



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2024; 12(1): 17-23

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Received: 22-11-2023

Accepted: 26-12-2023

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First report on diversity and inventory of spider fauna (Arachnida: Araneae) in Munia Conservation Reserve (MCR), Nagpur, Maharashtra, Central India

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DOI: <https://doi.org/10.22271/j.entomoljournal.2024.v12.i1a.9273>

Abstract

Munia Conservation Reserve (MCR), Nagpur is an important protected area lies on wildlife corridor from Pench Tiger Reserve to Tadoba Andhari Tiger Reserve with richest biodiversity. This study presents the initial diversity and distribution records of spider fauna in the Munia Conservation Reserve. In present study, 46 spider species identified, belonging to 42 genera and 18 families. The relative abundance was assessed, with Araneidae and Salticidae contributing significantly. The Shannon Wiener diversity index (H) is 1.978 and Evenness (E) is 0.684 for sample (N=18) of 42 genera and 18 families with 46 species. The findings highlight the importance of Munia Conservation Reserve in supporting a rich spider fauna and contribute to the baseline understanding of spider diversity in the region and provide vital information for conservation and management efforts.

Keywords: Arachnida, Spider fauna, Diversity, Inventory, MCR, Nagpur

Introduction

The Munia Conservation Reserve in Nagpur, Maharashtra, India, has been a subject of growing interest for its unique ecosystem. Spiders form a critical component of the natural ecosystems, playing a pivotal role in maintaining ecological balance. They have unique habitat and they live in almost all the environments. They are the most abundant predator of insects of terrestrial ecosystem and consume large number of preys without damaging the plants (Vairale, *et al*, 2021) ^[37]. Order Araneae is a large group of animals commonly known as spiders, might have been evolved 380 million years ago during Devonian period (Platnick, 1991) ^[19]. Pocock (1900) ^[22] who listed 216 spider species and provided the first detail account of Indian spider fauna. Spiders are the most numerous, varied and big invertebrates, as per the World Spider Catalogue (2018). They have 47761 species in 4101 genera and 118 families. Out of these, India has 1685 spider species from 438 genera and 60 families. There are 1520 spider species in 377 genera and 60 families in India, as stated by Sebastian and Peter (2009) ^[26]. Siliwal *et al*. (2005) ^[29] reported that India has 1442 spider species in 361 genera and 59 families. As per The Gazetteer of India, in its general series on fauna, documented 90 spider species in 14 families in Maharashtra State (Sebastian and Peter, 2009) ^[26]. The diversity of spiders in protected area was studied by some recent workers. They found 56 species in 13 families in Paradsinga, Dist-Nagpur (Raut, 2021) ^[23], 32 species in 25 genera and 13 families reported in forest area near Ashti Dist-Wardha (Ningare, 2023) ^[15], 20 species in 16 genera and 9 families discovered in NNTR, Gondia (Bhandarkar *et al*, 2019) ^[2], 21 species in 19 genera and 13 families reported in Karhandla, Nagpur (Gajbe PU, 2016) ^[7], 90 species in 57 genera and 21 families found in area of Chandrapur district (Sawane AP, 2016) ^[25], 42 species in 20 genera and 14 families discovered at Sawanga-Vithoba lake, Amaravati, 43 species in 34 genera and 10 families in Indapur (Markand SR, 2020) ^[13], and 26 species in 11 genera of family Araneidae in the area of Katepurna sanctuary, Akola (Shirbhate, *et al*, 2017) ^[28]. 108 spiders belonging to 3 families under the 8 genera and 13 species in Bori-Arab area (Vairale, *et al*, 2021) ^[37]. Despite their significance, the knowledge about spider diversity and distribution in many regions, including the Munia Conservation Reserve in Nagpur, Maharashtra, India, and remains limited.

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The objective of this study is to provide the first comprehensive diversity and distribution record of spider fauna in this important conservation area. Understanding the spider species present is crucial for conservation efforts and ecological balance.

