Persian J. Acarol., 15(3): 150305.

https://www.persianacarology.org

Research Article

https://biotaxa.org/pja

https://doi.org/10.22073/pja.150305

Diversity of edaphic mites (Acari: Mesostigmata) in Muthanga range of Wayanad Wildlife Sanctuary, Kerala, India

Shabana Thekkumpurath | Sobha Thalakkattil Raghavan | Praveena Karimbakkandi*

PG & Research Department of Zoology, Farook College (autonomous), affiliated by University of Calicut, Kerala, India; E-mails: tpshabana2000@gmail.com, sobharaghav72@gmail.com, praveenaprasanth1993@gmail.com

*** Correspondence**

praveenaprasanth1993@gmail.com

Received:
10 October, 2025

Accepted:
26 May, 2026

Published:
15 July, 2026

Subject Editor:
O. Joharchi

ABSTRACT

The present study was conducted to explore the diversity of edaphic mesostigmatid fauna in Muthanga range of Wayanad Wildlife Sanctuary, Kerala, India during August 2022 to March 2023. The results revealed the occurrence of 21 species of mesostigmatid mites belonging to nine families. The most abundant species belonged to genus *Stratiolaelaps* Berlese, 1916 (relative abundance: 18.3) of the family Laelapidae. The mite diversity was measured using the Shannon-Wiener and Simpson's diversity indices. The Shannon-Wiener index was 2.67 and Shannon equitability index was 0.88. The Simpson's diversity index was 0.08 and Simpson's dominance index was 0.92. The study also notes the influence of soil parameters like pH, soil temperature, organic carbon, total available nitrogen and soil texture on the abundance of mesostigmatid mites in the study area. A negative correlation was observed between soil pH and mite abundance ($r = -0.604$), whereas soil organic carbon ($r = +0.358$) and total nitrogen ($r = +0.55$) showed positive correlations with mite abundance. Soil temperature exhibited no significant relationship with mite abundance ($r = +0.069$). Chi-square test revealed a highly significant variation in abundance among different soil types ($\chi^2 = 329.25$, df = 4, $p < 0.001$). The present study highlights significant association between mite abundance and soil texture, along with the positive effects of organic carbon and total nitrogen and the negative influence of soil pH, indicating that edaphic factors play a crucial role in distribution of mesostigmatid mite communities.

KEYWORDS

Bioindication, Laelapidae, predatory mites, soil arthropods, soil ecosystem

CITE: Thekkumpurath, S., Thalakkattil Raghavan, S. & Karimbakkandi, P. (2026) Diversity of edaphic mites (Acari: Mesostigmata) in Muthanga range of Wayanad Wildlife Sanctuary, Kerala, India. *Persian Journal of Acarology*, 15(3): 150305.
https://doi.org/10.22073/pja.150305

INTRODUCTION

Mesostigmatid mites are known for their diverse ecological niches and behavior, occupying roles as predators, detritivores, and fungivores, integral to soil arthropod communities and play a crucial role in maintaining the ecological balance of terrestrial ecosystems (Koehler 1999a; Walter and Proctor 2013). The members of mesostigmatid families like Phytoseiidae and Macrochelidae primarily consume small arthropods and nematodes, demonstrating strong potential as biological control agents and are widely applied to regulate pests on crops cultivated both in greenhouses and open fields (Lindquist *et al.* 2009; Carrillo *et al.* 2010; Azevedo *et al.* 2015; Castilho *et al.* 2015; McMurtry *et al.* 2015).

Due to their sensitivity to changes in environmental conditions, mites are considered as valuable bioindicators for assessing soil health and ecosystem stability (St. John *et al.* 2006; Gulvik 2007). Their communities are characterized by a high degree of species richness, reflecting the biodiversity of their habitat. In addition, these mites are typically found in relatively large numbers, making them easier to study and more statistically reliable in ecological assessments. They can tolerate a variety of sampling and extraction procedures without significant damage or loss, which enhances the reliability of data collected from them (Koehler 1999b; Călugăr 2018).

Studies from the Caatinga biome reveal that edaphic Gamasina mite communities exhibit considerable diversity, with natural vegetation supporting the highest abundance and richness, and numerous morphospecies, many new to science, highlighting the ecological and taxonomic significance of these soil mesostigmatids (Barros *et al.* 2021). Edaphic mites exhibit higher diversity in structurally conserved land uses, confirming their sensitivity to soil disturbances and their utility as reliable indicators of soil ecosystem integrity (Lima *et al.* 2024). Mesostigmatid mite communities exhibit distinct patterns of abundance, richness, and indicator species across differently managed grasslands, confirming the strong influence of abiotic variables and management practices on soil mesofaunal diversity (Manu *et al.* 2022).

A variety of diversity indices can be used in soil ecology to assess the environmental quality and the disturbance effects on soil communities. Their application clearly reflects differences in soil community structure under varying land use types and environmental conditions. Diversity indices such as Shannon-Wiener, Simpson and Margalef, along with total abundance, were found to be higher in undisturbed habitats like orchards with greater organic matter and natural oak forests, but declined in disturbed environments such as post-harvest crop fields, indicating the sensitivity of mesostigmatid mites to habitat disturbance (Amani *et al.* 2020; Bagheri-Kordeshami *et al.* 2021).

Despite the ecological importance of mesostigmatid mites as indicators of soil health, there is a notable lack of detailed studies on their diversity and environmental determinants within the natural forest ecosystems of the Western Ghats, Kerala, particularly the protected areas like sanctuaries. Existing research from Kerala largely focuses on agricultural or plantation habitats, providing limited insight into species composition, abundance patterns, and microhabitat preferences in protected forest areas. Additionally, the influence of key soil parameters, such as pH, temperature, organic carbon, nitrogen availability, and soil texture,on mesostigmatid community structure remains poorly explored. This creates a significant gap in understanding how edaphic factors shape mite diversity in this biologically rich but understudied region.

