

Centipede Diversity in Reserved Forests of Southern Kerala: A Preliminary Observation

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Abstract

The present study focuses on the southern districts of Kerala, viz., the reserved forests of Thiruvananthapuram, Kollam and Pathanamthitta for the period from May, 2021 to June, 2022. Representatives of three orders belonging to three families, six genera and 14 species have been recorded. The dominant orders reported are *Scolopendromorpha*, followed by *Scutigermorpha*. Within *Scolopendromorpha*, the genera *Rhysida* and *Digitipes* are the most abundant and enjoy a rich distribution in these areas.

Keywords: Centipedes, *Chilopoda*, *Scolopendromorpha*, *Scutigermorpha*

Introduction

The reserved forests of Kerala are home to a vast array of flora and fauna, including the fascinating and diverse group of arthropods known as centipedes. The wide array of soil types with varying degrees of moisture makes perfect habitats for different centipedes (Aswathy *et al.*, 2017). Centipedes are found in almost every corner of the world and have adapted to a wide variety of environments, from deserts to rainforests. In this context, the diversity of centipedes in the reserved forests of Kerala is a topic of great interest and importance. Centipedes are intriguing creatures and play an essential role in maintaining the ecological balance of their respective habitats (Menta and Ramelli, 2020). These arthropods are important predators, feeding on insects and other small invertebrates, and also serve as prey for larger animals such as birds, mammals, and reptiles (Edgecombe and Giribet, 2007). Thus, the study of centipede diversity in the reserved forests of Kerala can help us to better understand the overall biodiversity and ecological dynamics of the region.

The current version of ChiloBase (ChiloBase 2.0, a web-based catalogue of centipedes) accounts for 4114 valid centipede species groups globally from over 5000 published taxonomic references. Vinod Khanna (2008) validated 92

species of Scolopendromorph centipedes in the updated checklist from India. Despite the high diversity of centipedes in the reserved forests of Kerala, there has been lack of studies on their taxonomy, ecology and conservation status. This scarcity is more pronounced in the parts of the Western Ghats that stretch into the southern districts of Kerala. Despite having the largest reserve forest division in Kerala, the district Pathanamthitta is totally unexplored when compared to other districts of Kerala (Sureshan *et al.*, 2006). Dhanya and Sureshan (2018) published a checklist of 32 species of Scolopendromorph centipedes from Kerala. This constitutes 35% of the total species recorded from India and 5% of the global record.

Many studies on forest biodiversity have focused on charismatic groups such as mammals, birds, spiders and butterflies, while less attention has been given to understudied taxa such as centipedes. As a result, there is a significant knowledge gap in understanding the diversity, distribution, and ecological role of centipedes in the region (Sureshan *et al.*, 2006). Furthermore, the lack of taxonomic expertise in the region has hindered the identification of many centipede species.

Methodology

After a pilot survey in selected sites, viz., Ponmudi in Thiruvananthapuram, Thenmala in Kollam and Konni in Pathanamthitta, five random quadrats (10m x 10m each) were laid in each site (Druce *et al.*, 2007). Active sampling methods are adopted to collect the specimens from the selected quadrats seasonally (Pre-monsoon, Monsoon, and Post-Monsoon) from May 2021 to June 2022. The sampling methods include ground collection by flipping rocks and fallen wood, litter sampling, and from vegetation. The captured specimens were brought to the laboratory and fixed using ethyl alcohol. After the microscopic examination using Labomed – Luxeo 6z stereo microscope, the specimens are preserved in 70% ethyl alcohol (Dhanya and Sureshan, 2017).

For the taxonomic identification of Scolopendromorph centipedes, keys by Joshi *et al.*, (2020), Joshi and Edgecombe (2019), Dhanya and Sureshan (2018), Joshi and Edgecombe (2013), Bonato and Minelli (2004), Sureshan *et al.*, (2003), Khanna and Yadav (1997), Yadav (1993), and Würmli (1979) were utilized. The Shannon-Weiner index, dominance index, and Simpson's reciprocal index were used in these areas to compare the alpha diversity across study sites. MS Excel 2016 and Past 4.03 software package were used for the data analysis.

