

DIVERSITY OF MILLIPEDES (ARTHROPOD: DIPLOPODA) FROM DISTRICT-KOLHAPUR, WESTERN MAHARASHTRA INDIA

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ABSTRACT:

The Arthropod, Class- Diplopoda, Millipedes are important as they are detritivores and play important role in decomposition of dead plant material and helps in enhancing microbial activity. It is also important to know that it plays a role in nutrient flux, it plays key role in food chain. Changes in soil conditions due to habitat destruction or fragmentation might also have major influence on millipedes as they are highly sensitive. In present study, research elucidates millipede's diversity from District-Kolhapur of Western Maharashtra, India. Two millipede's species as a Rusty millipede belonging to Order- Spirobolida and Family- Trigonulidae and Giant-Pill millipede belonging to Order- Sphaerotheriida were recorded. From these above mentioned millipedes, rusty millipede was found in large number as compared to Giant pill millipede.

Key words: - *Arthropod, Diplopoda, Millipedes, Pill millipedes, Rusty millipedes.*

INTRODUCTION:

Biodiversity plays a significant role in maintaining ecological balance. It helps in the survival of humankind and other species present in ecosystem. Biodiversity provides functioning ecosystem with several direct and indirect ecological and economic benefits to humankind (Ehrlich and Ehrlich, 1992). Tilman (1999) studied how diversity influences ecosystems and ecological processes especially over the past few years. The biological diversity helps to enrich the soil, maintain water and climatic cycles, and converting waste materials into nutrients by different processes. Soil fertility is enhanced by soil macro-fauna which makes an important contribution by promoting the stability and productivity of forest ecosystems, mainly due to their influence on soil process such as litter decomposition and nutrient dynamics (Irmler, 2000). Likewise, millipedes are also important as they are detritivores. They perform main role in decomposition of dead plant material and enhance microbial activity which is essential for nutrient

cycling (Hattenschwiler and Gasser, 2005). Millipedes were influenced by soil edaphic factors such as: texture of soil, content of soil, soil temperature, mineral content like Calcium, magnesium, humidity of soil, humus type, etc. Branquar *et. al.*, (1995) states that most diverse millipede's population helps to produce calcium rich soil. The fecal pellets of millipedes attracts endogenic earthworm (Bonkowski *et. al.* (1998)), Scheu and Wolters (1991) showed that, like *Lumbricus castaneus* and *Octolasion lacteum* earthworms incorporated fecal pellets of pill millipedes into soil and increases carbon mineralization.

Millipeds were grouped into five eco-morphological types based on the structure by Hopkin and Read, (1992); Kime and Golovatch, 2000, and the classification is as:- 1. Cylinder millipedes (bulldozers or rammers) (Julidae, Spirobolidae and Spirostreptidae) are long cylindrical forms; use their broad head a ram to burrow the soil, 2. Plated millipedes or wedgers (Polydesmidae) are short forms with

laterally expanded segments, have keels with tapered anterior part which facilitates burrowing and litter splitting, 3. Borers (Chordeumatid and colobognath millipedes) have free sternites and pleurites with strongly tapered anterior portion which helps in forward movement and widen the crevice, 4. Pill millipedes or rollers (Glomeridae and Sphaerotheriidae) roll into sphere as a defensive mechanism, which also reduces the water loss and minimizes the surface area exposed to air, 5. Bristle millipedes (Polyxenidae) are small flat, bark dwellers, lack burrowing ability and live beneath bark.

They are one of the few groups which are able to fragment dead wood and plant debris into smaller pieces, pre-processing the organic material and making it available for further decomposition by fungi, bacterial and micro-invertebrates. Millipedes are helpful in increasing fertility of soil, helps in organic farming and also these creatures interact with much diverse fauna and microbes which helps in organic matter processing (Shridhar and Ashwini, 2016).

Millipedes are common all over the world, they are particularly diverse in the tropics, worldwide distribution, 16 orders, 135 families, and close to 11,000 species of millipedes have been explored. Identifying ecologically meaningful casual factors is essential in order to explain variation in species richness along elevation gradients (Naniwadekar and Vasudevan, 2007). Telford and Dangerfield, (1993) studied the activities of millipedes are confined to upper strata because of high quality food source mate acquisition and to avoid the saturated soil condition. Henrik Enghoff (1990) studied influence of factors on body size, such as age, sex, food, latitude, altitude, habitat and co-existence with other species and also correlation between body size and ancestry. Millipeds belong to Class- Diplopoda, a highly diverse group of terrestrial organisms with over 12,000 described (Shelly, 2007; Sierwald and Bond, 2007). Millipeds are saprophagous

fauna. It is the largest class constituting the third biggest group of terrestrial arthropods after Insecta and Arachnida. In India especially from Maharashtra, there is no such proper information available on the identification, diversity and role of millipedes in forest ecosystem. Hence, the present study was undertaken to observe and identify the diversity of millipedes from District-Kolhapur Western Maharashtra.

MATERIAL AND METHODS:

Material:

For present study, material selected was Millipedes from Kolhapur district. The occurrence of millipedes was mostly from every selected site. Millipedes were collected from the study area by handpicked method. At each and every sampling time, air temperature and soil temperature were recorded at 10 cm above and at depth of the strata using mercury thermometer. After observations, these millipedes were again released into their natural environments.