The present study aims to explore the diversity of edaphic mesostigmatid mites in the Muthanga range of Wayanad Wildlife Sanctuary, Kerala. By examining the species composition, abundance, and diversity of these mites, along with the influence of soil parameters such as pH, temperature, organic carbon content, nitrogen availability, and soil texture, this study seeks to contribute to the understanding of soil health and ecosystem sustainability in this region. The findings of the study are expected to provide valuable insights into the ecological roles of mesostigmatid mites and their potential as bioindicators in forest ecosystems.

MATERIAL AND METHODS

Study site

The present study was conducted in two locations, Naikatty (11.660° N, 76.3150° E) and Moolankavu (11.67510° N, 76.2950° E), within the Muthanga range of the Wayanad Wildlife Sanctuary during the period of August 2022 to March 2023 (Fig. 1). The Muthanga Range, situated in the south-eastern part of Wayanad district between 11° 31' N to 11° 41' N and 76° 17' E to 76° 28' E, is characterized by undulating terrain with elevations ranging from 650 to 1,266 m above sea level, supporting diverse habitats of tropical moist deciduous forests interspersed with semi-evergreen and evergreen patches (Fig. 2). Naikatty, located at 700–800 m elevation, represents a cooler and more humid zone dominated by moist deciduous vegetation, whereas Moolankavu, situated at 650–750 m elevation, comprises similar forest types but includes additional grassland and bamboo thicket patches that enhance its floral heterogeneity. The area receives an average annual rainfall of approximately 2,300 mm, primarily during the southwest and northeast monsoons, with temperature ranging from 15 to 30 °C, creating favorable conditions for rich biological diversity.

Figure 1. Map of two sampling locations, Naikatty and Moolankavu from Muthanga range of Wayanad Wildlife Sanctuary.

Figure 2. Muthanga range of Wayanad Wildlife Sanctuary.

Sampling

Soil samples were systematically collected from two locations, Naikatty and Moolankavu, within the Muthanga range using a random sampling approach. Sampling was conducted monthly from August 2022 to March 2023, between 7:00 am and 8:00 am, resulting in a total of eight sampling events at each site. During each sampling event, three replicate samples were collected using a Mac-Fadyen corer (5 cm diameter), obtaining soil along with semi-degraded leaf litter from 10 cm depth, following the protocol of McFadden (1962). In addition to soil sampling, key environmental parameters, including pH, soil temperature, organic carbon content, total available nitrogen, and soil texture, were recorded for each sampling event.

Sample extraction and mite identification

The specimens were extracted from soil samples by modified Tullgren funnels (Haq and Ramani 2002) for 3–5 days (depending on the sample moisture) and extracted mites were transferred into 75% ethanol. The mites were cleared in 80% lactic acid and mounted in Hoyer's medium for microscope slides (Walter and Krantz 2009). Adults and immature stages of mesostigmatid mites were counted and identified with a high-power Carl Zeiss Research Microscope/Phase contrast microscope following the relevant literature with appropriate keys: Hajizadeh and Joharchi (2018), Joharchi and Negm (2020), Abo-Shnaf *et al.* (2025) (Laelapidae); Gilyarov and Bregetova (1977) (Phytoseiidae); Hyatt (1980), Karg (1993), Mašán and Fenda (2004), Gwiazdowicz (2007), Mašán (2007, 2017), Lindquist *et al.* (2009), Mašán and Halliday (2014) (Pachylaelapidae); Halliday (2015) (Uropodidae); Lekveishvili and Klompen (2006) (Sejidae).

Determination of soil parameters

Various soil parameters were analyzed to understand their influence on the abundance of mesostigmatid mites as follows: soil pH was determined using a C532 Jasco Consort pH meter, employing a potentiometric method with a 1:1 v/v soil-to-distilled water ratio; soil temperature was measured using a bimetallic soil thermometer, providing accurate readings of the in-situ conditions; soil texture was assessed using the feel method, as described by Ritchey *et al.* (2015) which involves manually gauging the soil's grain size composition; organic carbon and total nitrogen content were quantified through the dry combustion method, following the procedure outlined by Craft *et al.* (1991), with the use of a LECO Truspec CN automatic analyzer to ensure precise measurements.

Data analysis

Species richness, Shannon-Wiener and Simpson's indices were estimated using Microsoft Excel software.

Shannon-Wiener diversity index formula:

$$H' = -\sum_{i=1}^{S} p_i \ln(p_i)$$

where

S = total number of species; p_i = proportion of individuals belonging to species 'i'

$$p_i = \frac{n_i}{N}$$

n_i = number of individuals of species 'i'; N = Total number of individuals in the sample.

Simpson's diversity index (1 − D) formula:

$$D = \sum_{i=1}^{S} {p_i}^2$$

where

$$p_i = \frac{n_i}{N}$$

n_i = number of individuals of species 'i'; N = Total number of individuals in the sample; S = total number of species

The influence of the environmental parameters, such as soil pH, soil temperature, organic carbon and total available nitrogen on the abundance of mesostigmatid mites in the study area were determined by correlation analysis using Microsoft Excel software. The variation in mite abundance across different soil texture also determined by Goodness of fit Chi square test using Microsoft Excel software.