Soil physico-chemical parameters like soil temperature is measured by using a thermometer. For calculating pH, organic carbon and moisture, soil samples from the study sites were brought to the lab. Soil pH is determined by using a digital pH meter, soil organic carbon and moisture content is calculated using standard laboratory procedures.

Results and Discussion

The current study presents the seasonal data of centipede diversity from May 2021 to June 2022. A total of 14 species in six genera, six families and three orders (Table 2) are recorded from the study area during this period. The obtained data indicate the seasonal variation in diversity, as shown in Figure 1 and 2. The highest diversity during the post-monsoon period can be correlated with the optimum soil temperature and active reproduction of centipedes (Lewis, 1972). The highest Shannon-Wiener index value is obtained during the post-monsoon season in all sites (Figure 1) and the minimum in pre-monsoon. Simpson's reciprocal index also shows the same trend (Figure 2). Species like *Cormocephalus*

dentipes, *Digitipes jonesii*, *Rhysida aspinosa*, and *Rhysida trispinosa* are found throughout the study period and abundant in samples collected. The values of dominance (Figure 3) show a minimum in post-monsoon and high in pre-monsoon. The data substantiate that the post-monsoon season is found to be favourable for centipedes. The post-monsoon data indicates that the highest centipede diversity is found in Thenmala, Kollam (Site 2), followed by Konni, Pathanamthitta (Site 3) (Table 1).

Table 2 shows the physico-chemical properties three sites across three seasons. The vegetations of the study sites include – moist mixed semi-evergreen forest (Site 1 – Ponmudi), West coast semi-evergreen forests (Site 2 – Thenmala), and moist mixed deciduous forest (Site 3 – Konni). The soil temperatures reported in study areas vary across the seasons. The highest temperature was recorded at the site – 2 during the pre-monsoon period and lowest recorded at the site – 3 during monsoon season. The variations in the Shannon Weiner index suggest the influence of temperature on the diversity and showed a positive correlation of $r = 0.98047$ (site 1), $r = 0.25597$ (site 2) and $r = 0.72632$ (site 3). Soil moisture also influences the distribution and diversity of centipedes and followed a positive correlation trend across the seasons ($r = 0.98073$ at site 1, $r = 0.4599$ at site 2, and $r = 0.6072$ at site 3). High soil temperature and low moisture content could be the reason behind the low Shannon Weiner index at site – 2 during pre-monsoon period. The soil pH range seems slightly acidic and ranges from 4.3 to 6.49 across the seasons. It showed a significant positive correlation with Shannon diversity index in site 1 and site 3 but insignificant in site 2. In the case of OC (Organic Carbon), site 2 showed a high correlation of $r = 0.9323$, followed by site 1 with $r = 0.4423$ and site 3 with $r = 0.16898$.

Out of nine genera listed in the checklist (Dhanya and Sureshan, 2018) of Scolopendromorph centipedes from Kerala, four genera were found in the present study (Figure 4). The representatives of the genus *Asanada*, *Scolopendra*, *Ethmostigmus*, *Cryptops* and *Paracryptops* are not found. The present study recorded a *Scutigera* centipede, *Thereuopoda longicornis* from Thiruvananthapuram. A few specimens of *Geophilomorph* centipedes belonging to the genus *Mecistocephalus* were also captured. *Scutigera* and *Geophilomorpha* are the two poorly documented centipede orders with no comprehensive contribution ever done in India. Likewise, many species remain undescribed or poorly understood, making it difficult to assess their conservation status or prioritize them for conservation efforts.

Centipedes, like many other organisms, whose diversity and distribution are influenced by the land use patterns. Among the three study sites, Ponmudi (site 1), especially the lower regions contain human settlement. The diversity is not much pronounced in these areas but certain species were found abundant (*Rhysida longipes*, *Digitipes jonesii*). Likewise, extensive monoculture (Teak and Rubber) found in Thenmala (site 2) and Konni (site 3) also show similar trend in diversity. Less disturbed areas with heterogenous habitats

showed maximum diversity among study sites. Some species (*Cormocephalus westwoodi*, *Digitipes chhotanii*, and *Digitipes pruthi*) are exclusively found from these areas. Overall, the lack of centipede diversity studies in the reserved forests of Southern Kerala highlights the need for increased research and conservation efforts for these important arthropods. Such efforts could lead to a better understanding of the role of centipedes in the forest ecosystem and help to ensure their conservation for future generations.

