comprising specialized and polyphagous predators, parasites, phytophages, fungivores, microbivores, saprophages, detritivores and omnivores which sustain and thrives in the habitable zones of soil and play various pivotal roles. These soil arthropods which reside in soil are acknowledged for many ecosystem services. These tiny creatures not only keep our soil healthy and fertile but many are known to promote growth in plant, some induces resistance for several disease and pests and many fights pathogens and devours parasitic nematodes. In terms of soil fauna arthropods may represent as much as of 85% population. The Macro, meso and micro arthropods involves in significant work of cutting, chopping, grinding and decomposition of litter and most importantly mineralization of various nutrients. The soil arthropods comprises of variety of mites, collembolans, Isopods, pseudoscorpions, centipedes, millipedes, symphylans, diplurans, proturans, hymenopterans, coleopterans and so on. They play key role in liberating nutrients and increase productivity within the agriculture and forest ecosystem (less disturbed ecosystem) by breakdown process. Amongst soil arthropods, the Acarina and the Collembolans are the most diverse and abundant group. Different soil organisms forage on diverse organic substrates and their biological activity get affected by the organic matter available to them. Nutrient exchanges of organic matter, water and soil are essential for soil fertility and

need to be preserved for sustainable process. Where the soil is extensively used for crop production without restoring the organic matter and nutrients which ultimately lead to break in nutrient cycles, decline in soil fertility and the balance of agro-ecosystem get destroyed. Therefore, a good extensive research work on soil arthropod communities and Collembola will be very worthwhile in developing management tactics for both wild and cultivated ecosystems to make soil productive.

### Soil Fauna of Collembola

The Collembola (springtails) are the most profuse entognathous, wingless insects inhabiting the soil all over the world, can be found in infinite numbers from the tropics to the poles. They are plentiful in the agricultural soil and their density can reach 98% proportion of the total density of arthropods presents in soil over period of time. A total number of 8600 described species of Collembola so far reported worldwide. In Indian subcontinent their fauna represented by 299 species in 103 genera under 18 families (Janssens, 2016). They are fragile tiny creatures ranging from 4-6 mm in length. Being so diverse they can be spotted in all Zoogeographical regions of the world inhabiting a wide range of ecological niche and climate. They embraces a variety of habitats where they act as scavengers on decaying vegetation, organic decomposes and soil fungi even up in the vicinity of both south and north poles. They are key members of terrestrial ecosystems and particularly specific adherents of the soil communities, founding a significant share of the animal biomass by reaching densities up to 200 to 1800 individuals per cm<sup>3</sup>, densities surpassed by the Acarine soil population. The diversity and ecology of Collembola from the Eastern and North-Eastern part of India, and they reported a total 76 species of Collembola belonging to 38 genera and 6 subfamilies segregated from the soil and leaf-litter of the above mentioned parts of India. Among the samples collected, 28 species were found to be endemic to the said regions i.e. 36.84% total species recorded of these parts and 14.28% of total Indian fauna of collembolan. Most diverse and species rich collection of Collembola was recovered from the parts of Sikkim state which comprises 39 species under 26 genera, however least diversity was recorded in the state of Meghalaya with 11 species under 5 genera. Shyamrao et al. (2020) nicely compiled and reviewed the biodiversity and impact of conventional and newer insecticides on non-target soil mesofauna (springtails) in rice ecosystem of Varanasi region. Results revealed a total of 21 specimens under 14 genera of Collembola belonging to 7 families. The species viz., *Lepidocyrtus fimetarius*, *L. curvicollis*, *L. paradoxus*, *Proisotoma ripicola*, *Hypogastrura sonapani*, *H. viatica*, *Salina selebensis*, *Isotoma dagamae* and *I. trispinata* were the most abundant. Toldan, et al. (2015) reported that the total 96 specimens under 7 genera viz., *Proisotoma*, *Isotoma*, *Sinella*, *Cyphoderus*, *Hypogastrura*, *Knowltonella* and *Onychiurus* of Collembola

belonging to 5 families viz., Isotomidae, Entomobryidae, Cyphoderidae, Hypogastruridae and Onychiuridae were studied from different tree ecosystems.

### Soil Fauna of Mites

Population richness and diversity of soil inhabiting mites vary in relation to various environmental factors like temperature, moisture, organic matter, nutrient availability, etc. A total of 1130 individuals belong to 92 species, 47 genera and 16 families were noted. The Araneidae and Tetragnathidae were the most dominant families and *Tetragnatha mandibulata* Walckenaer 1842 (Family Tetragnathidae) the most abundant species.

### Role of Collembolans and Soil Mites in Agricultural Soil

Soil arthropods contribute and perform vast numbers of essential ecological services for the sustainable functioning ecosystem. They act as the key driving agents of nutrient cycling, regulating the dynamics of the soil organic matter, helps soil carbon sequestration and greenhouse gas emissions; altering soil physical and chemical profile and water systems, improving the amount and efficacy of nutrient procurement by the flora and ultimately enhancing plant health. These ecological services are not only essential to the functioning of natural ecosystems but it's free of costs and constitutes an important resource for sustainable agricultural systems. Maximum soil arthropods reside on soil surface. The leaves and woody materials are plenty and abundant in the soil surface. However, the underneath ground influence to detritus mass has been valued at 1.75 times that of all above ground litter inputs and roots may provide 2.3 times more nitrogen to the soil pool than the all other inputs. The nutrients available to the plants are present in soil in the form of inorganic substances. This decomposer breaks the available organic substances into inorganic form. For instance the amino acids break down in to ammonium and nitrate. The arthropods converts plant litter in to mineral forms and they mix with soil to increase nutrient concentration. Collembolans are so important reservoir of biodiversity which play an essential role in various soil ecosystem functions; additionally, it is often used as soil quality indicators. The biology of arthropods play key role in systematic and sustainable development of soil organization. They dwell and dig burrows to make pore in the soil, which increases soil water holding capacity and also create aeration of soil particle. A systematic and sustainable soil structure confirms suitable nutrient conservation, helps root infiltration, and stops surface crusting and erosion of topsoil. Arthropods affect the structural properties of soils in various ways. Some Collembola and oribatid mites are known to create active micro tunnels in the soil matrix. The micro fauna decompose the minor particles into inorganic form like N, O, S, Ca etc. The digging and burrowing

of arthropods offer channels for air movement and water infiltration and also serve to incorporate organic matter into the upper and lower soil layers. Here in this review an effort took to begin and highlight the significance of arthropods as valuable creature of the soil fauna. Such noteworthy appreciation may largely vague from the public knowledge.

### Conclusion

**L**arge numbers of meso fauna working in soil. It is primary part of ecosystems and fertile soil is very essential for flora and fauna. The main contribution of the springtails and soil mites to nutrient cycling is through direct and indirect process, as secondary decomposers. Meso fauna cut and chop the smaller particles into smaller one and dig funnel in soil. Overall its role in the soil is increasing soil fertility, maintaining

nutrient cycling, decomposition, changes of Nutrient elements into mineral, etc. In the absence of meso fauna and their activities the soil becomes deprived and goes to desertification process which is very dangerous for earth life.

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