

EXTR ACTION OF SOIL MICRO-ARTHROPODS BY TULLGREN FUNNEL

¹Pritesh Vitthalrao Kothekar ²Jayashree Dhote.

¹Research Student ²Associate professor

¹Dept. of Zoology

¹Shri Shivaji Science College Amravati

¹Shri Shivaji Science College Amravati, India.

Abstract : Nearly every soil is home to many different arthropods species. Certain row-crop soil contains several dozen species of arthropods in a square mile. Several thousand different species which may live in a square mile of forest soil. The sample was collected in the summer season and extracted the micro-arthropods with the help of modified Tullgren funnel. The identified micro-arthropods are majority belongs to the class insecta. These arthropods increase the fertility of the soil by burrowing in the soil, decomposition of soil matter and distribution of nutrient in the soil. Arthropods bite and sting are capable to trasmite systemic disease also. The identified arthropods are *ant*, *pauropoda*, *pseudoscorpion*, *termite* and *rove beetle*. Aim of the study is to observed the behaviour of micro-arthropods and distribution of nutrient in soil by micro-arthropods.

Keywords: micro-arthropods, Tullgren funnel, insect.

I. Introduction

Many bugs, known as arthropods, make their home in the soil. They get their name from their jointed (arthros) legs (podos). Arthropods are invertebrates, that is, they have no back bone, and rely instead on an external covering called an exoskeleton.

Arthropods range in size from microscopic to several inches in length. They include insects, such as springtail, beetles and ants; crustaceans such as sowbugs; arachnids such as spiders and mite; myriapods such as centipedes, millipedes and scorpions.

Nearly every soil is home to many different arthropods species. Certain row-crop soil contains several dozen species of arthropods in a square mile. Several thousand different species which may live in a square mile of forest soil.

Arthropods can be grouped as shredders, predators, herbivores, and fungal-feeder, based on their function in soil. Most soil-dwelling arthropods eat fungi, worm or other arthropods. Root-feeder and dead-plant shredders are less abundant. As they feed, arthropods aerate and mix the soil, regulate the population size of other soil organisms and shred organic material.

Characters and classification:-

Phylum arthropoda (gr. Arthros= jointed; pods= foot) contains the great majority of the known animals, about one million species, and many of them are enormously abundant as individuals. It includes such common and well-known forms as the crabs, shrimps, insects, spiders, scorpions, ticks, centipedes, as well as a host of other less familiar forms. Cuvier (1800) placed all these animals together with annelida under the group articulate. Van siebold (1945) separated annelida from articu-lata. Annelida were placed under class vermes while the crustacea, arachnida and insecta under an independent group, the arthropoda.

General characters:-

1. Arthropoda are triploblastic. Bilaterally symmetrical, metamericly segmented animal.
2. Body is covered with a thick chitinous cuticle forming an exoskeleton.
3. Body segments usually bear paired lateral and jointed appendages.
4. Musculature is not continuous but comprises separate striped muscles.
5. Body cavity is haemocoel. The true coelom is reduced to the spaces of the organs.
6. Digestive system complete; mouthparts adapted for various modes of feeding.
7. Circulatory system open with a dorsal heart, arteries and blood sinuses.
8. Respiration by general body surface, gills, tracheae or book-lungs.
9. Excretory organs are green glands or malpighian tubules.
10. Nervous system with a dorsal nerve ring and a double ventral nerve cord.
11. Cilia are entirely absent from all parts of the body.
12. Sexes are generally separate and sexual dimorphism is often exhibited by several forms.
13. Fertilization is internal. Development is usually indirect through larval stages.
14. Parental care is also often will marked in many arthropods.

By nearly any measure, the most successful animal on the planet are the arthropods. They have conquered land, sea, and air, and make up over three-fourth of all currently known living and fossil organism, or over one million species in all. Since many arthropod species remain undocumented or undiscovered, especially in tropical rain forest, the true number of living arthropod species is probably in the term of millions. One recent conservative estimate puts the number of arthropod species in tropical forest at 6 to 9 million species (thomas, 1990).