RESULTS

A total of 683 mite specimens, representing 21 species and 21 genera belonging to nine families, were collected during the current study (Table 1). Among the families, Laelapidae was the most dominant, with the species Stratiolaelaps scimitus constituting 18.3% of all individuals (Fig. 3). The distribution of species among families is illustrated in Figure 4, where Laelapidae exhibited the highest species diversity, followed by Uropodidae, Sejidae, Rhodacaridae and Parasitidae.

Table 1. List of Mesostigmatid mites and their relative abundance (%).

Species	Family	Relative Abundance
***Adenosejus* sp.**	Sejidae	0.58
***Arctoseius* spp.**	Ascidae	6.14
***Asca annandalei* Bhattacharyya & Sanyal, 2002**	Ascidae	0.9
***Clausiadinychus* sp.**	Uropodidae	0.29
***Cosmolaelaps vacua* (Michael, 1891)**	Laelapidae	5.27
***Epicroseius* sp.**	Sejidae	1.75
***Gaeolaelaps aculeifer* (Canestrini, 1884)**	Laelapidae	2.19
***Gamasodes* sp.**	Parasitidae	2.19
***Holoparasitus calcaratus* (Koch, 1839)**	Parasitidae	1.17
***Holostaspella parornata* Bhattacharya, 1972**	Macrochelidae	4.09
***Minirhodacarellus* sp.**	Rhodacaridae	7.02
***Ololaelaps venetus* (Berlese, 1904)**	Laelapidae	3.51
***Pachylaelaps dorsarlis* Bhattacharya, 1970**	Pachylaelapidae	0.87
***Parasitellus fucorum* (De Geer, 1778)**	Parasitidae	4.97
***Phaulodinychus* sp.**	Uropodidae	4.6
***Proctolaelaps scolyti* Evans, 1958**	Melicharidae	9.07
***Rhodacarellus* sp.**	Rhodacaridae	6.73
***Rhodacarus roseus* Oudemans, 1902**	Rhodacaridae	8.19
***Sejus australis* Hirschmann & kaczmarek, 1991**	Sejidae	1.31
***Stratiolaelaps scimitus* (Womersley, 1956)**	Laelapidae	18.3
***Trichocylliba morosa* Elzinga, 1995**	Uropodidae	9.51

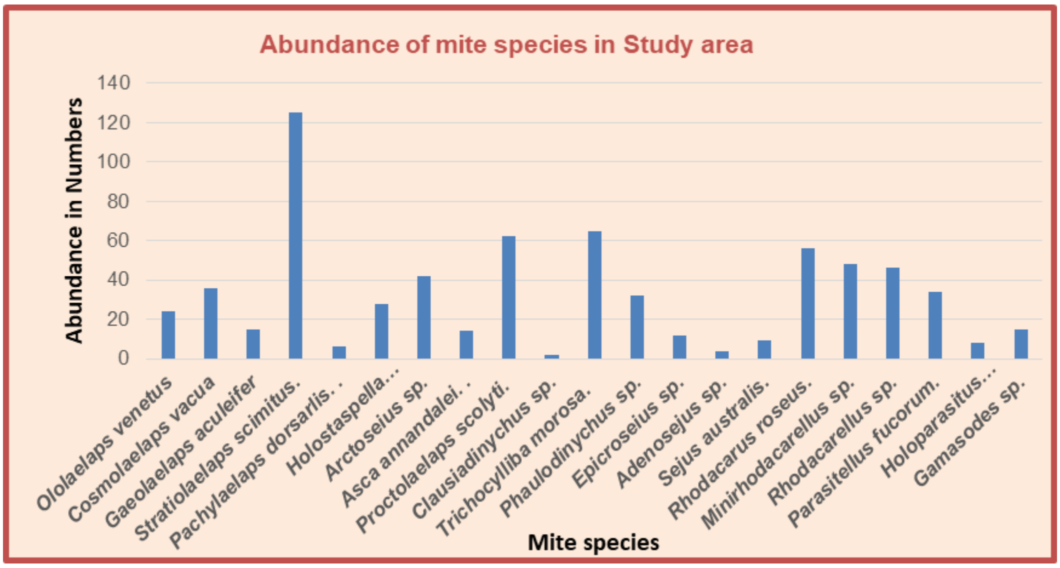


Figure 3. Abundance of mesostigmatid mite species in the study area.