Materials and Methods

Study Area: The present study was carried out in the Munia Conservation Reserve, situated in Nagpur, Maharashtra, India. Sampling was conducted through systematic surveys in different habitats- Dense Forest, shrub area, and grassland within the Munia Conservation Reserve (Fig 1).

The Munia Conservation Reserve (MCR) was declared by the Maharashtra State Government on 11 May 2021 by a notification (Notification no. WLP.0321/CR-67/F-1). The MCR covers an area of 9601.43 Ha. (96.01sq.km) in the Butibori and North Umred ranges of the Nagpur Forest Division, which is part of the Nagpur Forest Circle. The MCR has a diverse landscape, with forests on hilly slopes and

plains, grasslands, zudapi Jungle, dense forest, wetlands, and rocky forest with distinct eco-tone. The vegetation growth is affected by the very hot summer, which increases the radiation from the exposed quartzite and basalt in the region. The rainy season usually begins in the second week of June and lasts until the end of September every year. The forests of the Nagpur Division are classified as the Sub Group 5A - Southern Tropical Dry Deciduous Forests according to the 'Revised Classification of Indian Forest Types by Champion and Seth' (1968). This information given in the Working Plan of the Nagpur Forest Division, Volume I, for the period 2015-16 to 2024-25 prepared by P. Kalyankumar and T.K. Choubey (Chandewar *et al.*, 2023) [6]. The reserve boasts a remarkable variety of wildlife, especially arachnids, which are abundant and diverse. It is also home to many insects, such as lepidopterans, coleopterans and hymenopterans that add to its ecological richness. Munia Conservation Reserve is a vital sanctuary for preserving and safeguarding the natural heritage of Maharashtra.