Soil arthropods are a vital link in food chain as decomposer and without these organism nature would have no way of recycling organic significance material on its own. The process of decomposition are controlled largely by soil arthropods in conjunction with some soil invertebrates like protozoa and worms which also contribute to the soil community by mixing, loosening and aerating the soil. Arthropods also serve as the largest prey base for small predators, thus sustaining other arthropods. Without arthropods most terrestrial ecosystems would rapidly collapse. Arthropods have been able to fill every niche available in the ecosystem. They inhabit different protocol required to survey arthropods in different niches. The berlese tullgren funnel instrument is one of the most frequently used in the assessment of micro soil dwelling arthropods. It is best for extracting soil micro arthropods with efficiency of about 90%.

Tullgren funnel:- berlese – tullgren extraction is used to separate arthropods from litter and soil samples. Arthropods can be extracted from almost any moist substrate (nest material, decaying wood, fungi. Etc.) Using a berlese – tullgren or similar type of apparatus. Unlike many of the arthropod sampling protocols presented here, the berlese- tullgren apparatus extracts arthropods from a standard volume of substrate. The quantitative data (number of specimens) collected are scalable abundance measures for each species extracted from the sample.

A modified tullgren apparatus, based on the berlese funnel (thus often called berlese- tullgren funnel), and its various modifications, is the most commonly used method for separating arthropods from soil and litter. The essential component of these extractors is a sample container with wire mesh or screening on the bottom, a metal or plastic funnel in which, or over which, the sample container is placed and a collecting vessel below the funnel which usually contains a liquid preservative, generally 70-80% ethanol. A source of heat and desiccation (light bulb) is placed above the sample. The objective is to create a steep gradient of temperature and moisture throughout the sample. Arthropods react to the heat and desiccation by moving downward (away from heat) and eventually fall through the screen at the bottom into the preservative. Cheesecloth below the sample and/or a baffle in the funnel can reduce debris from the sample falling into the preservative as the sample dries out or is agitated by the movement of larger organism. The wattage of light bulb used in berlese-tullgren funnel depends on the size and water content of sample and on the distance of the bulb from the sample surface.

II. REVIEW OF LITERATURE:

B. H. Rohita (1981) concludes about separating apparatus for soft body insect. The sample to be separated in place of detachable sieve at bottom lowered into a saturated magnesium sulphate both and the detachable sieve (containing the heavier fraction) is exchanged with an identical sieve. The unit then contains the separated insect sample.

Gerhard Eisenbeis and Wilfried wickard (1987) observed sowbugs are relative of crabs of lobsters. Their powerful mouthparts are used to fragment plant residue and leaf litter and 1/8 of an inch long spider lives near the soil surface where it attacks other soil arthropods. The spider's eyes are not the tip of the projection above its head.

T. P. Martin (1976) said that long, slim centipeds crawl through spaces in the soil preying on earthworm and other soft-skinned animals. Centipede species with longer legs are familiar around homes and in leaf litter.

John N. Klironomos and Bryce Kendrick (1997) investigated Temporal and spatial relationship in a maple forest soil among mycophagous microarthropods, total hyphal length, vesicular arbuscular mycorrhizal (VAM) fungus spore, microfungus diversity, root biomass and some abiotic variables (temp., water content, pH, organic matter content.)

Lee, B. H. and W. K. Lee (1981) studied on taxonomy of *Homidia* (Entomobryidae) and *Aribatai* (Cryptostigmata) collected during 1975 to 1981. Three new species of collembolan; *H. Mediasela n. sp.*; *H. grisea sp.* And one new species of *H. munda nigra*.

Choi, J.Y., M. A. Kozlov (2001) observed two proteleas species, *P. nefrens kononova* and *P. sulcatus kozlov* are recorded in 1st time in Korea.

Kim, B. J., K. Kim and K. H. Lim (1993) worked on the diverse fauna of invertebrates and systematic work on ant has been carried during 1991 and 1992 he examined all specimen collected from Chejudo province, 38 species are confirmed under the stereomicroscope, wild M8. Among them 15 species are newly recorded.

