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Diversity of millipedes along the Northern Western Ghats, Rajgurunagar (MS), India (Arthropod: Diplopod)

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ABSTRACT

The different vegetation type was used to identify the oligarchy among millipede species and establish that millipedes in different vegetation types are dominated by limited set of species. In the present research elucidates the diversity of millipede rich in part of Northern Western Ghats of Rajgurunagar (MS), India. A total four millipedes, *Harpaphe haydeniana*, *Narceus americanus*, *Oxidus gracilis*, *Trigoniulus corallines* taxa belonging to order Polydesmida and Spirobolida; 4 families belongs to Xystodesmidae, Spirobolidae, Paradoxosomatidae and Trigoniulidae and also of 4 genera were recorded from the tropical or agricultural landscape of Northern Western Ghats. There was *Harpaphe haydeniana* correlated to the each species of millipede which were found in Northern Western Ghats region of Rajgurunagar. At the time of diversity study, *Trigoniulus corallines* were observed more than other millipede species, which supports the environmental determinism condition. *Narceus americanus* was single time occurred in the agricultural vegetation landscape due to the geographical location and habitat differences.

Keywords: Diplopod, Northern Western Ghats, millipede diversity, *Narceus americanus*, *Trigoniulus corallines*

1. Introduction

The activities of millipedes are confined to upper strata because of high quality food source, mate acquisition and to avoid the saturated soil condition [1]. Millipedes belong to class Diplopoda, a highly diverse group of terrestrial organisms with over 12,000 destructive species and an estimated 80,000 yet to be described 145 families and 16 orders [2, 3, 4, 5]. The Diplopoda (Millipedes) is the third largest class of terrestrial Arthropoda. Millipedes act destructive plant debris and play a crucial role in soil formation process useful to the plant or crops. Several species of millipedes are as an indicator of environmental conditions and to improve the nutrients and organic matter of soil [6, 7]. The abundance of millipedes totally depends on its habitat which changes with increasing altitude [8], thereby differentiated by availability of food and vegetation structure [9]. Biodiversity is economically beneficial to the humankind by directly or indirectly [10]. Last few years, research interest focused on how diversity influences ecosystems and ecological processes which are created positively relationship near about 97% or more than [11, 12, 13, 14].

Diversity of millipedes was reported in Algar Hills Reserve Forest in Tamilnadu [15]. A little diversity of the arthropods was reported in an evergreen forest of Western Ghats, India and diurnal periodicity and distribution [16, 17, 18]. Distribution, diversity and population dynamics of chosen insects were extensively studied in Courtallam tropical evergreen forest [19]. The species richness and diversity of ant populations from different localities was studied in Western Ghats, India [20]. Also, litter arthropod diversity was reported in an evergreen forest in the Wayanael region of Western Ghats, India [16]. The Northern Western Ghats investigated that the some exotic species which were urgent need to conserve and save them. This information provided with help in understands the threatened as well as diversity and conservation of fresh water fishes [21]. In India, there is no proper information available on the diversity, distribution, identification and the role of millipede in the forest ecosystem. The main objectives of this study are to identify and provide the information of millipede diversity within Northern Western Ghats of India.

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2. Materials and Methods

Western Ghats is one of the hotspot of diversity, endowed with a rich variety of flora, fauna and microorganisms. Wide range of evergreen, semi evergreen, moist and dry deciduous forests, and grasslands spread overall. Northern Western Ghats has a very rich, unique and diverse flora and fauna, but the Northern Western Ghats diversity is yet to be fully explored. Several plants and animal species are endemic to the Western Ghats [22]. The study was carried out during the monsoon season. The green forest vegetation and grassland regeneration is very poor. In the grassland vegetation, five locations were selected at different altitude and the type of forest at Northern Western Ghats. Occurrence of millipedes' observation was made in each and every site. Millipedes were collected from the study area by handpicked method and identified by using various fields' guider, literature and Wikipedia site. At each and every sampling time, air temperature and soil temperature were determined at 10cm above and depth the strata using mercury thermometer. Standard methods were used for the richness and evenness of millipede species at different altitude.

3. Results and Discussion

In the present study total four numbers of species belongs to four genera of four families were recorded from the Rajgurunagar ecosystem of Northern Western Ghats (MS), India (Table 1). The millipede diversity of Northern Western Ghats (MS), India in which order Polydesmida belongs to two species and order Spirobolida belongs to two species were determined. As with millipedes in Northern Western Ghats millipede fauna was somewhat poorly known or not known.