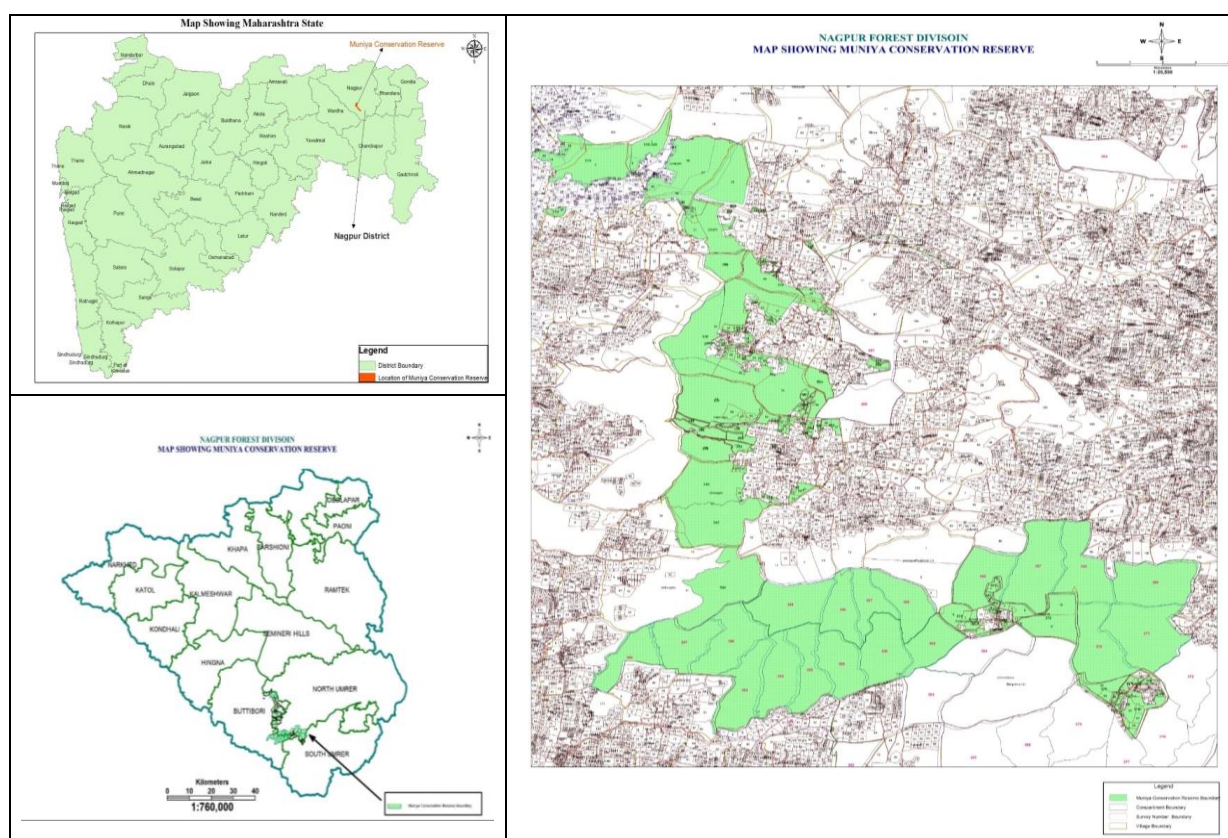


Fig 1: Map showing Munia Conservation Reserve (MCR)

Survey, Sampling and Data Collection: Sampling was carried out using a combination of visual surveys and pitfall traps to capture ground-dwelling and foliage-dwelling spiders (Sorensen *et al* 2002) [30]. The study spanned three years from January 2020 to December 2022. The arachnid population was plentiful, and the number and variety of species were elevated in the last quarter of the year, that is rainy season (Raut, 2021) [23]. Specimens were collected, taking photographs, identified, and classified at the Genus or up to species level using standard taxonomic keys and expert validation. The standard literature is used to ascertain the identity of the spiders such as Tikader and Malhotra (1980) [32], Tikader (1982) [34], Gajbe (2004) [8], Uniyal (2006) [36], Barrion and Litsinger (1987) [1], Reddy and Patel (1992) [24], Biswas and Biswas (2003) [4], Sabastian and Peter (2009,

2017) [26], Platnick (2019) [21]. Spiders were collected only for photograph, for identification and then release in habitat and no specimens were collected for future preservation. It was not possible to take a photograph of some spiders, visual survey used (Pinto-Leite CM and Rocha PLB, 2012) [18]. The relative abundance of each species was calculated based on the number of genera and species recorded for each family. Systematic survey in different habitat by different methods, protocols given by Sorensen *et al* (2002) [30] are followed.

1. **Pitfall Trapping:** A widely employed technique for gathering spider communities of litter or soil dwellers.
2. **Sweep Netting:** Consists of collecting by sweeping the net through the herbaceous layer.
3. **Ground Hand Collection:** Involves manually picking up spiders from the ground up to the knee height.

4. **Aerial Hand Collection:** Entails capturing spiders from the knee height up to the arm length level.
5. **Vegetation Beating:** The vegetation was struck by a stick to dislodge the samples onto a cloth.
6. **Litter Sampling:** Comprises separating spiders from the litter material.

Statistical Methods

Suitable statistical method used to calculate diversity index as per given below.

Shannon-Wiener Diversity Index formula as given below,

$$H' = - \sum [(Pi) \times \ln (Pi)] \quad E = H' / H \text{ max}$$

Where,

\sum = Summation

'Pi' = Number of individuals of species (I) / Total number of species

'S' = Number of species or species richness

'H-max' = Maximum diversity possible

Evenness denoted by 'E' = H'/H max

Results

The research identified 46 spider species distributed across 18 families and 43 genera in the Munia Conservation Reserve (Table 1). Araneidae and Salticidae were the higher diversity and the most abundant families, collectively constituting 43.5% of the total species, comprising 21.75% of the recorded species each. Salticidae and Thomisidae were found to be relatively abundant, constituting 21.75% and 8.70% of the total species, respectively. The total relative abundance of all recorded species summed to 100%, indicating a

comprehensive survey of the spider fauna in the study area. Oxyopidae also exhibited notable diversity with three species (Table 2). The Shannon-Wiener diversity index (H) and Evenness (E) for sample (N=18) of 18 families and 43 genera with 46 species are, 1.978 and 0.684 respectively. The data indicate a diverse spider community within the reserve (Fig 2 and 3).