Table 1 – Post-monsoon data of the study areas

	Site 1	Site 2	Site 3
Shannon-Wiener Index	1.908	2.276	2.15
Dominance	0.1719	0.1105	0.1255
Evenness	0.749	0.8852	0.8588

Site 1 – Ponmudi, Thiruvananthapuram

Site 2 – Thenmala, Kollam

Site 3 – Konni, Pathanamthitta.

Table 2 – List of species found in the present study

Order – Scolopendromorpha	
1	<i>Cormocephalus dentipes</i>
2	<i>Cormocephalus westwoodi</i>
3	<i>Digitipes barnabasi</i>
4	<i>Digitipes chhotanii</i>
5	<i>Digitipes coonoorensis</i>
6	<i>Digitipes jonesii</i>
7	<i>Digitipes pruthi</i>
8	<i>Ostostigmus gravelyi</i>

9	<i>Rhysida aspinosa</i>
10	<i>Rhysida longipes</i>
11	<i>Rhysida pazhuthara</i>
12	<i>Rhysida trispinosa</i>

Order – Scutigeroformorpha

13	<i>Thereuopoda longicornis</i>
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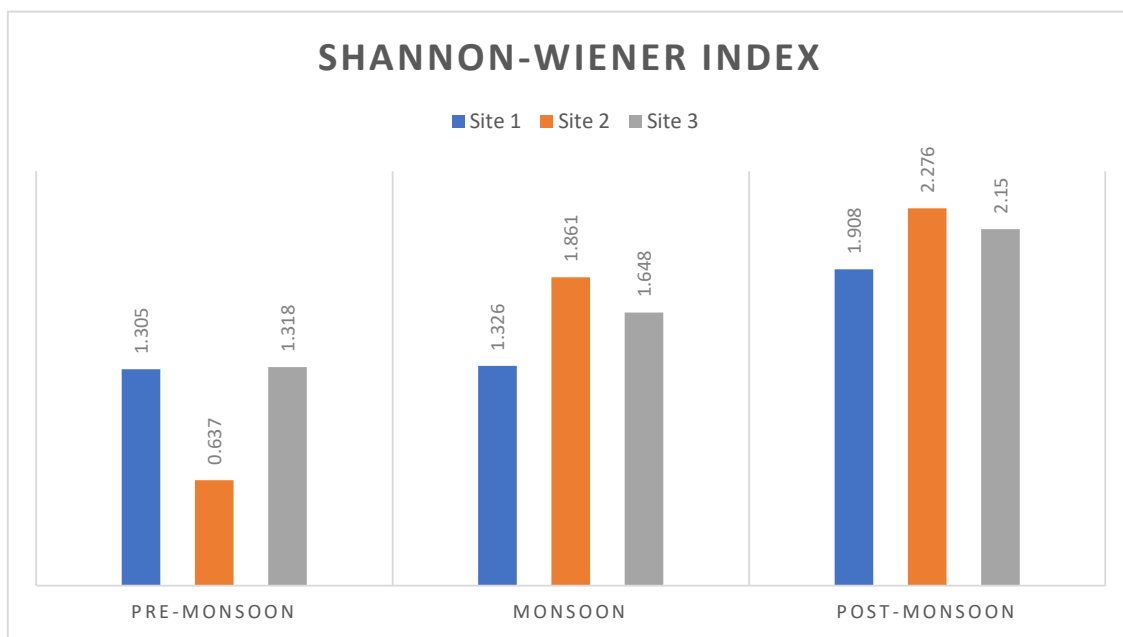
Order – Geophilomorpha

14	<i>Mecistocephalus sp.</i>
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Table 3 – Mean Shannon Diversity index and soil physico-chemical properties of three sites across three seasons.