The following species of millipedes were identified from the study area-

1. *Harpaphe haydeniana* (Wood, 1964) belongs to order Polydesmida and family Xystodesmidae. *Harpaphe haydeniana* (Wood) was a black colour body and both sides with patches of yellow spots. It was 4 to 5cm length and 0.1 to 0.3cm width consist of 15- 20 body segments, bearing a total 30 (male) or 31 (female) pairs of legs (Fig. 1).
2. *Narceus americanus* (Palisot de Beauvois, 1817) belongs to order Spirobolida and family Spirobolidae. It was a large and elongated or cylindrical brownish black colour body. The length of *Narceus americanus* was about 3 to 4 inches often be found in agricultural area (Fig. 2).
3. *Oxidus gracilis* (Koch, 1847) belongs to order Polydesmida and family Paradoxosomatidae. *Oxidus gracilis* was a brown colour body and patches of both sides are faint yellow spotted. It was 4 to 5cm length consists of 15- 20 body segments (Fig. 3).
4. *Trigoniulus corallines* (Gervais, 1847) belong to order Spirobolida and family Trigoniulidae. *Trigoniulus corallines* were also called as rusty millipede. It was medium to large in size; brick red in colour. It was 4 to 5cm length often be found in botanical gardens. The rusty millipedes are breed in summer and commonly sight in morning with in bunch (Fig. 4).



Fig 1: *Harpaphe haydeniana*



Fig 2: *Narceus americanus*



Fig 3: *Oxidus gracilis*



Fig 4: *Trigoniulus corallines*

Table 1: Order and family distribution of Millipede species of Northern Western Ghats, Rajgurunagar (MS), India

Millipede Species	Order	Family	Genus
<i>Harpaphe haydeniana</i>	Polydesmida	Xystodesmidae	Harpaphe
<i>Narceus americanus</i>	Spirobolida	Spirobolidae	Narceus
<i>Oxidus gracilis</i>	Polydesmida	Paradoxosomatidae	Oxidus
<i>Trigoniulus corallines</i>	Spirobolida	Trigoniulidae	Trigoniulus

All selected location of ecosystems included *Harpaphe haydeniana* and Rusty millipedes were abundant in nature. The millipede species reported from the Northern Western Ghats, total four species which were occurred currently not introduced. The millipede species were active at early morning in few months of rainy season; it means wet landscape. Most collection sites were sampled during a short period. The time using in the most cases no diplopod species collection techniques like hand collection techniques [23]. Thus, our list and especially the resultant figures were shown above must be viewed only as ephemeral efforts.

The present study of millipedes was the first of its kind and this was the first report of the elevation distribution of millipede in the Northern Western Ghats. A few studies have been carried out on their distribution, seasonal activities and litter performances [24, 25, 26, 27]. The changes in life on earth were due to abundance and diversity of organisms along the earth major environmental gradients, including those of elevation [28]. The present result reveals that the small number of millipede richness was reported and in the latest account for the ecosystem of Northern Western Ghats is a serious underestimation. As per the physical environmental condition, the closed canopy reduced the sunlight. Thus, the under storey vegetation which again results in a reduced number of potential richness. The atmospheric humidity and water streams could be the season for moderate evenness and diversity indices shown by these elevations. The agricultural pests and some endemic as well as rare snake species were well diverse in the part of Northern Western Ghats regions, Rajgurunagar [29, 30].

4. Conclusion

However, these studies demonstrate the pivotal role in biodiversity and conservation biology and many diplopod species were micro-endemics. So, they were very vulnerable to the destruction of their natural habitat. The species diversity were going extinct at accelerate and dangerous rate, because of non- natural environment changes as well as human interference. These facts of millipede diversity should motivate a fast inventory and that to be find hotspots of invertebrate diversity before they become extinct. Mostly the millipede fauna were poorly known taxonomically. There were good decomposers, especially in forest ecosystem because of millipede diversity plays important role in to maintain the healthy and moist ecosystem. The present result also highlighting that, further research would considerably improve the millipede inventory. The Northern Western Ghats (MS) is immediate need to conserve the endemic species and increase their species richness. The present millipede diversity study helps us to gauge the level of status by climatic changes.