Statistical analysis

Shannon-Wiener Diversity Index formula as given below,

$$H' = - \sum [(Pi) \times \ln (Pi)], \quad \text{Evenness denoted by 'E' = } H' / H \text{ max}$$

Where,

\sum = Summation

'Pi' = Number of Individuals of species I / Total number of species

'S' = Number of species or species richness

'H max' = Maximum diversity possible

Evenness denoted by 'E' = H'/H max

The samples of 18 families with 46 species are 10, 2, 1, 2, 1, 2, 1, 1, 3, 1, 2, 10, 1, 1, 2, 4, 1

The Shannon-Wiener Di Index using above formula and Evenness for given sample values are,

Shannon-Wiener Diversity Index and Evenness of present study shown as below,

Sum of values = 10, 2, 1, 2, 1, 2, 1, 1, 1, 3, 1, 2, 10, 1, 1, 2, 4, 1 = 46

Shannon-Wiener Diversity Index (H') = 1.978 and Evenness (E) = 0.684 (Table 3).

Table 1: Taxonomical diversity of spider fauna collected from MCR

Sr. No.	Name of Family	Number of Genera	Number of Species	Relative Abundance
1	Araneidae	8	10	21.75
2	Clubionidae	2	2	4.35
3	Eresidae	1	1	2.17
4	Gnaphosidae	2	2	4.35
5	Hersiliidae	1	1	2.17
6	Lycosidae	2	2	4.35
7	Miturgidae	1	1	2.17
8	Nephilidae	1	1	2.17
9	Oecobiidae	1	1	2.17
10	Oxyopidae	1	3	6.52
11	Philodromidae	1	1	2.17
12	Pholcidae	2	2	4.35
13	Salticidae	9	10	21.75
14	Scytodidae	1	1	2.17
15	Sparassidae	2	1	2.17
16	Tetragnathidae	2	2	4.35
17	Thomisidae	4	4	8.70
18	Uloboridae	1	1	2.17
		42	46	

Table 3: Shannon Wiener Diversity Index (H) Calculation

Sr. No.	Number of Sample (N)	Pi = Sample/Sum	ln (Pi)	Pi X ln (Pi)
1.	10	0.217	-1.528	-0.331
2.	2	0.043	-0.844	-0.036
3	1	0.022	-3.817	-0.083
4	2	0.043	-0.844	-0.036
5	1	0.022	-3.812	-0.083
6	2	0.043	-0.844	-0.036
7	1	0.022	-3.817	-0.083
8	1	0.022	-3.817	-0.083
9	1	0.022	-3.817	-0.083
10	3	0.065	-2.733	-0.177

11	1	0.022	-3.817	-0.083
12	2	0.043	-0.844	-0.036
13	10	0.217	-1.528	-0.331
14	1	0.022	-3.812	-0.083
15	1	0.022	-3.812	-0.083
16	2	0.043	-0.844	-0.036
17	4	0.087	-2.442	-0.212
18	1	0.022	-3.812	-0.083
	46			1.978

