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## Research Article

# List of Millipede Species from Southern Western Ghats of Tirunelveli District, Tamil Nadu, India

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## Abstract

**Background and Objective:** Millipedes have a crucial role in the environment especially in the forest ecosystem, unfortunately, we have very poor knowledge about it and we think it's harmful invertebrate and venomous but it's not, it is important to understand about these are eco-friendly and best decomposer in the forest ecosystem. The main objective of this work is to update species descriptions and morphological features of identified millipede species from the study area. **Materials and Methods:** Samples were collected from various locations (forest region) of Tirunelveli District, Tamil Nadu, India. Species are identified based on literature and morphological keys and listed out. **Results:** This report was exploring the 6 millipedes' morphological features and their distribution from a particular study area. A total of 6 millipede species *Gyrodrepanum lamprum* (Chamberlin, 1920), *Anoplodesmus saussurii* (Humbert, 1865), *Xenobolus carnifex* (Fabricius, 1775), *Eucentrobolus maindroni* (Bouvier, 1903), *Aulacobolus gravelyi* (Silvestri, 1916) and *Trigoniulus corallinus* (Gervais, 1847) belonging to the order Polydesmida, Spirobolida 2 families Paradoxosomatidae, Pachybolidae also of 6 genera were annotated from the tropical or agricultural scapes of Southern Western Ghats. **Conclusion:** This present research was carried out to explore the list of millipedes in part of Southern Western Ghats of Tirunelveli, India. Simultaneously we need to conserve this, It is recommended to develop a policy on the millipede species management conservation and regeneration to the diversity rates of millipedes and develop the updated documents of millipedes. A typical report will help researchers to the identification of millipedes and know their distributions.

**Key words:** Millipedes, diplopoda, morphology, *Eucentrobolus maindroni*, *Gyrodrepanum lamprum*, pachybolidae, paradoxosomatidae

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**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

Diplopoda is one of the 4th largest classes of Arthropoda and oldest as they belonged to the Devonian period and the largest among terrestrial arthropods after Chelicerata, Crustacea and Hexapoda<sup>1</sup>. Even though the class Diplopoda is most diverse among terrestrial organisms, their diversity, phylogeny and morphology are less explored than other arthropod groups<sup>2</sup>. The animals have a long history on the earth over 400 million years. Their ecological importance is immense: The health and survival of various types of mostly tropical, since they are one of the prime biological decomposers of woods and leaf litters, especially in the tropics. Despite their importance, they are very poorly known and have long been neglected in all areas of biological research. Even basic identification of specimens is a challenge<sup>2</sup>. These early representatives were detritivores and likely played a role in early soil formation and the development of terrestrial nutrient cycling<sup>3</sup>. Detritivore's millipedes continue to play a pivotal role in ecosystem processes, though herbivorous and fungivorous diets also exist among extant millipedes<sup>4,5</sup>. Millipedes are known as indicating millipedes on mental alteration as they are sensitive to a narrow change in edaphic factors<sup>6</sup>. Detritus fragmentation and nutrient recycling are two of the many functions provided by millipedes<sup>7</sup>. Millipedes can be used as a model organism in addressing many evolutionary, ecological and biological concepts. In forests, millipedes occupy 3 main habitats (the litter and soil strata, the aerial part of vegetation, barks and rotten woody stumps of fallen logs) showing a vertical distribution. The forest floor or the soil strata shows a horizontal distribution of millipedes depending on the variety and quantity of the accumulated plant litter. Unlike another soil macrofauna (e.g., earthworms and woodlice) millipedes are generally conservative and sensitive to water deficit and fail to overcome the limitation of a single edaphic factor particularly soil texture and litter thickness although other ecological conditions are congenial<sup>8</sup>. Millipedes are known to ingest plant detritus and transform them into mineral-rich

faecal pellets<sup>9,10</sup>. Ashwini and Sridhar<sup>9</sup> were reported that millipedes are important sinks for Ca and Mg as they accumulate up to 5-fold higher than their diet. Increased Ca and Mg concentration was seen in faecal pellets of *A. magna*, thus preventing elemental leaching. Saprophagous fauna is very important in soil turnover, increased soil aeration, stimulation of soil respiratory enzymes, incorporation of organic matter into the mineral horizons, dispersion of microbes in the soil and release of nitrogen and phosphorus from organic matter. Millipedes are the major saprophagous fauna distributed throughout the world. Although broad ecological conditions are favourable for saprophagous fauna, millipedes are conservative and sensitive to water deficit, soil texture and litter thickness<sup>8</sup>. Despite their priority, they are very poorly known and have long been passed over in all areas of biological research simultaneously fundamental identification of specimens is a challenge, so that this work was very needful and will helpful.