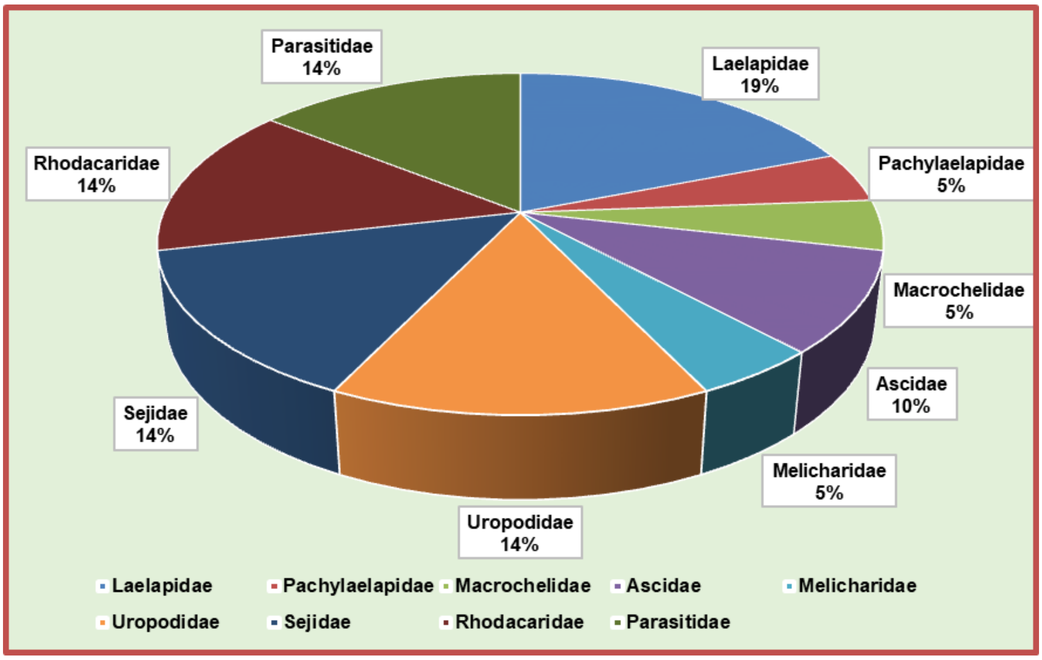


Figure 4. Abundance of mesostigmatid mite species in the study area.

The diversity indices reflected a moderately diverse and relatively even community structure. The Shannon-Wiener diversity index (H') was 2.6679, indicating moderate species diversity, while the Shannon equitability index I was 0.876, suggesting a fairly even distribution of individuals among species. In contrast, the Simpson's diversity index (1–D) was relatively low (0.08), and the Simpson's dominance index (D) was correspondingly high (0.92), demonstrating strong dominance by a few species, particularly members of the family Laelapidae.

Soil parameters exhibited varying degrees of influence on mite abundance. A negative correlation was observed between soil pH and mite abundance (r = –0.604), indicating that increasing acidity reduce mite populations (Fig. 5). In contrast, soil organic carbon (r = +0.358) and total nitrogen (r = +0.55) showed positive correlations with mite abundance, suggesting that nutrient-rich soils favour higher populations of mesostigmatid mites (Figs 6–7). Soil temperature exhibited no significant relationship with mite abundance (r = +0.069).

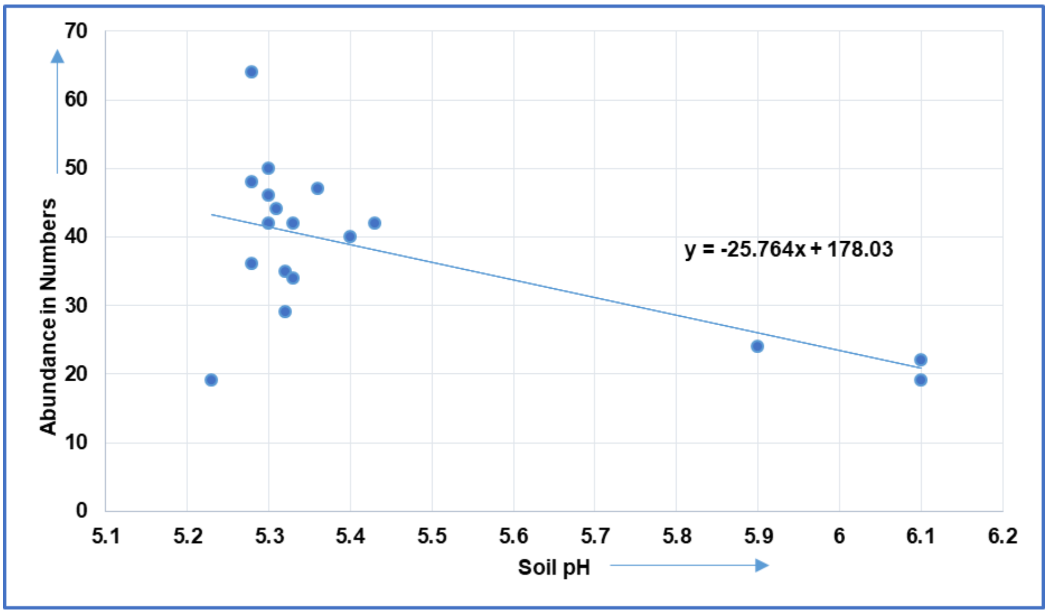
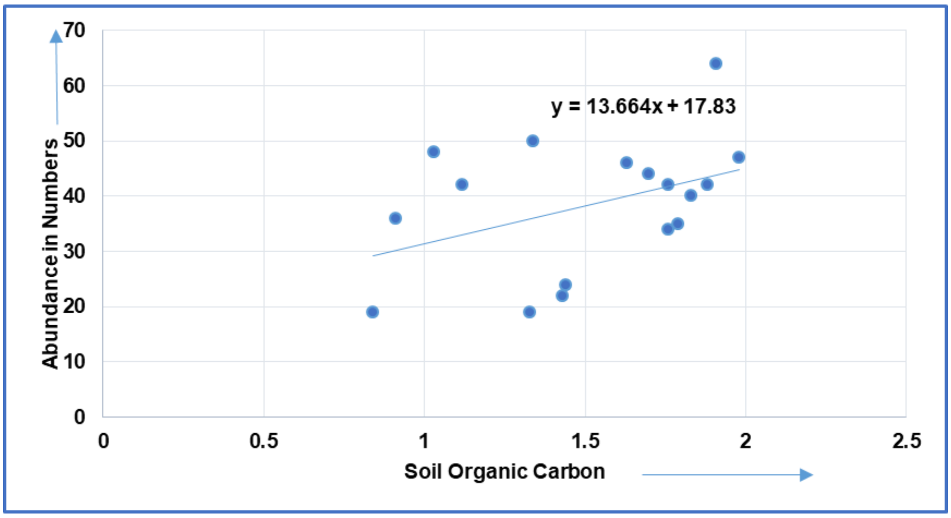
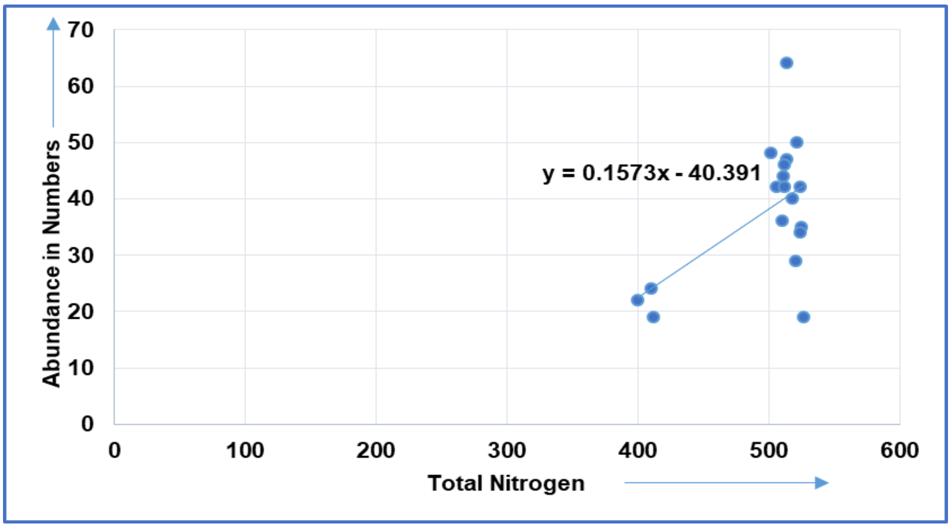