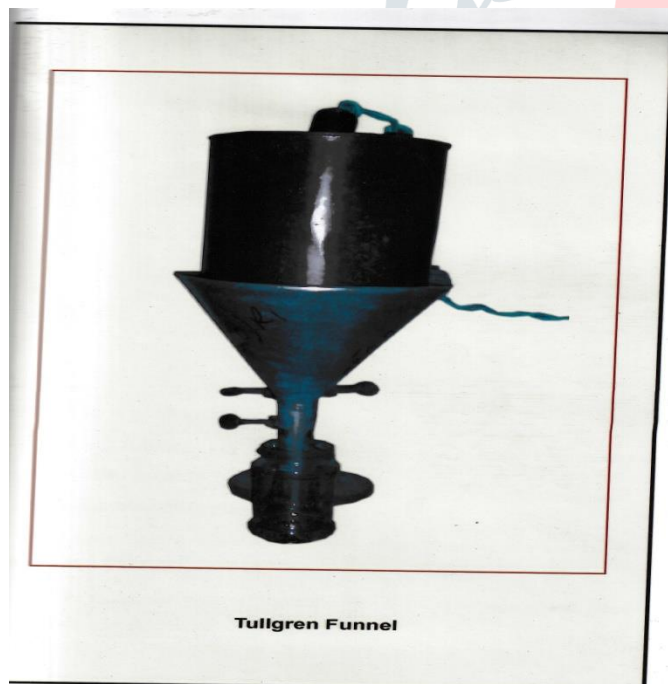
Kauzuo Ishikawa and haruko Ishikawa (1990) concluded that soil micro-arthropods, specially gamasid mites were studied in natural beech forest and a cedar plantation on Mt. Takarava. Abundance of soil micro arthropods was significantly higher in beech forest (103,025 per m²) than in a cedar plantation (22,950 per m²) . The micro arthropods fauna consisted of major taxonomic group in the beech forest and 12 in cedar plantation. Among these groups; Collembolan and Acarina were dominant and accounted for 96 and 90 percent of total animal in the beech forest and the cedar plantation respectively.

T. Ekraeken(2008) said that the introduction of sustainable development principle has lead to an increasing attention toward concepts such as soil quality and health. Soil quality is the ability of soil to function effectively as a component of a healthy ecosystem. Soil micro arthropods demonstrated to respond sensitively to land management practices and to be correlated with beneficial soil function.

Melo, Luiz Antonio Siveria and Ligo, Marco Antonio Vieira (1999) mentioned the soil core sampling by litter bags method to assess soil micro arthropods population. It tested in experimental plots of conventionally and organically grown tomato crops in Taguariuna, SP, Brazil. Soil mite and springtail population were assessed in three 20 X 10 m experimented plots for each cropping system. Using either four soil care, samples or two litter bags in each plot. A total of 30 mite and 4 springtail families were identified.

Suparoek Watanasit and Adullas Paoma (2009) studied the diversity of ant in Tarutao National Park (KNNP) located in southern part of Thailand. He identified the 22 species of 13 genera belonging to 4 subfamilies. The dominant sub family was *myrminirae* (11 speices, 5 genera) and *farmiciae* (8 species, 5 genera).

III. METHOD AND MATERIAL:



Soil arthropods were extracted with the help of modified tullgren funnel by application of heat.

1. A large metallic funnel with fine wire gauge sieve, soldered at junction of the body and the stem.
2. The funnel was held in fix position with a clamp. A beaker was placed below to receive the stem of the funnel.
3. 40 watt electric bulb was fitted above the funnel, which was enclosed in to the rounded container.

Procedure:

Known amount of soil sample i.e. 100 gm was collected from three different areas and was spread uniformly on the sieve of the funnel.

A clean beaker containing 70% alcohol was placed below the funnel. The stem of the funnel stand was kept above the alcohol level.

Bulb was switched on and soil temperature was recorded.

Left the apparatus overnight as it was.

The soil temp. was regulated by adjusting the distance between soil and the temp. with the rise of temp. the arthropods move away from the soil surface and at 50° C all of them were dropped into alcohol in the beaker.

The collected arthropods were identified and separated. The number of each species was counted for each soil sample and recorded.