## MATERIALS AND METHODS

**Study area:** This study was conducted in Tirunelveli District from 2018-2020, covers an area of 6,823 sq. km. It lies between 08°08' and 09°23' of Northern latitudes and 77°09' and 77°54' of eastern longitudes. The Western part of Tirunelveli is covered by the Western Ghats which is a long mountainous chain continuously going up to the Madurai region. The rivers that flow in this region are Tambraparani, Chittar, Manimuttar, Virasuli, Sarugani, Kundar and Vaippar. There are various types of forests like evergreen, dry evergreen, dry deciduous, scrub, deciduous, dry evergreen, teak plantation, moist deciduous, riparian, vegetation, woodland savanna, wet evergreen, grasslands located.

**Collection methods:** Millipedes were collected from kinds of forest and landscape (10 locations) Table 1 of the entire study area. Samples were collected by handpick method. These samples were taken from decomposed litters, deadwood, all debris, soil horizon stratum and under stones, etc.

Table 1: Study areas with Taluk, locality, longitude, latitude and elevation

Divisions	Forest types	Name of locality	Longitude (°E)	Latitude (°N)	Elevation (m)/Feet
Tenkasi	Evergreen, dry evergreen	Courtallam	77.2780°E	8.9341°N	167 m/(538 f)
Ambasamudram	Evergreen, dry deciduous	Papanasam	79.2706°E	10.9269°N	121 m/(396 f)
Ambasamudram	Scrub, deciduous, dry evergreen, teak plantation	Manimutharu	77.4124°E	8.6762°N	160 m/(524 f)
Nanguneri	Evergreen, dry deciduous, moist deciduous	Kalakkad	77.5506°E	8.5152°N	130 m/(426 f)
Ambasamudram	Riparian, vegetation, evergreen	Ambasamudram	77.4530°E	8.7093°N	76 m/(249 f)
Ambasamudram	Evergreen forest	Manjolai	77.4521°E	8.7090°N	939 m/(3080 f)
Ambasamudram	Woodland savanna, dry evergreen, evergreen	Kannikatti	77.4217°E	8.6991°N	850 m/(2788 f)
Ambasamudram	Dry deciduous, riparian vegetation, evergreen	Mundanthurai	77.3413°E	8.6750°N	1800 m/(5905 f)
Ambasamudram	Wet evergreen, grasslands	Kuthiraivetti	77.2462°E	8.6167°N	1500 m/(4921 f)
Ambasamudram	Dry evergreen, evergreen	Karayar	77.3092°E	8.6493°N	1319 m/(4327 f)

After collecting these millipedes were kept in plastic sample containers (100 mL). Before that, the same container was half-filled with soil to make the same atmosphere and make some minute holes for aeration. Then the sample was rinsed with water for removing the soil, after rinsing these samples were kept in 70% ethanol for permanent preservation and morphological investigations were carried out in the laboratory using an Olympus stereo microscope. This field study was conducted from December, 2018-2020.

## RESULTS

Six millipede species *Gyrodrepanum lamprum* (Chamberlin, 1920), *Anoplodesmus saussurii* (Humbert, 1865), *Xenobolus carnifex* (Fabricius, 1775), *Eucentrobolus maindroni* (Bouvier, 1903), *Aulacobolus graveleyi* (Silvestri, 1916) and *Trigoniulus corallinus* (Gervais, 1847) belonging to the order Polydesmida, Spirobolida 2 families Paradoxosomatidae and Pachybolidae also of 6 genera were annotated from the tropical or typical forest areas and agricultural landscape of Southern Western Ghats.