Location:

The green vegetation is the very little during the period of pre-monsoon. In the green grassland vegetation, following locations was selected at different altitude. Those selected sites were as- Shivaji University campus, Katyayani, Gaganbawada, Radhanagari, Panhala, Shahuwadi, Ambaghat region from District- Kolhapur of Western Maharashtra (Plate-I, Figure- a, b, c).

Elevation: 567.246

Latitude: 16° 42' 17.9532" N

Longitude: 74° 14' 35.7108" E Time

Zone: Asia/Kolkata.

Duration:

The study was carried out during the pre-monsoon, monsoon and post-monsoon season (June to December) in every week in early morning for two years (2012-2014).

Photography:

Photography was done by the Cannon Power shot SX50 HS Black Camera.

Identification key:

Millipedes were identified by using various field guides available, from literature, Identification keys available online and Wikipedia site and through the online Google search engine.

RESULT & DISCUSSION:

In the present study, two species belonging to two different orders were recorded from different regions of District-Kolhapur, Western Maharashtra, India. A Rusty millipede belongs to Order- Spirobolida and Family- Trigiulidae and Giant-Pill millipede belongs to Order- Sphaerotheriida. The following species of millipedes were identified from the study area:

1. Giant Pill millipedes (Fig 1 and Fig 2) are from the Order- Sphaerotheriida. They are relatively large-bodied compared to most other millipedes, with only eleven to thirteen body segments, and are capable of rolling into a ball when disturbed, as a defense against predators. They can also exude a noxious liquid, which may be both caustic and toxic, to repel predators. Pill millipedes are detritivores, feeding on decomposing plant matter. Giant pill millipedes possess large compound eye and short, stout antennae. They attain maximum length of 3 to 4 cm and extremely stoutly built.

2. The rusty millipede, *Trigoniulus corallines*, (Fig 3 and Fig 4) is from Order- Spirobolida and Family- Trigiulidae. This species of millipede is a medium to large-sized millipede. The body is brick red in color with pale blank bands on the sides. The adult may grows up to 5 cm in length. It has cylindrical body with two pairs of legs on body segments, except first segment, can have as few to hundred segments. These are harmless creatures and actually those are helping breaking down dead leaves and provide organic soil for growth of plants. They mostly found during early morning with hundreds or more in groups. These millipedes inhabit moist areas, rotten wood, gardens, etc.

From all the selected sites of study area, occurrence of Rusty millipedes and Giant Pill millipedes were recorded. From this study it was observed that Rusty millipedes, *Trigoniulus corallines* were found abundantly in nature in more than hundreds to thousands individuals in a groups, during early mornings. The Giant pill millipedes were restricted to moist, humid places on soil and they were not found in groups. Wesener and Sierwal (2005) described new giant pill millipedes from Order- Sphaerotheriida form littoral forest of Madagascar. Likewise Wesener *et. al.* (2014) described seven new species of Sphaerotheriida, Anthrosphaeridae) with integrative reversion of the Giant pill millipede genus Sphaeromimus from Madagascar. Wesener T. (2016) documented all species, genera and higher categories of the Giant pill millipede Order- Sphaerotheriida. Wesener (2009) discover 31 species of Giant pill millipede endemic to Madagascar further five new species of endemic Giant pill millipedes were studied by Wesener *et. al.* (2010) from Madagascar. Choudhari *et. al.* (2014) were observed and reported four species of millipedes from Order- Polydesmida and Order- Spirobolida, two species from each order. Shelley *et. al.* (2006) reported the millipede, *Trigoniulus corallinus* (Gervais, 1847) from Florida.

CONCLUSION

The study of millipedes gives the information that how and in what way they are helpful not only to mankind but also they play very important role in maintaining healthy and moist environmental conditions. It was also seen that many species of Diplopoda are becoming at risk of endemism due to environmental changes and also due to interference of human being, hence there is need to conserve these creatures on earth from different regions. Hence, there is need to focus on conservation of Millipede and also to increase their species richness.

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<https://www.fieldmuseum.org/science/special-projects/milli-peat-class-diplopoda/milli-peat-millipedes-made-easy/milli-peat-0>
<https://www.bmig.org.uk/checklist/millipede-checklist>
https://web.archive.org/web/20070929122437/http://www.fieldmuseum.org/research_collections/zoology/zoo_sites/millipeet/pdfsFullarticles/MP10Table3.pdf
<https://australian.museum/learn/animals/centipedes/polydesmid-millipedes/>
<https://keys.lucidcentral.org/keys/v3/TFI/start%20key/key/myriapoda%20key/Media/HTML/Sphaerotheriida.html>
<https://www.discovermagazine.com/planet-earth/10-ways-this-giant-millipede-is-ballin>
 Atlas of Living Australia: Myriapoda (https://bie.ala.org.au/species/urn:lsid:bio_diversity.org.au:afd.taxon:8edaf6f6-d5f7-45b0-ac82-ef7de21b47d9)
 Tree of Myriopoda: (<http://tolweb.org/Arthropoda/2469>)
 Encyclopedia of life: Myriapoda: (<http://tolweb.org/Diplopoda/2532>)

PLATE-I



Figure: a- Map of India



Figure: b- Map of Maharashtra



Figure: c- Map of Kolhapur

PLATE-II



Fig 1: Giant Pill Millipede



Fig 2: Giant Pill Millipede



Fig 3: Rusty Millipedes in groups



Fig 4: Rusty Millipedes (Magnified)