Sites	Season	Shannon Index	Temperature	pH	OC %	SM %
Site 1	PrM	1.305	26 ⁰ C	5.77	3.8	4.89
Site 1	M	1.326	23 ⁰ C	4.3	2.73	30.34
Site 1	PsM	1.908	24.5 ⁰ C	4.97	2.22	16.27
Site 2	PrM	0.6365	27.5 ⁰ C	6.49	3.13	1.35
Site 2	M	1.861	22.7 ⁰ C	4.52	2.77	37.61
Site 2	PsM	2.276	23.5 ⁰ C	5.23	3.21	20.96
Site 3	PrM	1.318	26.4 ⁰ C	5.51	2.26	2.73
Site 3	M	1.648	21.8 ⁰ C	4.62	2.8	27.11
Site 3	PsM	2.15	24 ⁰ C	4.95	3.12	19.47

Site 1 – Ponmudi, Thiruvananthapuram; **Site 2** – Thenmala, Kollam; **Site 3** – Konni, Pathanamthitta. **PrM** – pre-monsoon; **M** – monsoon; **PsM** – post-monsoon; **OC** – organic carbon; **SM** – soil moisture.

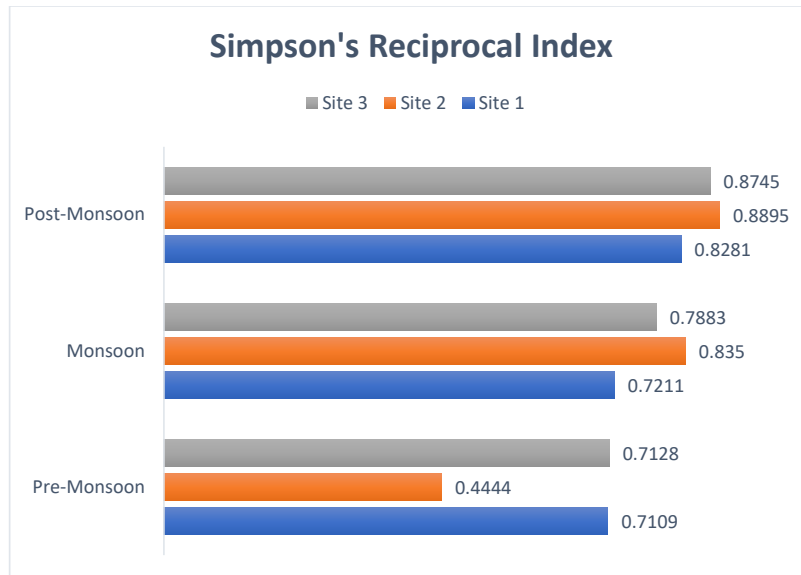


Site 1 – Ponmudi, Thiruvananthapuram

Site 2 – Thenmala, Kollam

Site 3 – Konni, Pathanamthitta.

Figure 1 – Seasonal variations of Shannon-Wiener index across Site 1, Site 2 and Site 3