Figure 5. Correlation between mesostigmatid mite abundance and soil pH.



Figures 6. Correlation between mesostigmatid mite abundance and soil organic carbon.



Figures 7. Correlation between mesostigmatid mite abundance and total nitrogen in the soil.

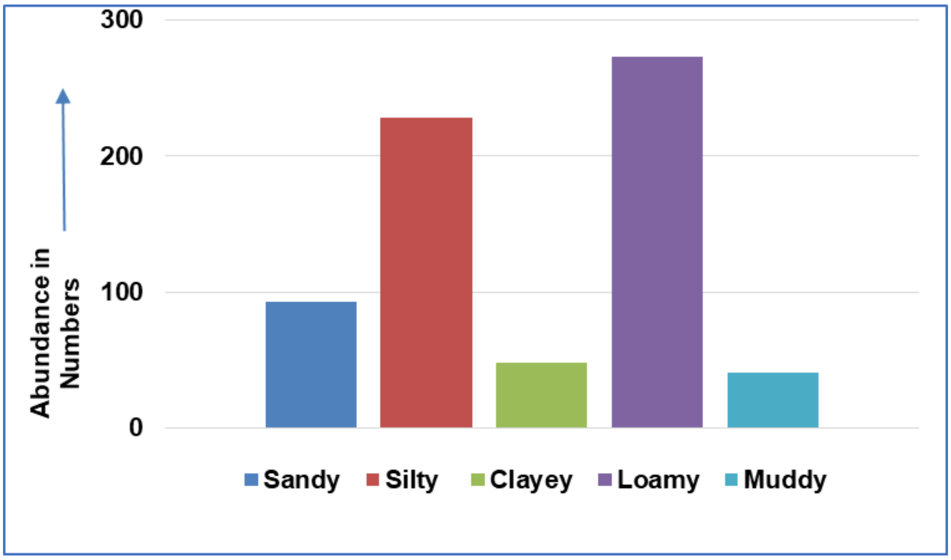


Figure 8. Abundance of mesostigmatid mites in different soil type.

Mite abundance varied significantly across different soil types (Fig. 8). Chi-square test revealed a highly significant variation in abundance among different soil types ($\chi^2 = 329.25$, df = 4, $p < 0.001$). Loamy soils supported the highest abundance, followed by silty and sandy soils, whereas clayey and muddy soils harbored substantially fewer individuals. These results indicate that loamy and silty substrates provide more suitable microhabitats for mesostigmatid mites compared to compact or water-logged soil types.

DISCUSSION

The present study demonstrates that mesostigmatid mite communities in the Muthanga range are strongly influenced by both biotic and abiotic soil factors, with soil texture and nutrient availability emerging as key determinants of species abundance and diversity. The dominance of the family Laelapidae aligns with earlier observations that the members of this family thrive in well-drained, nutrient-rich substrates where organic matter supports an active and diverse soil food web (Koehler and Sanchez 2022). The moderate Shannon–Wiener diversity index coupled with a high Simpson dominance index reflects a community structure characterized by a few dominant taxa but supported by adequate species richness to maintain ecological stability, a pattern consistent with soil mite assemblages across various terrestrial ecosystems (Gerson and Smiley 1990).

The strong correlations between mite abundance and soil nutrient parameters further highlight the ecological sensitivity of mesostigmatid mites. The positive relationships with organic carbon and total nitrogen support earlier findings that nutrient-rich soils promote diverse soil microarthropod communities by sustaining microbial productivity and detrital resources (Liu *et al.* 2018). Conversely, the negative correlation observed with soil pH suggests that increasing acidity suppress mite populations, potentially by altering microbial activity, nutrient availability, or prey distribution (Coleman *et al.* 2018). These results reinforce the value of mesostigmatid mites as bioindicators of soil fertility and chemical status, particularly in forest ecosystems where changes in soil conditions can influence broader ecological processes.