### ***Gyrodrepanum lamprum* (Chamberlin, 1920)**

#### **Classification:**

**Order :** Polydesmida

**Family :** Paradoxosomatidae

**Genus :** *Gyrodrepanum* (Carl, 1932)

**Species :** *Gyrodrepanum lamprum* (Chamberlin, 1920)

**Description:** Length mostly 18.8-23.0 (♂) or 19.2-128.3 mm (♀), the width of midbody pro- and meta zone 1.6-1.9 and 1.8-2.5 mm (♂) or 1.8-2.1 and 1.9-2.8 mm (♀), respectively. Body rings-19(♂, ♀). The colouration of live animals is blackish with a pattern of posterior halves of paraterga contrasting yellow head and antennae blackish to dark brown, legs and venter light brown to pale yellow. Antennae moderately long, reaching body segment 3 (♂, ♀) when stretched dorsally. In width, head<segment 4<collum<segment 3<5<2<6-17 (♂, ♀), thereafter body gently and gradually tapering. Legs very long and slender, midbody one's 1.3-1.4 (♂) 1.1-1.2 times (♀) as long as body height, prefemora without modifications, tarsal brushes absent. Gonopods are rather simple, coxa curved caudad, sparsely setose distoventrally. Collum-A little narrower than the head. Posterior edge slightly produced caudally. Marginal rim narrow. The third somite wider than the 2nd, the keels anteriorly and posteriorly slightly shouldered at the base, caudally produced but not projecting behind the margin.

Metatergites polished. Transverse furrow deeply impressed and distinctly ribbed, running to near the base of the keels and sometimes dividing into 2 branches there. Anal somite. Epiproct is rather short and broad, rather conspicuously tapering, with concave sides and a pair of lateral preterminal tubercles (Fig.1a).

**Material examined:** Courtallam: (77.2780°E, 8.9341°N, 167 m/(538 f): 32 ♂♂ and 20 ♀♀ and 4 juveniles, Collection date: (28.9.2019), Papanasam: (79.2706°E, 10.9269°N, 121 m/(396 f): 2 ♂♂ and 16 ♀♀ and 3 juveniles, Collection date: (11.7.2020), Manimutharu: (77.4124°E, 8.6762°N, 160 m/(524 f): 8 ♂♂ and 19 ♀♀: Collection date: (16.12.2019), Kalakkad: (77.5506°E, 8.5152°N, 130 m/(426 f): 3 ♂♂ and 7 ♀♀, Collection date: (7.4.2019), Ambasamudram: (77.4530°E, 8.7093°N, 76 m/(249 f): 25 ♂♂ and 12 ♀♀ and 8 Juveniles Collection date: (29.1.2020), Mundanthurai: (77.3413°E, 8.6750°N, 1800 m/(5905 f): 2 ♀♀ Collection date: (4.4.2020), Karayar: (77.3092°E, 8.6493°N, 1319 m/(4327 f): 16 ♂♂ and 19 ♀♀, Collection date: (22.9.2020). All species collected by: B. Usha by hand (Fig.1a).

**Distribution:** India: Tamil Nadu: Tirunelveli: Southern Western Ghats: Courtallam, Papanasam, Manimutharu, Kalakkad, Ambasamudram, Mundanthurai, Karayar.

### ***Anoplodesmus saussurii* (Humbert, 1865)**

#### **Classification:**

**Order :** Polydesmida

**Family :** Paradoxosomatidae

**Genus :** *Anoplodesmus*

**Species :** *Anoplodesmus saussurii*

**Description:** Length mostly 21.8-27.0 (♂) or 24.2-29.8 mm (♀), the width of midbody pro- and meta zone 2.1-2.4 and 2.2-2.5 mm (♂) or 1.9-2.3 and 2.3-2.9 mm (♀), respectively. Body rings-19 (♂, ♀). The colouration of live animals' slight villus antennas and legs are black, passerby's pitch-black colour front and on the sides. Segments are deep black passer by pitch colour on the middle of their ventile part. Carnes and tip preanal a light-yellow segment (deviant a white dirty in dry individuals). Segment-the 2nd segment runs more in the community than any other. The 3rd and 4th fewer short segments in their milieu than 2nd but by their careers against bean crop shorter (especially in the 5th) as the following segments. Paws are brown-yellowish dirty (whitish in dry individuals). On a uniform width on 4th is 5th segment to