Sample Values (S) = 43; Number of Sample (n) = 18

H max = In (N) = In (18) = 2.89

Evenness (E) = H' / Hmax = 1.978 / 2.89 = 0.684

Shannon-Weiner Diversity Index (H) = 1.978 and Evenness (E) = 0.684

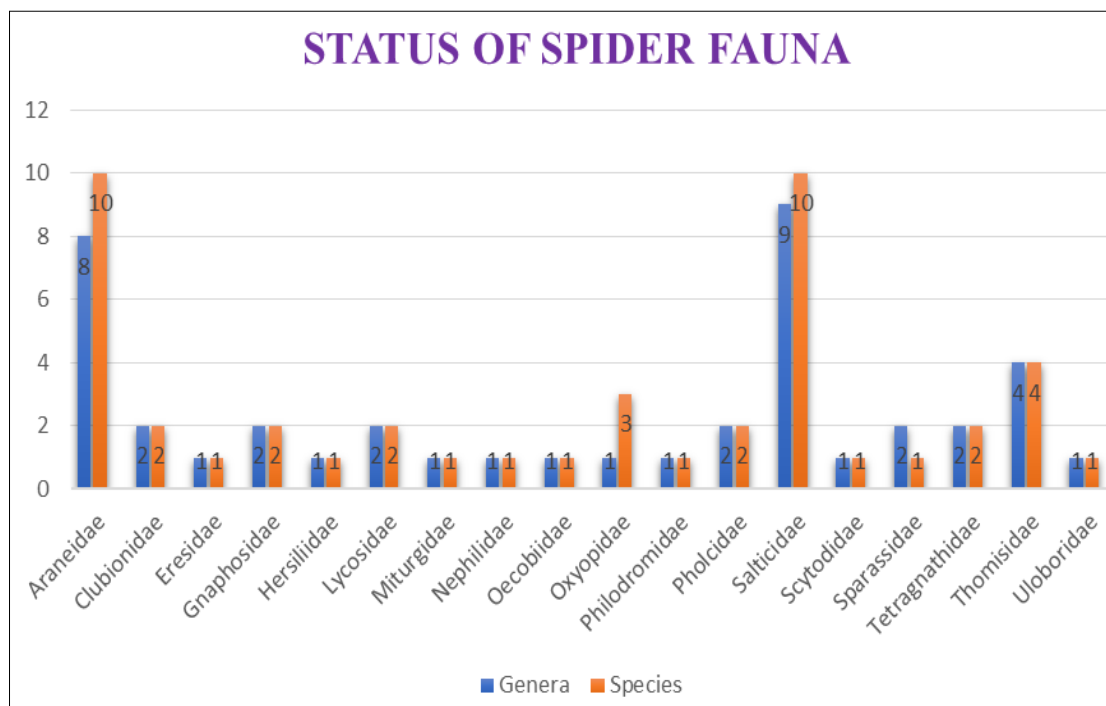


Fig 2: Graphical Representation of Status of Spider Fauna

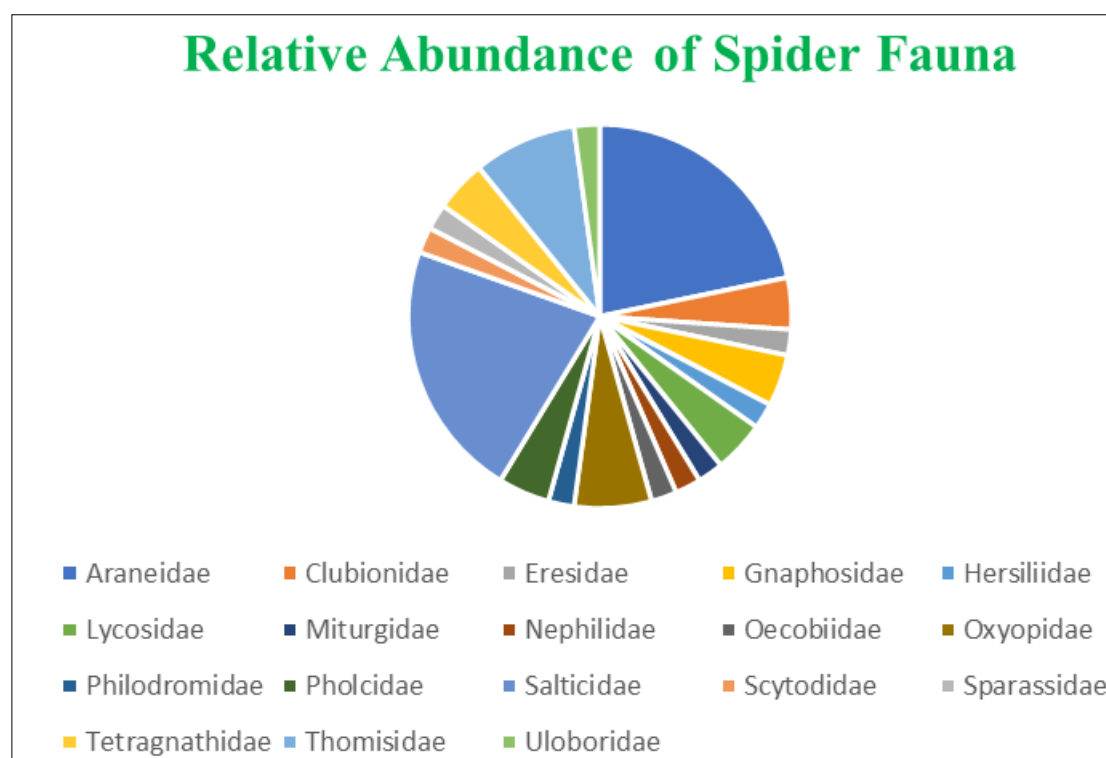


Fig 3: Relative Abundance of Spider fauna in MCR

Table 4: Checklist of spider fauna family wise collected from MCR

Sr. No.	Name of Family	Genus and Species
1.	Araneidae	<i>Araneus mitificus</i> (Simon, 1886)
		<i>Araneus spp.</i>
		<i>Cyclosa spp.</i>
		<i>Neoscona spp.</i>
		<i>Poltys spp.</i>
		<i>Zygeilla spp.</i>
		<i>Neoscona singhagadensis</i> (Tikader, 1975)
		<i>Cyclosa hexatuberculeta</i> (Tikader, 1982)
		<i>Argiope aemula</i> (Walckenaer, 1842)
		<i>Cyrtophora citricola</i> (Forsk., 1775)
2.	Clubionidae	<i>Oedignatha spp.</i>
		<i>Clubiona tikadary</i>
3.	Eresidae	<i>Stegodephus spp.</i>
4.	Gnaphosidae	<i>Zelotes spp.</i>
		<i>Scopoides maitraiae</i> (Tikader and Gajbe, 1977)
5.	Hersiliidae	<i>Hersilia spp.</i>
6.	Lycosidae	<i>Hippasa agelenoides</i> (Simon, 1884)
		<i>Lycosa spp.</i>
7.	Miturgidae	<i>Cheirachanthium spp.</i>
8.	Nephilidae	<i>Nephila pilipes</i> (Fabricius, 1793)
9.	Oecobiidae	<i>Oecobius putus</i> (Cambridge, 1876)
10.	Oxyopidae	<i>Oxyopus spp.</i>
		<i>Oxyopus burmenicus</i> (Thorell, 1887)
		<i>Oxyopus pankaji</i>
11.	Philodromidae	<i>Philodromus spp.</i>
12.	Pholcidae	<i>Pholcus spp.</i>
		<i>Crossopriza iyon</i> (Blackwall, 1867)
13.	Salticidae	<i>Menemerus bivittatus</i> (Dufour, 1831)
		<i>Harmochirus spp.</i>
		<i>Myrmarahnae spp.</i>