Soil texture also played a substantial role in shaping mite community structure, with loamy and silty soils supporting the highest abundance. Their balanced aeration and moisture-holding capacity appear to provide favorable microhabitats for soil-dwelling arthropods. In contrast, clayey and muddy soils likely impose physical constraints such as compaction, reduced aeration, and waterlogging, which limit mite mobility and survival. These findings align with patterns reported from other forested and agricultural landscapes, underscoring the importance of soil physical properties in regulating soil biodiversity (Behan-Pelletier 1999; Lavelle and Spain 2001). The close linkage between soil physical and chemical characteristics and mite abundance indicates that maintaining optimal levels of organic matter, preventing soil compaction, and minimizing erosion could support more diverse and functionally effective mesostigmatid communities

Overall, the study highlights the complex interactions between soil properties and mesostigmatid mite communities, suggesting that both chemical and physical soil parameters need to be considered in efforts to conserve and manage soil biodiversity. Further research could explore the specific mechanisms by which soil parameters influence mite behavior and survival, as well as the potential implications of changing soil conditions due to environmental factors such as climate change or land-use practices. The long-term monitoring of mesostigmatid mite populations and their responses to environmental changes may help to understand their role as ecological indicators and their impact on soil health and ecosystem sustainability.

ACKNOWLEDGEMENTS

We gratefully acknowledge the support of the Rashtriya Uchchatar Shiksha Abhiyan (RUSA) for providing the necessary equipment that made this research possible.

Author contributions: Methodology: ST; Sampling, collection and preparation of specimens: ST. Analyses and data curation: ST; Illustration and photography: ST, PK; writing – original draft preparation: ST; writing – revisions and editing: ST, PK, STR; supervision: STR. All authors have read and agreed to the published version of the manuscript.

Availability of data and materials: Data are available upon request from the authors.

Ethics approval and consent to participate: This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

Consent for publication: NA.

Competing interests: The authors declare no conflict of interest.

Generative AI statement: The authors declare any use of Gen AI in the creation of this manuscript.

REFERENCES

Abo-Shnaf, R., Negm, M.W. & Joharchi, O. (2025) Review of the family Laelapidae (Acari, Mesostigmata) in Egypt, and a key to the Egyptian species. *Systematic and Applied Acarology*, 30(7): 1098–1208. https://doi.org/10.11158/saa.30.7.3

Amani, M., Khajehali, J., Moradi-Faradonbeh, M. & Macchioni, F. (2020) Species diversity of soil mites (Acari: Mesostigmata) under different agricultural land use types. *Persian Journal of Acarology*, 9(4): 353–366. https://doi.org/10.22073/pja.v9i4.59610

Azevedo, L.H., Emberson, R.M., Esteca, F.D.C. & de Moraes, G.J. (2015) Macrochelid mites (Mesostigmata: Macrochelidae) as biological control agents. *In:* Carrillo, D., de Moraes, G. & Peña, J. (Eds.), *Prospects for biological control of plant feeding mites and other harmful organisms*. Progress in biological control. Vol. 19. Springer, Cham, pp. 103—132. https://doi.org/10.1007/978-3-319-15042-0_4

Bagheri-Kordeshami, A., Khajehali, J., Nourbakhsh, F. & Ardestani, M.M. (2021) Responses of soil-inhabiting mesostigmatid mites to deforestation and disturbance in oak (*Quercus brontii*) forests of southwestern Iran. *Journal of Forest Science*, 67(12): 562–569. https://doi.org/10.17221/54/2021-JFS

Barros, Á.R. de A., Azevedo, E.B. de, Silva, E.S., Castilho, R.C. & de Moraes, G.J. (2021) Diversity of edaphic Gamasina mites (Acari: Mesostigmata) in different ecosystems of the Caatinga biome in northeast Brazil. *Systematic and Applied Acarology*, 26(7): 1301–1313. https://doi.org/10.11158/saa.26.7.10

Behan-Pelletier, V.M. (1999) Oribatid mite biodiversity in agroecosystems: Role for bioindication. *Agriculture, Ecosystems and Environment*, 74(1–3): 411–423. https://doi.org/10.1016/S0167-8809(99)00046-8

Călugăr, A. (2018) Soil mesostigmatid mites as a potential tool for bioindication concerning ecological status of forest. *Acarologia*, 58 (Suppl): 18–24. https://dx.doi.org/10.24349/acarologia/20184285

Carrillo, D., Peña, J.E., Hoy, M.A., Frank, J.H. (2010) Development and reproduction of *Amblyseius largoensis* (Acari: Phytoseiidae) feeding on pollen, *Raoiella indica* (Acari: Tenuipalpidae), and other microarthropods inhabiting coconuts in Florida, USA. *Experimental and Applied Acarology*, 52: 119–129. https://doi.org/10.1007/s10493-010-9360-1

Castilho, R.C., Venancio, R. & Narita, J.P.Z. (2015) Mesostigmata as biological control agents, with emphasis on Rhodacaroidea and Parasitoidea. *In:* Carrillo, D., de Moraes, G.J. & Peña, J. (Eds.), *Prospects for biological control of plant feeding mites and other harmful organisms*. Progress in biological control. Vol. 19. Springer, Cham, pp. 1–32. https://doi.org/10.1007/978-3-319-15042-0_1

Coleman, D.C., Crossley, D.A. & Callaham M.A. (2018) *Fundamentals of soil ecology*. Academic Press, San Diego, USA, 369 pp. https://doi.org/10.1016/C2015-0-04083-7

Craft, C.B., Seneca, E.D. & Broome, S.W. (1991) Loss on ignition and Kjeldahl digestion for estimating organic carbon and total nitrogen in estuarine marsh soils: Calibration with dry combustion. *Estuaries*, 14: 175–179. https://doi.org/10.2307/1351691

Gerson, U. & Smiley, R.L. (1990) *Acarine biocontrol agents, an illustrated key and manual*. Chapman and Hall, New York, USA, 174 pp.

