

Diversity of Spiders (Araneae) in the Melghat Region of Maharashtra, India: A Review of Research from 2015–2025

Saloni Prajapati., Hemlata Nandurkar

Department of Zoology, Sant Gadge Baba Amravati University, Amravati, Maharashtra

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ABSTRACT

Spiders (Arachnida: Araneae) constitute one of the most ecologically important groups of terrestrial predatory arthropods. They regulate populations of insects and other arthropods, contribute to terrestrial food webs and can serve as indicators of habitat quality. The Melghat landscape of Maharashtra, situated in the Satpura ranges of central India and encompassing the Melghat Tiger Reserve (MTR), supports a heterogeneous assemblage of tropical dry deciduous forests, grasslands, meadows, riparian habitats and human-modified environments. These habitats provide suitable conditions for a diverse spider fauna. The present review synthesizes available published and institutional information concerning spider diversity in the Melghat region during 2015–2025, while incorporating earlier investigations as a baseline for comparison. The review demonstrates that Melghat has historically supported substantial spider diversity, although published species totals differ considerably because of differences in geographical coverage, sampling effort, habitat selection and taxonomic treatment. Earlier investigations reported 25 spider families from Melghat, while an intensive survey of selected relocated areas documented 254 species belonging to 113 genera and 27 families. More recent management and media sources have referred to approximately 204 species in the reserve, but these figures should not be interpreted as a temporal trend without standardized sampling. During the review period, taxonomic research contributed important knowledge, including the first record of the male of *Tropizodium viridurbium*. Prajapati *et al.*, (2016) from Melghat forest, published in 2021. The species is currently accepted by the World Spider Catalog. The review also identified an important research gap: despite the ecological importance of spiders, there is no clearly documented standardized, decade-long quantitative monitoring program covering the entire Melghat landscape from 2015 to 2025. Future investigations should combine standardized seasonal sampling, habitat-specific surveys, morphological taxonomy, DNA barcoding, ecological-guild analysis and long-term monitoring. Such an integrated approach would establish a reliable baseline for spider conservation and improve understanding of the ecological functioning of the Melghat landscape.

Keywords: Araneae, spiders, spider diversity, Melghat, Melghat Tiger Reserve, Satpura, Maharashtra, conservation, ecological indicators.

INTRODUCTION

Spiders belong to the order Araneae within the class Arachnida and are among the most important predatory arthropods in terrestrial ecosystems. They occur in forests, grasslands, agricultural fields, wetlands, deserts, caves, rocky habitats and human-dominated landscapes. Their predatory activities contribute to the regulation of insect populations and make them important components of terrestrial food webs.

The Melghat region is particularly important for biodiversity research because it forms part of the Satpura landscape of central India. The Melghat Tiger Reserve contains extensive forest habitat and a range of associated ecosystems. The official Melghat Tiger Reserve website identifies resources specifically devoted to spiders, including a publication titled *Spiders of Melghat*, indicating institutional recognition of the importance of this group.

Despite this importance, information on Melghat spiders remains fragmented. Several early studies established the existence of high spider diversity, but comparatively fewer studies have focused specifically on Melghat

during 2015–2025. Therefore, a review of the literature is necessary to distinguish established records from estimates, identify taxonomic advances and highlight gaps in ecological monitoring.

The present review aims to:

1. Synthesize available information on spider diversity in Melghat,
2. Assess research conducted or published during 2015–2025,
3. Compare recent information with earlier baseline studies,
4. Examine habitat and ecological factors associated with spider diversity,
5. Highlight taxonomic developments,
6. Identify major limitations in existing knowledge and
7. Propose priorities for future spider research and conservation in Melghat.

Study Area: Melghat Region

Melghat is situated in the Satpura mountain system of Maharashtra and is primarily associated with Amravati district. The Melghat Tiger Reserve represents a large protected forest landscape containing diverse vegetation formations and topographical conditions.

The landscape includes dry deciduous forests, teak-dominated forest areas, valleys, plateaus, streams, grasslands and meadows. The combination of vegetation layers, exposed soil, leaf litter, tree trunks, shrubs, grasses and rocky surfaces creates numerous microhabitats for spiders.

The official Melghat Tiger Reserve website identifies Chikhaldara, Aamzari, Semadoh, Kolkas, Harisal and Shahanur among the important locations associated with the reserve landscape.

METHODOLOGY OF THE REVIEW

Literature search

The present review considered scientific publications, taxonomic papers, institutional reports, biodiversity databases and reliable regional reports relating to spiders of Melghat and its immediate landscape.

The principal review period was **January 2015 to December 2025**. Earlier publications were included only when they provided essential baseline information needed to interpret the 2015–2025 literature.