		<i>Hasarius adansoni</i> (Audouin, 1826)
		<i>Marpissa spp.</i>
		<i>Plexippus petersi</i> (Karsch, 1878)
		<i>Phidippus spp.</i>
		<i>Telonomia spp.</i>
		<i>Plexippus paykulli</i> (Audouin, 1826)
		<i>Euophrys spp.</i>
14.	Scytodidae	<i>Scytodus spp.</i>
15.	Sparassidae	<i>Olios sp.</i>
		<i>Heteropoda venatoria</i> (Linnaeus, 1767)
16.	Tetragnathidae	<i>Tetragnatha spp.</i>
		<i>Leucange decorata</i> (Walckenaer, 1841)
17.	Thomisidae	<i>Thomisus spp.</i>
		<i>Theredion spp.</i>
		<i>Bomis spp.</i>
		<i>Regillus spp.</i>
18.	Uloboridae	<i>Uloborus spp.</i>

Discussion

The high diversity of spider families in Munia Conservation Reserve underscores its ecological significance. The presence of 46 species belonging to 18 families and 42 Genera underscores the high species richness and diversity of spiders in this region. Araneidae and Salticidae, being dominant, play key roles in maintaining ecological balance and suggests their ecological significance and potential as bio indicators of environmental health. The presence of unique species such as those from Oxyopidae adds to the conservation value. The relative abundance data further elucidates the ecological importance of various spider families within the reserve. Future studies should explore the ecological interactions and behaviors of these spider species to enhance our understanding of the Munia Conservation Reserve's ecosystem. This research provides a foundational understanding of the spider fauna in Munia Conservation

Reserve, serving as a baseline for further investigations and conservation initiatives in this ecologically important region.