Fig. 1(a-f): Identified millipede species in Southern Western Ghats of Tirunelveli District, Tamil Nadu, (a) ♂ *Gyrodrepanum lamprum*, (b) ♀ *Anoplodesmus saussurii*, (c) ♀ *Xenobolus carnifex*, (d) ♂ *Eucentrobolus Maindroni*, (e) ♀ *Aulacobolus gravelyi* and (f) ♀ *Trioniulus corallinus*

15 segments, starts smaller. Antennae reaching the middle or the edge of posterior at 4th segment, article basilar short articles 2-6 segment significantly, the very small 7th. Angles posterior segments of the middle region of the body rights, protracted in some individuals in a posterior edge. Anal valves of each have 2 prettys' elevations near the anal slit. A sub-anal plate of medium sizes its hind margin around. Spineless legs are mediocre but apparently, vary in length without this variation binds to a sex difference. A wide range and short, rounded edge and thickened, projecting between the legs of the anterior segment 5th (4th pair), directed obliquely from top to bottom and front to back and forming with the direction of the body at 45 (Fig.1b).

**Material examined:** Courtallam: (77.2780°E, 8.9341°N, 167 m/(538 f): 32 ♂♂ and 20 ♀♀ and 4 juveniles, Collection date: (28.9.2019), Papanasam: (79.2706°E, 10.9269°N, 121 m/(396 f): 2 ♂♂ and 16 ♀♀ and 3 juveniles, Collection date: (11.7.2020), Manimutharu: (77.4124°E, 8.6762°N, 160 m/(524 f): 8 ♂♂ and 19 ♀♀: (Collection date: 16.12.2019), Kalakkad: (77.5506°E, 8.5152°N, 130 m/(426 f): 3 ♂♂ and 7 ♀♀, Collection date: (7.4.2019), Ambasamudram: (77.4530°E, 8.7093°N, 76 m/(249 f): 25 ♂♂ and 12 ♀♀ and 8 Juvenlies Collection date: (29.1.2020), Mundanthurai: (77.3413°E, 8.6750°N, 1800 m/(5905 f) : 2 ♀♀ (Collection date: 4.4.2020), Karayar: (77.3092°E, 8.6493°N, 1319 m/(4327 f): 16 ♂♂ and 19 ♀♀, Collection date: (22.9.2020), Manjolai:

(77.4521°E, 8.7090°N, 939 m/(3080 f): 2 ♂♂ and 2 ♀♀ and Collection date: (28.9.2020), Kuthiraivetti: (77.2462°E, 8.6167°N, 1500 m/(4921 f): 1 ♂♂, Kannikatti: (77.4217°E, 8.6991°N, 850 m/(2788 f) Collection date: (30.1.2020), All species collected by: B. Usha by hand. (Fig. 1b).

**Distribution:** India, Tamil Nadu, Tirunelveli, Southern Western Ghats, Courtallam, Papanasam, Manimutharu, kalakkad, Ambasamudram, Manjolai, Kannikatti, Mundanthurai, Kuthiraivetti, Karayar.

***Xenobolus carnifex* (Fabricius, 1775)**

**Classification:**

**Order :** Spirobolida

**Family :** Pachybolidae

**Genus :** *Xenobolus*

**Species:** *Xenobolus carnifex*

**Description:** Length mostly 74.8-76.0 (♂) or 75.2-76.8 mm (♀), the width of midbody pro- and meta zone 5.4-5.8 and 5.6-5.9 mm (♂) or 5.7-5.9 and 5.9-6.1 mm (♀), respectively. Body rings-50 (♂, ♀). The colouration of matured animals is blood-red (male)/orange (female) and black. Head, antennae, collum, ring 2, pre-anal ring, anal valves, legs blood-red/orange. Vertex between eyes black. Body rings except ring