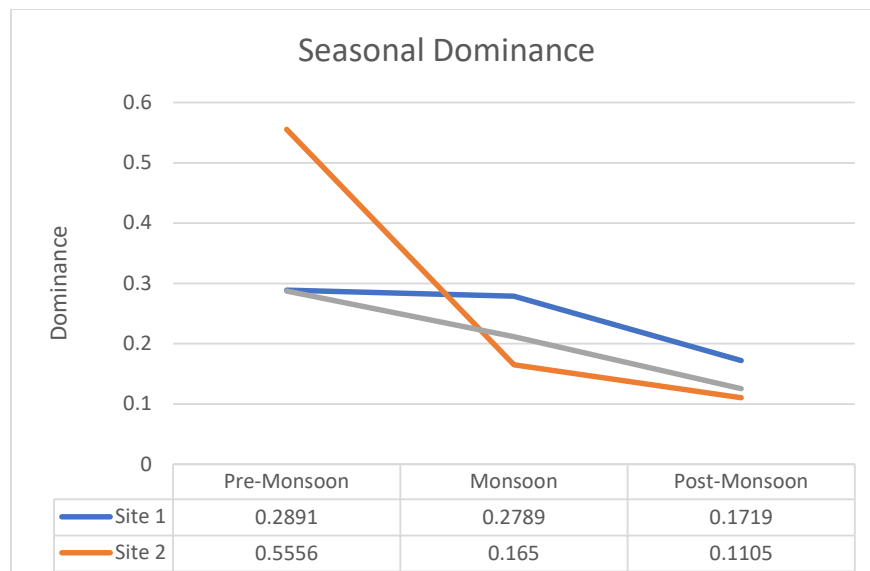


Site 1 – Ponmudi, Thiruvananthapuram

Site 2 – Thenmala, Kollam

Site 3 – Konni, Pathanamthitta.

Figure 2 – Seasonal variations of Simpson's Reciprocal index across Site 1, Site 2 and Site 3



Site 1 – Ponmudi, Thiruvananthapuram

Site 2 – Thenmala, Kollam

Site 3 – Konni, Pathanamthitta.

Figure 3 – Seasonal variations of Dominance across Site 1, Site 2, and Site 3

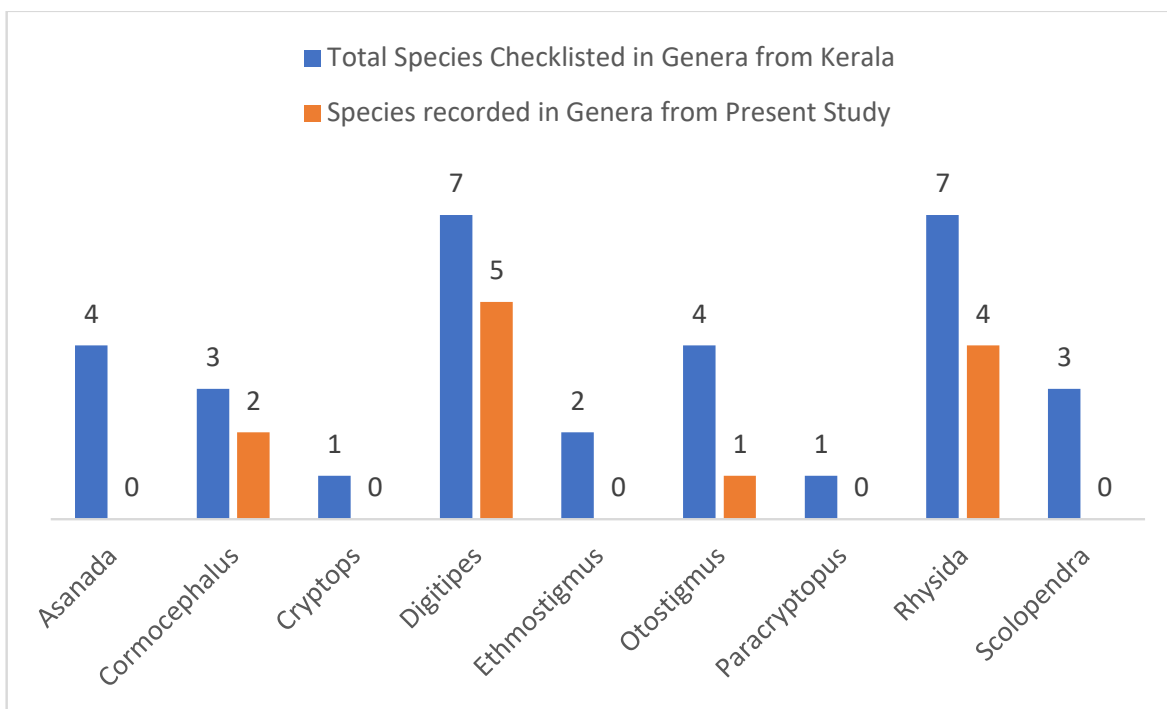


Figure 4 – Comparison of total Genera (Scolopendromorpha) checklisted in Kerala with present study records.

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