Conclusion

This study represents the first comprehensive assessment of spider diversity and distribution in the Munia Conservation Reserve, Nagpur, Maharashtra, India, and highlights the ecological significance of this understudied group. The data presented here will be valuable for future research, conservation planning, and management of the reserve, while also contributing to the broader understanding of arachnid biodiversity in India.

Acknowledgment

Authors are thankful to Government of Maharashtra, Forest Department for support and giving opportunity for this research work. Also thankful to Conservator of Forests (T),

Nagpur Circle and Deputy Conservator of Forest, Nagpur Division & Field staff of the North Umred and Butibori Forest Range for their help during this work on spiders.

Declaration of conflict of interest

The authors have no competing interests to report.

References

- Barrion A, Litsinger J, Soekarna D. Upland rice insect pests: their ecology, importance, and control. IRRRI Research Paper Series. 1987;(123):1-41.
- Bhandarkar SV, Paliwal GT. First distribution record of spider fauna (Aracnida: Araneae) in Navegaon National Park (NNTR) Gondia, Maharashtra. Eur J Biotechnol Biosci. 2019;7(1):01-04.
- Biswas B, Biswas K. Araneae: spiders in state Fauna Series-3: Fauna of West Bengal, Part 3. Zool Surv India Publ, 1992, 357-500.
- Biswas B, Biswas K. Fauna of Sikkim, (Araneae: Spider) State fauna series. 2003;9:67-100.
- Biswas B, Biswas K. Araneae: Spiders. In: Fauna of Manipur, State Fauna Series 10. Zoological Survey of India; 2004:25-46.
- Chandewar NG, Sreelakshmi A. Preliminary survey and species diversity of odonates of munia conservation reserve (MCR) of Nagpur District, central India: A checklist. Int J Zool Stud. 2023;8(4):71-78.
- Gajbe PU. Record of Some Spiders (Arachnida: Araneae) from Karhandla in Nagpur District, Maharashtra. JNBR. 2016;5(3):133-138.
- Gajbe PU. Spiders of Jabalpur, Madhya Pradesh (Arachnida: Araneae), Zoological Survey of India. 2004:1-154.
- Gajbe UA. A new scopodes spider from India (Araneae: Gnaphosidae) bulletin of the zoological survey of India. 1987;8:285-287.
- Gajbe PU. Checklists of Spiders (Arachnid; Araneae) of Madhya Pradesh and Chattisgarh. Zoos Print J. 2003;18(10):1223-1226.
- Keswani S, Wankhede GN. Diversity, Population and Habitat Used by Spiders, In Banana agro-ecosystem, Department of Zoology, SGB Amravati University, Amravati-402446. 2012.
- Majumder SC. Studies on spider fauna of coastal region of India: description of two new species of *Pardosa* Koch (Araneae: Lycosidae) from the coastal region of Sunderbans, West Bengal (Part-1). Rec Zool Surv India. 2004;(102):97-103.
- Markand SR. Diversity of spider fauna of Indapur Tehsil, (Ujani backwater region) Pune, Maharashtra, India. J Emerging Technologies Innovative Res. 2020;7(9):549-556.
- Mathew MJ, Sebastian PA, Sunish E. Updated checklist of Indian Spiders (with references) PP. 432-603 In: Sebastian PA and KV Peter. Spiders of India. University Press, (India) Private Limited; c2009.
- Nimgare SS. Diversity of spiders in forest nearby Ashti, Dist-Wardha (MS). IJRBAT. 2023 Sept;8(3):13-16.
- Palem H, Kanike S, Purushottam VRS. Diversity of spider fauna (Arachnida: Araneae) in different eco-systems, Eastern Ghats, Southern Andhra Pradesh, India. South Asian J Life Sci. 2016;4(2):51-60.