IV. OBSERVATION AND RESULT :

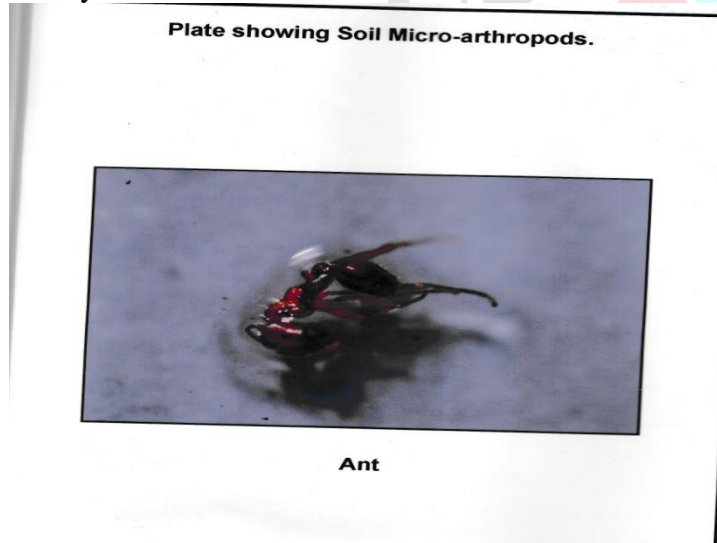
Collected arthropods were observed under microscope and identified.

The identified arthropods were counted per sample.

Arthropods	Ant	Termites	Pseudoscorpion	Pauropoda	Rove beetle
Sample 1	4	2	1	6	2
Sample 2	3	5	1	3	2
Sample 3	4	6	3	5	1

Ant

Kingdom: Animalia
 Phylum: Arthropoda
 Class: Insecta
 Order: Hymenoptera
 Suborder: Apocrita
 Superfamily: Vespoidea
 Family: *Formicidae*



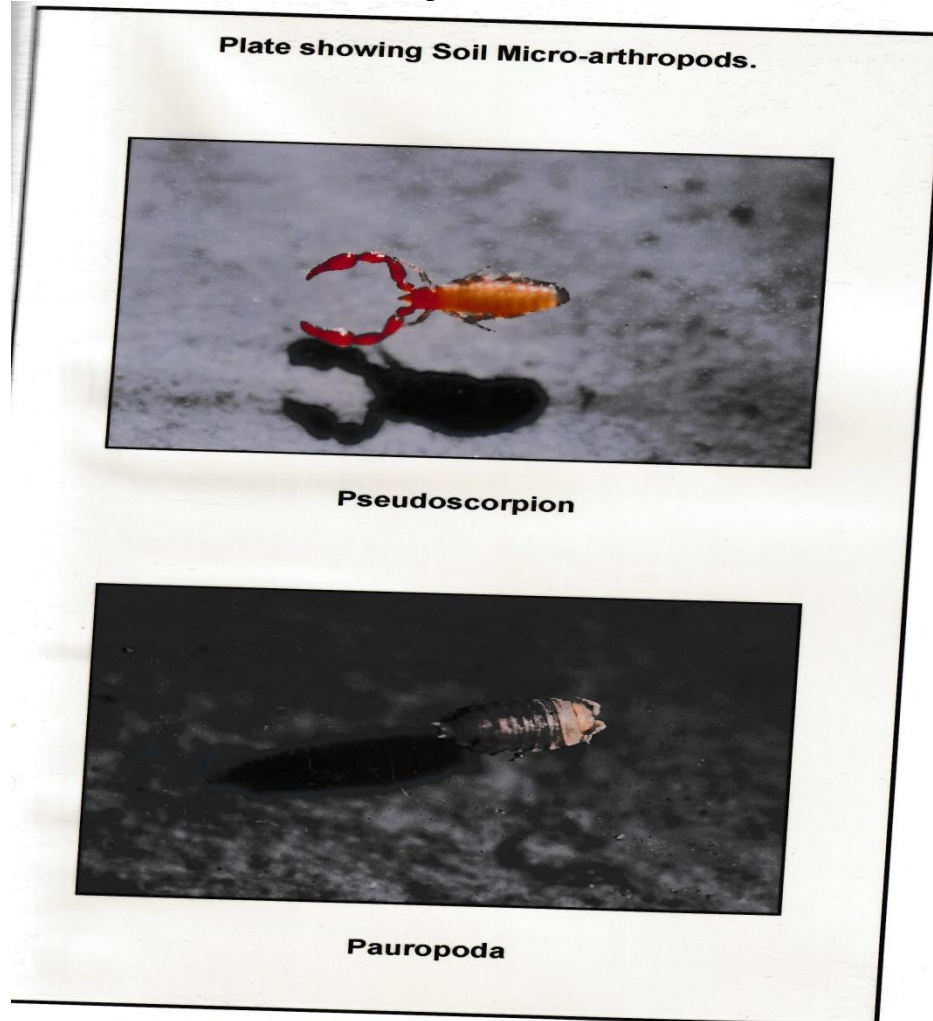
Ants are social insect of the family Formicidae and along with the related wasp and bees, belong to the order Hymenoptera. Ants evolved from wasp like ancestor in the mid-Cretaceous period between 110 and 130 million year ago and diversified after the rise of flowering plants. More than 12500 species are classified and upper estimated of species is about 22000. They are easily identified by their elbowed antennae and a distinctive node-like structure that forms a slender waist.