Gilyarov, M.S. & Bregetova, N.G. (1977) *Manual of edaphic mites (Mesostigmata)*. Akademiya Nauk SSSR, "Nauka" Publishing House, Leningrad, Russia, 718 pp.

Gulvik, M.E. (2007) Mites (Acari) as indicators of soil biodiversity and land use monitoring: A review. *Polish Journal of Ecology*, 55(3): 415–440.

Gwiazdowicz, D.J. (2007) *Ascid mites (Acari, Mesostigmata) from selected forest ecosystems and microhabitats in Poland*. Bogucki Wydawnictwo Naukowe, Poznań, Poland, 246 pp.

Hajizadeh, J. & Joharchi, O. (2018) Review and identification key for mites of family Laelapidae (Acari: Mesostigmata) in Guilan province. *Plant Pest Research*, 8(3): 15–29. https://doi.org/10.22124/iprj.2018.3109

Halliday, R.B. (2015) Catalogue of genera and their type species in the mite suborder Uropodina (Acari: Mesostigmata). *Zootaxa*, 3972(2): 101–147. http://doi.org/10.11646/zootaxa.4061.4.2

Haq, M.A. & Ramani, N. (2002) Sampling, extraction, and identification of oribatid mites. *In:* Yadav, P.R., Chauhan, R., Putatunda, B.N. & Chhiliar, B.S. (Eds.), *Mites: Their identification and management*. ICAR Centre of Advanced Studies, Department of Entomology, CCSS, Haryana Agricultural University, Hisar, India, pp. 195–216.

Hyatt, K.H. (1980) A revision of the genus *Gamasellus* Berlese, 1903 (Acari: Mesostigmata) with a diagnosis of a new family. *British Museum of Natural History*, 38: 237–378.

Joharchi, O. & Negm, M.W. (2020) Soil-inhabiting mites of the family Laelapidae (Acari: Mesostigmata) from Assiut Governorate, Egypt. *Zootaxa*, 4759(4): 488–510. https://doi.org/10.11646/zootaxa.4759.4.2

Karg, W. (1993) Acari (Acarina), Milben. Parasitiformes (Anactinochaeta). Cohors Gamasina Leach, Raubmilben. *Die Tierwelt Deutschlands*, 59: 1–523.

Koehler H.H. (1999a) Predatory mites (Gamasina, Mesostigmata). *Agriculture, Ecosystems and Environment*, 74: 395–410. http://dx.doi.org/doi:10.1016/S0167-8809(99)00045-6

Koehler, H.H. (1999b) Predatory mites (Gamasina, Mesostigmata) in sustainable agricultural systems: A review. *Journal of Agricultural and Urban Entomology*, 16(4): 209–231.

Koehler, H.H. & Sanchez, E. (2022) Predatory soil mites and their role in regulating prey populations in agroecosystems. *Applied Soil Ecology*, 191: 104362.

Walter, D.E. & Krantz, G.W. (2009) Collecting, rearing, and preparing specimens. *In:* Krantz, G.W. & Walter, D.E. (Eds.), *A manual of Acarology*. 3rd ed. Texas Tech University Press, Texas, USA, pp. 83–96.

Lavelle, P. & Spain, A.V. (2001) *Soil Ecology*. Springer, Dordrecht, 654 pp. https://doi.org/10.1007/0-306-48162-6_3

Lekveishvili, M. & Klompen, H. (2006) New classification of the family Sejidae (Acari: Mesostigmata) based on morphological analyses. *Journal of Natural History*, 40(41–43): 2317–2339. https://doi.org/10.1080/00222930601068950

Lima, A.A., Silva, G.V., Castro e Silva, T., Pereira, M.J., Santos, L.A.C., Freitas, P.V.D.X., Calil, F.N., Daud, R.D. & Melo e Silva-Neto, C. (2024) Edaphic mite communities in different land uses. *Nativa*, 12(1): 73–79.

Lindquist, E.E., Krantz, G.W. & Walter, D.E. (2009) Order Mesostigmata. *In:* Krantz, G.W. & Walter, D.E. (Eds.), *A manual of acarology*. Texas Tech University Press, Texas, USA, pp. 124–232.

Liu, J., Gao, M., Liu, J., Guo, Y., Liu, D., Zhu, X. & Wu, D. (2018) Spatial distribution patterns of soil mite communities and their relationships with edaphic factors in a 30-year tillage cornfield in northeast China. *PLoS One*, 13(6): e0199093. https://doi.org/10.1371/journal.pone.0199093

Manu, M., Băncilă, R.I., Mountford, O.J., Maruşca, T., Blaj, V.A. & Onete, M. (2022) Soil mite (Acari: Mesostigmata) communities and their relationships with environmental variables in experimental grasslands from Bucegi Mountains in Romania. *Insects*, 13(3): 285. https://doi.org/10.3390/insects13030285

Mašán, P. (2007) *A review of the family Pachylaelapidae in Slovakia, with systematics and ecology of European species (Acari, Mesostigmata: Eviphidoidea)*. Institute of Zoology, Slovak Academy of Sciences, Bratislava, 249 pp.

Mašán, P. (2017) A revision of the family Ameroseiidae (Acari, Mesostigmata), with some data on Slovak fauna. *ZooKeys*, 704: 1–228. https://doi.org/10.3897/zookeys.704.13304

Mašán, P. & Fenda, P. (2004) *A review of the family Pachylaelapidae in Slovakia, with systematics and ecology of European species (Acari, Mesostigmata: Eviphidoidea)*. Institute of Zoology, Slovak Academy of Sciences, Bratislava, 344 pp.