- Patel BH. Fauna of protected areas in India-I: Spiders of Vansda National Park, Gujrat. Zoos' Print J. 2003;18:1079-1083.
- Pinto-Leite CM, Rocha PLB. Visual Search for Tropical Web Spiders: The Influence of Plot Length, Sampling Effort, and Phase of the Day on Species Richness. Environ Entomol. 2012;41(6):1534-1543.
- Platnick NI. A revision of the gourd spider family Cithaeronidae (Araneae, Gnaphosoidea). Am Mus Novit. 1991;(3018):1-13.
- Platnick NI. The World Spider Catalog, Version 11.5. Am Mus Nat Hist; c2011 Jan.
- Platnick NI. The World Spider Catalogue, Version 17.5. American Museum of Natural History; c2019. Online at <http://research.amnh.org/iz/spider/catalog>.
- Pocock RI. The Fauna of British India, including Ceylon and Burma, Arachnida; c1900.
- Raut NM. Distribution of Spider Fauna in the Chintamunishwar hill at Paradsinga, Dist. Nagpur (Maharashtra State) India. Int Res J Sci Eng. 2021;Special Issue A11:205-210.
- Reddy TS, Patel BH. A new species of *Neoscona* Simon (Araneae: Araneidae) from Coastal Andhra Pradesh, India. Entomon. 1992;17:129-130.
- Sawane AP. Diversity and distribution of spiders (Arachnids: Araneae) from Chandrapur District, Maharashtra, India. Int Interdiscip Res J. 2016;VI(1):70-78.
- Sebastian PA, Peter KV. *Spiders of India*. First Edition. Universities Press, Hyderabad; c2009.
- Sebastian PA, Peter KV. *Spiders of India*. Universities Press, Hyderabad; c2017.
- Shirbhate MV, Shirbhate AM. Diversity and distribution of Spider fauna (family- Araneidae) in and around Katepurna Sanctuary, Akola, India. Environ Conserv J. 2017;18(3):45-52.
- Siliwal M, Molur S, Biswas BK. Indian Spiders (Arachnida: Araneae): Updated Checklist 2005. Zoos, Print J. 2005;20(10):1999-2049.
- Sorensen LL, Coddington JA, Scharff N. Inventorying and estimating sub-canopy spider diversity using semi-quantitative sampling methods in an Afromontane Forest. Environ Entomol. 2002;31:319-330.
- Tikader BK. Gazetteer of India, Maharashtra State, General Series: Fauna, Chapter 4 – Spiders, 1974, 295-306.
- Tikader BK, Malhotra MS. *Fauna of India, Spiders, Family Lycosidae*. Published by Zoological Survey of India, Kolkata. 1980;1(2):190.
- Tikader BK. *Fauna of India, Spiders, Family Thomisidae*. Published by Zoological Survey of India, Kolkata. 1980;1(1):247.
- Tikader BK. *Fauna of India, Spiders, Family Araneidae*. Published by Zoological Survey of India, Kolkata. 1982;2(1):293.
- Tikader BK. *Handbook of Indian Spiders*. Zoological Survey of India, Calcutta, 1987, 1-251.
- Uniyal VP. Records of Spiders from Indian Trans-Himalayan Region. Indian Forester. 2006;132(12a):117-181.
- Vairale AB, Wagh GA. Diversity of Spiders in Microhabitats of a Tropical Reserve Forest of Amravati, Maharashtra, India. Biosc Biotech Res Comm. 2021;14(1):446-452.
- Wankhade VW, Manwar NA, Rupwate AA, Raut NM. Diversity and abundance of spider fauna at different

- habitats of University of Pune, M.S. (India). G Adv Res J Environ Sci Toxicol. 2013;1(8):203-210.
39. World Spider Catalog. World Spider Catalog. Natural History Museum Bern; c2016, Online At: <http://wsc.nmbe.ch>, Version 17.0.
40. World Spider Catalog. World Spider Catalog. Version 19.5. Natural History Museum Bern; c2018. Online At: <http://wsc.ch>. DOI: 10.24436/2.