Ants form colonies that range in size from a few dozen predatory individuals living in small natural cavities to highly organised colonies which may occupy large territories and consist of millions of individuals. These larger colonies consist mostly of sterile females forming castes of 'workers', 'soldiers' or other specialised groups. Nearly all ant colonies also have some fertile males called 'drones' and one or more fertile females called 'queens' the colonies are sometimes described as super organisms because the ants appear to operate as unified entity, collectively working together to support the colony.

Pseudoscorpion

Kingdom: Animalia
 Phylum: Arthropoda
 Class: Arachinda
 Subclass: Dromopoda

Order: Pseudoscorpionida



A pseudoscorpion, (also known as a false scorpion or book scorpion), is an arachnid belonging to the order Pseudoscorpionida, also known as Pseudoscorpiones or Chelonethida.

Pseudoscorpions are generally beneficial to humans since they prey on clothes moth larvae, carpet beetle, booklice, ants, mites, and small flies. They are small and inoffensive, and are rarely seen due to their size.

Pauropoda

Kingdom: Animalia
 Phylum: Arthropoda
 Subphylum: Myriapoda
 Class: Pauropoda
 Order: Pauropodina

Plate showing Soil Micro-arthropods.



Termite



Rove beetle

Pauropods are small, pale, centipede-like arthropods. They form the order Pauropodina, belonging to the monotypic class Pauropoda. About 500 species in four families are found worldwide, living in soil and leaf mould. They look rather like centipedes, but are probably the sister group to millipedes. The name is derived from the Greek root *pauro* “small” and *podo* “foot”.

Termites

Kingdom: Animalia
 Phylum: Arthropoda
 Class: Insecta
 Subclass: Pterygota
 Order: Isoptera.

The termites are a group of eusocial insects usually classified at the taxonomic rank of order Isoptera (but see also taxonomy below). Along with ants and some bees and wasps which are all placed in the separate order Hymenoptera, termites divide labour among gender lines, produce overlapping generation and take care of young collectively. Termites mostly feed on dead plant material, generally in the form of wood, leaf litter, soil, or animal dung, and about 10% of estimated 4000 species (about 2600 taxonomically known) are economically significant as pest that can cause serious structural damage to buildings, crops or plantation forests. Termites are major detritivores, particularly in the subtropical and tropical regions, and their recycling of wood and other plant matter is of considerable ecological importance.

Rove beetle

Kingdom: Animalia
 Phylum: Arthropoda
 Class: Insecta
 Order: Coleoptera
 Suborder: Polyphaga
 Infraorder: Staphyliniformia

Superfamily: Staphyloidea

Family: Staphylinidae

The rove beetles are a large family (Staphylinidae) of beetles, primarily distinguished by their short elytra that leave more than half of their abdomens exposed. With over 46000 species in thousands of genera, the group is the second largest family of beetles after the Curculionidae (the true weevils). It is an ancient group, with fossil rove beetles known from the Triassic, 200 million year ago.

V. CONCLUSION:

The sample was collected in the summer season and extracted the micro-arthropods with the help of modified tullgren funnel. The identified micro-arthropods are majority belongs to the class insecta and these all organism are herbivorous. These arthropods increase the fertility of soil by burrowing in the soil. The key role of termites in decomposition has been acknowledged for a long time, they are primary consumers especially herbivores. As termites bring large quantities of dung below the soil surface, disturb and enrich soils with nutrient.

Arthropods bites and stings are capable of inflicting injury, inciting allergic reaction and transmit systemic disease.

The identified arthropods are *ant*, *pauropoda*, *pseudoscorpion*, *termite*, and *rove beetle*.

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