Mašán, P. & Halliday, B. (2014) Review of the mite family Pachylaelapidae (Acari: Mesostigmata). *Zootaxa*, 3776(1): 1–66. https://doi.org/10.11646/zootaxa.3776.1.1

McFadyen, A. (1962) Control of humidity in three funnel-type extractors for soil arthropods. *In:* Murphy, P.W. (Ed.), *Progress in Soil Zoology*. Butterworths, London, UK, pp. 158–168

McMurtry, J.A., Sourassou, N.F., Demite, P.R. (2015) The Phytoseiidae (Acari: Mesostigmata) as biological control agents. *In:* Carrillo, D., de Moraes, G.J. & Peña, J. (Eds.), *Prospects for biological control of plant feeding mites and other harmful organisms*. Progress in biological control. Vol. 19. Springer, Cham, pp. 133–149. https://doi.org/10.1007/978-3-319-15042-0_5

Ritchey, E.L., McGrath, J.M. & Gehring, D. (2015) Determining soil texture by feel. *Agriculture and Natural Resources Publications*, 139. https://uknowledge.uky.edu/anr_reports/139

St. John, M.G., Wall, D.H. & Hunt, H.W. (2006) Are soil mite assemblages structured by the identity of native and invasive alien grasses? *Ecology*, 87(5): 1314–1324. https://doi.org/10.1890/0012-9658(2006)87[1314:ASMASB]2.0.CO;2

Walter, D.E. & Proctor, H.C. (2013) Mites in soil and litter systems. In: Walter, D.E. & Proctor, H.C. (Eds.), *Mites: ecology, evolution and behaviour: life at a microscale*. Springer, Dordrecht, The Netherlands, pp. 161–-228. https://doi.org/10.1007/978-94-007-7164-2_6

تنوع هرناهای خاکزی (Acari: Mesostigmata) در محدوده Muthanga پناهگاه حیات وحش ویاناد، کرالا، هند

شبانا تکومپورات | صبحا ثلاکاتل رَغوان | پراوینا کریمباکندی*

گروه پژوهشـی تحصـیلات تکمیلی و جانورشـناسـی، دانشـکدهٔ فاروق (خودمختار)، وابسـته به دانشـگاه کالیکوت، کرالا، هند؛ رایانامه‌ها: tpshabana2000@gmail.com، praveenaprasanth1993@gmail.com، sobharaghav72@gmail.com

*** نویسندهٔ مسئول**

praveenaprasanth1993@gmail.com

دریافت
۱۸ مهر ۱۴۰۴
پذیرش
۵ خرداد ۱۴۰۵
انتشار
۲۴ تیر ۱۴۰۵
دبیر تخصصی
ا. جوهرچی

چکیده

مطالعه حاضر به منظور بررسی تنوع جانوران میان‌سُفتیان خاکزی در محدوده موتانگا از پناهگاه حیات وحش ویاناد، کرالا، هند، طی دوره زمانی آگوست ۲۰۲۲ تا مارس ۲۰۲۳ انجام شد. نتایج، وجود ۲۱ گونه از کنه‌های میان‌سُفتیان متعلق به نُه خانواده را نشان داد. فراوان‌ترین گونه متعلق به جنس *Stratiolaelaps* Berlese, 1916 (فراوانی نسبی: ۱۸/۳) از خانواده Laelapidae است. تنوع کنه‌ها با استفاده از شاخص‌های تنوع شانون–وینر و سیمپسون اندازه‌گیری شد. شاخص شانون–وینر ۲/۶۷ و شاخص برابری شانون ۰/۸۸ است. شاخص تنوع سیمپسون ۰/۰۸ و شاخص غالبیت سیمپسون ۰/۹۲ است. همچنین این مطالعه به تأثیر پراسنجه‌های خاک مانند pH، دمای خاک، کربن آلی، نیتروژن کل موجود و بافت خاک بر فراوانی کنه‌های میان‌سُفتیان در منطقه مورد مطالعه اشاره می‌کند. همبستگی منفی بین pH خاک و فراوانی کنه مشاهده شد ($r = -0.604$)، در حالی که کربن آلی خاک ($r = +0.358$) و نیتروژن کل ($r = +0.55$) همبستگی مثبتی با فراوانی کنه نشان دادند. دمای خاک هیچ رابطه معنی‌داری با فراوانی کنه نشان نداد ($r = 0.069$). آزمون کای–اسکوئر تنوع بسیار معنی‌داری را در فراوانی بین انواع مختلف خاک نشان داد ($\chi^2 = 329.25$، $df = 4$، $p < 0.001$). مطالعه حاضر ارتباط معنی‌دار بین فراوانی هرنا و بافت خاک، همراه با اثرات مثبت کربن آلی و کل نیتروژن و تأثیر منفی pH خاک را برجسته می‌کند، که نشان می‌دهد عوامل خاکی نقش مهمی در توزیع جوامع کنه‌های میان‌سُفتیان دارند.

واژگان کلیدی: نشانگری زیستی، Laelapidae، هرناهای شکارگر، بندپایان خاک، اکوسیستم خاک

CITE: Thekkumpurath, S., Thalakkattil Raghavan, S. & Karimbakkandi, P. (2026) Diversity of edaphic mites (Acari: Mesostigmata) in Muthanga range of Wayanad Wildlife Sanctuary, Kerala, India. *Persian Journal of Acarology*, 15(3): 150305.
https://doi.org/10.22073/pja.150305