2 laterally black, latero-basally and ventrally with a blood-red/orange stripe interrupted at the posterior margin of metazonites with irregular creamy and black patches. Metazonites greyish with irregular creamy-white markings. Antennae short, protruding back to ring 2. The relative length of antennomeres: 1<2>3>4<5<6. Mandible. Slim and elongated. Collum. Lateral margin rounded, not reaching the tips of ring 2, surface weakly punctate. Legs Coxae 1 and 2 elongated and fused with sternites. Female copulatory organ (vulva). Simple, bivalve-like, consisting of 2 simple, subequally-sized, sclerotized valves. Each valve proximo-laterally bearing 2 or 3 rows of short setae located towards the opening. 'Operculum' membranous, roughly circular with an anterior projection. Male sexual characters. Coxae 3-7 modified, in particular 3rd and 4th with long, flat, rod-shaped, Antero-mesal processes, 5th with a short, flat process, 6th and 7th with narrow, flat prominences. Podomeres from prefemur to tibia of leg-pairs 1-6 and prefemur to post femur of 7th modified with flat ventral excrescence (Fig. 1c).

**Material examined:** Courtallam: (77.2780°E, 8.9341°N, 167 m/(538 f): 5 ♂♂ and 8 ♀♀ and 4 juveniles, Collection date: (28.9.2019, 30.11.2019, 15.2.2020), species collected by: B. Usha by hand (Fig. 1c).

**Distribution:** India, Tamil Nadu, Tirunelveli, Southern Western Ghats, Courtallam.

### ***Eucetrobolus maindroni* (Bouvier, 1903)**

#### **Classification:**

**Order :** Spirobolida

**Family :** Pachybolidae

**Genus :** *Eucetrobolus*

**Species :** *Eucetrobolus maindroni*

**Description:** Length mostly 68.4-72.3 (♂) or 69.2-76.8 mm (♀), the width of midbody pro- and meta zone 5.1-5.6 and 5.5-5.7 mm (♂) or 5.6-5.8 and 5.9-6.1 mm (♀), respectively. Body rings-53 (♂, ♀). The colouration of the matured animal is Perfectly black colour, the antennae and legs are of the same colour, except for the claws, which are transparent and dark brown. Wrinkled face and punctuated, uneven, scalloped triangle on the edge of the labrum and provided with a median furrow that extends the top of the indentation and a length equal year tales thereof. Antennas are remarkable by the development of their terminal section, which is ovide as

long as the precedent and a little wider. Triangular eyes have peaks obtuse, slightly wider than half of the gap that separates them. On the face, a reduced depression accompanies the inner edge of the excavation. Collum punctuates a little emarginate but not deflected backwards to its lower end, which does not natter the free edge of the second segment. Tubers spin formes the number of 8-12 in each segment, usually 10 in number, these tubers are smooth, inflected backwards and separated by an irregular granular zone, they do not always follow a ring to the other so that one cannot distinguish the surface of the body longitudinal series regular tubers. The anterior half of each is finely wrinkled and separated by a ring groove of the wearer tubers. Legs long and strong, fitted with quite many bristles on their inner edge and a few shorter bristles on their outer side, near the top of the articulated, curved claw, roughly as long as the preceding article. Telson with epiproct inversely curved and long, thick and snout and ends near to anal segment and absence of tuberculiform over the anal segment (Fig. 1d).

**Materials examined:** (Kannikatti): (77.4217°E, 8.6991°N, 850 m/(2788 f): 1 ♀♀, Collection date: (30.11.2019), (Kuthiraivetti): (77.2462°E, 8.6167°N, 1500 m/(4921 f): 1 ♀♀, Collection date: (15.2.2020), species collected by: B. Usha by hand (Fig. 1d).