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6. References

- Telford SR, Dangerfield JM. Mating tactics in the tropical millipede *Alloporus uncinatus* (Diplopoda: Spirostreptidae). Behaviour 1993; 124:45-56.
- Shelley RM. Taxonomy of extant Diplopoda (Millipedes) in the modern era: perspectives for future advancements and observations on the global diplopod community (Arthropoda: Diplopoda). Zootaxa 2007; 1668:343-362.
- Sierwald P, Bond JE. Current status of the myriapod class diplopoda (millipedes): taxonomic diversity and phylogeny. Ann Review of Ento 2007; 52:401-420.
- Adis J. Taxonomical classification and biodiversity. In: Adis, J. (ed.): Amazonian Arachnida and Myriapoda. Pensoft Publishers, Sofia-Moscow, 2002, 13-15.
- Shelley RM. A revised, annotated, family-level classification of the Diplopoda. Arthropoda Selecta 2002c; 11:187-207.
- Loranger-Merciris G, Imbert D, Bernhard-Reversat F, Ponge JF, Lavellae P. Soil fauna abundance and diversity in a secondary semi- evergreen forest in Guadeloupe (Lesser Antilles): influence of soil type and dominant tree species. Biology and Fertility of Soils 2007; 44:269-276.
- Seeber J, Seeber GUH, Langel R, Scheu S, Meyer E. The effect of macro- invertebrates and plant litter of different quality on the release of N from litter to plant on alpine pastureland. Biology and Fertility of Soils 2008; 44:783-790.
- Brunner H. Vogelgemeinschaften an der oberen Waldgrenze unter dem Einfluss traditioneller und modern Landnutzung im Nockgebiet (Karnten, steiermark), Carinthia, Jahrgang, 2001; 533-544.
- Blake JG, Loiselle BA. Diversity of birds along an elevation gradient in the Cordillera Central, Costa Rica. The Auk 2000; 117:663-686.
- Ehrlich PR, Ehrlich AH. The value of biodiversity. Ambio 1992; 21:219-226.
- Timan D. The ecological consequences of changes in biodiversity: a search for general principles. Ecology 1999; 80:1455-1474.
- Purvis A, Hector A. Getting the measure of biodiversity. Nature 2000; 405:212-219.
- McCann KS. The biodiversity- stability debate. Nature 2000; 405:228-233.
- Jaen-Francois P. Interaction between soil fauna and their environment, 1999; 45-76.
- Periasamy A, Ramanathan B. Diversity of millipedes in Alagar Hills Reserve Forest in Tamil Nadu, India. International Journal of Biodiversity 2013; 1-5.
- Anu A, Sabu TK, Vineesh PJ. Seasonality of litter insects and relationship with rainfall in wet evergreen forest in South Western Ghats. Journal of Insect Sciences 2009; 9.
- Kadamannar BS, Shridhar KR. Diurnal periodicity of three endemic species of pill Millipedes (Arthrosphaera) in Western Ghats, India. Tropical and Subtropical Agroecosystems 2009; 10:505-513.
- Yasuyuki N, Zoltan K. Distribution and diversity of millipedes of the Ryukyu Archipelago, with the Senkaku and Daito Island Groups: A literature review (Arthropoda: Diplopoda). Acta Arachnologia 2010; 59:73-86.
- Edwin J. Distribution, diversity and population dynamics of chosen insects in Courtallam tropical evergreen forest, [Ph. D dissertation], Madurai Kamraj University, Madurai, India, 1997.
- Gadagkar R, Chandrasekaran K, Bhat DM. Ant species

- richness and diversity in some selected localities in Western Ghats, India. *Hexpoda* 1993; 5:79-94.
21. Theurkar SV, Takalakar DL, Pawar SS and Jadhav SS. Diversity and composition of fishes of Chaskaman Dam, Rajgurunagar, part of Northern Western Ghats, Pune (MS), India. *International Research Journal of Animal, Veterinary and Fishery Sciences* 2013; 1(1):7-10.
 22. Myers N, Mittermeier A, da Fonseca CG, Kent J. Biodiversity hotspots for conservation priorities. *Nature* 2000; 403:853-858.
 23. Mesibov R, Taylor RJ, Brereton RN. Relative efficiency of pitfall trapping and hand-collecting from plots for sampling of millipedes. *Biodiversity Conservation* 1995; 4:429-439.
 24. Ashwini KM, Shridhar KR. Leaf litter preference and conversion by a saprophagous tropical pill millipede, *Arthrosphaera magna* Attemp. *Pedobiologia* 2005; 49:307-316.
 25. Ashwini KM, Shridhar KR. Seasonal abundance and activity of pill millipedes (*Arthrosphaera magna*) in plantation and semi- evergreen forest of Southern India. *Acta Oecologica* 2006; 29:27-32.
 26. Ashwini KM, Shridhar KR. Distribution of pill millipedes (*Arthrosphaera*) and associated soil fauna in the Western Ghats and west coast of India. *Pedosphere* 2008; 18:133-167.
 27. Mesibov R. The millipede genus *Lissodesmus* Chamberlin, (Diplopoda: Polydesmida: Dalodesmidae) from Tasmania and Victoria, with descriptions of a new genus and 24 new species. *Memoirs of Museum Victoria* 2006; 62:103-146.
 28. Brown JH. Mammals on mountainsides: elevation patterns of diversity. *Global Ecology and Biogeography* 2001; 10:101-109.
 29. Theurkar SV, Patil SB, Ghadage MK, Zaware YB and Madan SS. Distribution and Abundance of White grubs (Coleoptera: Scarabaeidae) in Khed Taluka, part of Northern Western Ghats, MS, India. *International Research Journal of Biological Sciences* 2012; 1(7):1-6.
 30. Ghadage MK, Theurkar SV, Madan SS, Bhor GL and Patil SB. Distribution of *Calliophis melanueus*, *Boiga trigonata*, *Coluber gracilis* and *Coronella brachyura* in western region of Khed Tahsil. *International Journal of Recent Sciences* 2013; 2 (ISC-2012):24-25.