**Distribution:** India, Tamil Nadu, Tirunelveli, Southern Western Ghats, Kannikatti, Kuthiraivetti.

### ***Aulacobolus graveleyi* Silvestri, 1916**

#### **Classification:**

**Order :** Spirobolida

**Family :** Pachybolidae

**Genus :** *Aulacobolus*

**Species :** *Aulacobolus graveleyi*

**Description:** Length mostly 59.4-62.3 (♂) or 63.2-69.8 mm (♀), the width of midbody pro- and meta zone 5.9-6.6 and 6.1-6.7 mm (♂) or 6.7-7.3 and 6.9-7.5 mm (♀), respectively. Body rings-45 (♂, ♀). The colouration of the matured female body with a blackhead, feet and yards of red or brick and 32-45 segments. Head smooth, middle furrow sub continues, a small lateral shields depression, longitudinally 7 seriates compound antennae short, accommodated without exceeding the quota of softness peak. Anti-coad slightly convex outer edge of the sides of the neck, the sides of the

trunk outward slightly convex sides of the 1st segment, the 1st segment sides are short without reaching the sides of the trunk. The trunk, the segment of the bottom sides of the neck a little more than the 1st time, drawing out the sides, the longitudinal edge of the keel to form a whole, a corner of the anterior is sharp, in front ectoderm a little longer, sides of the second segment to the previous level keelback slightly thickened and produced, cylindrical other segments. Praezona all segments above small pores of the points under the body obliquely striped, metazoan smooth, set the pores hardly streaked, far under the body longitudinally striped, large pores. The ♀ body a little more tapered than the ♂, feet a little thicker (Fig. 1e).

**Materials examined:** Courtallam: (77.2780°E, 8.9341°N, 167 m/(538 f): 24 ♂♂ and 19 ♀♀, Collection date: (28.9.2019), Papanasam: (79.2706°E, 10.9269°N, 121 m/(396 f): 12 ♂♂ and 11 ♀♀, Collection date: (11.7.2020), Manimutharu: (77.4124°E, 8.6762°N, 160 m/(524 f): 9 ♂♂ and 17 ♀♀: Collection date: (16.12.2019), Kalakkad: (77.5506°E, 8.5152°N, 130 m/(426 f): 9 ♂♂ and 6 ♀♀, Collection date: (7.4.2019), Ambasamudram: (77.4530°E, 8.7093°N, 76 m/(249 f): 12 ♂♂ and 3 ♀♀ Collection date: (29.1.2020), Mundanthurai: (77.3413°E, 8.6750°N, 1800 m/(5905 f): 5 ♀♀ Collection date: (4.4.2020), Karayar: (77.3092°E, 8.6493°N, 1319 m/(4327 f): 11 ♂♂ and 14 ♀♀, Collection date: (21.9.2020). All species collected by: B. Usha by hand (Fig. 1e).

**Distribution:** India: Tamil Nadu, Tirunelveli, Southern Western Ghats, Courtallam, Papanasam, Manimutharu, Kalakkad, Ambasamudram, Mundanthurai, Kuthiraivetti.

### ***Trigoniulus corallinus* (Gervais, 1847)**

#### **Classification:**

**Order :** Spirobolida

**Family :** Pachybolidae

**Genus :** *Trigoniulus*

**Species :** *Trigoniulus corallinus*

**Description:** Length mostly 69.4-71.3 (♂) or 71.2-74.8 mm (♀), the width of the midbody and meta zone 5.9-6.6 and 6.1-6.7 mm (♂) or 6.7-7.3 and 6.9-7.5 mm (♀), respectively. Body rings-48 (♂, ♀). The colouration of the matured animal is generally red, from the head, antenna, posterior margin of somite and legs evenly semitransparent-red, central-dorsal of the body with a longitudinal black line, Mesozonit, ventral of

body and coxa of legs pale pink, prozonite white. The anterior angle of stipes of mandible obvious is clear, not round, sculpture of segments complex, ozopore in middle of somite, tarsus with pad. Eye semitransparent black, covered by the transparent red cornea. collum with lip, groove from the level of the eye to end, end sub truncate. Ventral setae of legs obvious (long and thick), Telopodite and coxae constituting L-shaped posterior gonopod, the joint between telopodite and coxae conspicuous. The middle level of telopodite with the columnar process (inner arm or medial lobe), like a grinder, porous, joint of inner arm and telopodite with a thin and helix branch, about 1.5 times length of inner arm, underside of the distal end of telopodite with a horn-shaped process, join of inner arm and telopodite with conspicuous fold and depression in interior view, prostatic groove from inner arm to the underside of coxa, through by interior tissue of joint (Fig. 1f).

**Materials examined:** Courtallam: (77.2780°E, 8.9341°N, 167 m/(538 f): 12 ♂♂ and 8 ♀♀, Collection date: (28.9.2019), Papanasam: (79.2706°E, 10.9269°N, 121 m/(396 f): 9 ♂♂ and 11 ♀♀, Collection date: (11.7.2020), species collected by: B. Usha by hand (Fig. 1f).

**Distribution:** India, Tamil Nadu, Tirunelveli, Southern Western Ghats: Courtallam, Papanasam.

## **DISCUSSION**

The present study identified 6 millipede species representing in 6 genus, 2 family and 2 orders in Southern districts of Tirunelveli District, Tamil Nadu. Forty-one species belonging to 16 genera under 5 families were reported in Nilgiri Biosphere Reserve in Tamil Nadu. Five millipede species were reported from Alagar Hills of Tamil Nadu and counted 191/m<sup>2</sup> individuals on an average. Ten millipede species were reported from the Vellore district of Tamil Nadu<sup>11</sup>. A total of 6 millipede species *Gyrodrepanum lamprum* (Chamberlin, 1920), *Anoplodesmus saussurii* (Humbert, 1865), *Xenobolus carnifex* (Fabricius, 1775), *Eucentrobolus maindroni* (Bouvier, 1903), *Aulacobolus graveleyi* (Silvestri, 1916) and *Trigoniulus corallinus* (Gervais, 1847) belonging to the order Polydesmida, Spirobolida 2 families Paradoxosomatidae, Pachybolidae also of 6 genera were annotated from the tropical or agricultural scapes of Southern Western Ghat<sup>12</sup>. which was rarely studied species and identified through male genital organs 4 millipede species were identified in polydesmida order which consists

of 3 families out of which millipedes of only one family was represented in the present study<sup>12</sup>. The available literature on the diversity of millipedes shows that 12,000 species are represented in 140 families and 16 orders<sup>2,4,12-14</sup>. However, the same is extrapolated to 80,000 species. Golovatch and Wesener<sup>15</sup> reported 279 millipedes representing 25 families in 90 genera and 11 orders whereas the same was reported in 1988 by Bandyopadhyay and Mukhopadhyaya as 161 species belonging to 59 genera, under 12 families. However, millipedes are not studied well in the recent past especially since the taxonomic efforts are inconsistent<sup>15</sup>. This is evident that in the past researchers described around 300 millipede species in a year whereas, the same was not evident. In India, very poor diversity studies are done about millipedes. We have limited keys and pieces of literature but the millipede is the best decomposer in the forest ecosystem, we have no awareness about it, because of a lack of documents. We just listed only 6 millipedes in our study area but we need to do more work even identification. This millipede comes under arthropods and it is huge in numbers. When we can identify individual millipedes, afterwards we can get the role of individual species.

To certify the reestablished and to conserve the species, even from becoming extinct. Recommended developing the documents for conservation and regeneration. Create more knowledge about millipedes for researchers and people to know the role of millipedes in the environment.

### **CONCLUSION**

Even though Tirunelveli district is among the rich biodiversity part of Southern Western Ghats of Tirunelveli district, Tamil Nadu. Many species are still existing, although no documents are listed about millipedes from this study area. In the forest ecosystem, millipedes have the most crucial role like an earthworm. Very few documents are classified about millipede's role. In common, if the diversity of species is much in the study area as differentiate the other forestry, which requires enhance the documents to support environmental health. Millipedes indicate environmental health because millipedes live in most moisture and healthy environment. Documentation about millipedes is the best result to recover the troubles. This study showed the list of millipede species from Southern Western Ghats of Tirunelveli district, Tamil Nadu.

### **SIGNIFICANCE STATEMENT**

This study was exploring the list of millipedes in Southern Western Ghats of Tirunelveli District. This study will help the

researcher to millipede identification and help to know about the role of millipedes in the environment as well as help to conserve this for making healthy environment. Through this research explore the distribution of millipedes in particular divisions.

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