Searches were conducted using combinations of the following terms:

- Melghat spider diversity.
- Melghat Tiger Reserve spiders.
- Melghat Araneae.
- Melghat spider fauna.
- Chikhaldara spiders.
- Amravati spiders.
- Melghat taxonomy Araneae.

- Melghat Tropizodium.
- Melghat Zodariidae.

Taxonomic names were additionally checked against current online spider databases, particularly the World Spider Catalog and *Araneae of India*. The World Spider Catalog currently recognizes *Tropizodium viridurbium* as an accepted species and lists the 2021 Melghat paper as a taxonomic reference.

Inclusion criteria

Studies were considered particularly relevant when they:

- Directly sampled spiders in Melghat,
- Reported species or family-level records from Melghat,
- Described or documented taxa from Melghat,
- Provided a Melghat checklist,
- Contributed directly to the taxonomy of Melghat spiders or
- Provided institutional biodiversity information specifically referring to Melghat.

Studies from other parts of Amravati district or Maharashtra were considered only for regional ecological comparison and were not treated as Melghat records.

Year	Evidence	Relevance to Melghat
2015	Continuing use of earlier Melghat inventories	Baseline for later research
2016	Description of <i>Tropizodium viridurbium</i> from India	Important taxonomic background for later Melghat record
2017–2020	Regional Maharashtra spider research and taxonomic studies	Provides comparative context
2019	<i>Tropizodium viridurbium</i> material recorded in Melghat	Material subsequently studied taxonomically
2021	First record of male <i>Tropizodium viridurbium</i> from Melghat forest	Major Melghat-specific taxonomic contribution
2021	Publication of additional Maharashtra spider literature	Supports regional taxonomic context
2022	MTR management and biodiversity activities increasingly included smaller fauna	Evidence of expanding conservation interest
2023	Training involving MTR personnel and spider identification	Indicates capacity building for spider documentation
2024	Continued national and regional taxonomic work	Provides updated taxonomic context
2025	Updated ZSI national Araneae checklist	Important for nomenclatural validation
2025	Regional report of a purported new spider from Melghat	Requires verification from primary taxonomic literature before formal citation

Table No. 1

Historical Baseline of Spider Diversity in Melghat

Understanding the 2015–2025 literature requires consideration of earlier studies because much of the current knowledge of Melghat spiders originates from baseline surveys conducted before 2015.

An important study comparing three Maharashtra ecosystems recorded **25 spider families from the Melghat Tiger Sanctuary**, compared with 19 families at Lonar Crater Sanctuary and 31 families in a southern tropical thorn forest ecosystem. The authors emphasized the value of such surveys for developing spider biodiversity databases and conservation planning.

Another major study investigated spider diversity in relocated areas of Melghat Tiger Reserve. The investigation covered Koha, Kund and Bori meadows and recorded **254 species belonging to 113 genera and 27 families**. The study interpreted the high diversity in relation to habitat recovery following village relocation.

An older source also reported a much higher figure of **517 spider species from Melghat Sanctuary**, attributed to Vairale and Vankhede (2010). This number is repeatedly cited in later Maharashtra spider literature.

However, these figures cannot simply be added together or arranged as a chronological increase. They represent different studies, sampling areas, sampling intensities and taxonomic treatments.

This is an important methodological issue for any review of Melghat spider diversity.

Overview of Evidence from 2015–2025

The available literature indicates that the 2015–2025 period did not produce a continuous annual census of Melghat spiders. Instead, the period is characterized by:

- Continuation of taxonomic investigation,
- Publication of new distributional information,
- Confirmation of previously poorly known species,
- Regional spider surveys,
- Institutional documentation and
- Increasing interest in spiders as components of biodiversity monitoring.

The following summary illustrates the major evidence available for the review period.

The 2021 record is the strongest clearly documented Melghat-specific taxonomic contribution within the accessible 2015–2025 literature.

Taxonomic Developments during the Review Period

Tropizodium viridurbium

The most significant taxonomic development directly associated with Melghat during the review period concerns the ant spider *Tropizodium viridurbium* Prajapati *et al.*, (2016).

The species was described in 2016. The World Spider Catalog currently recognizes the species as valid and records its distribution as India.

Bodkhe *et al.*, (2021) subsequently published the **first record of the male from Melghat forest**, in *Serket*, volume 17, issue 4, pages 413–419.

The specimens were associated with the Tapi River basin, including locations near Rangubeli, Dharkhora Buralghat and Nawab Nala, Ghatang. The field material was reportedly encountered during summer 2019 and subsequently examined morphologically. Contemporary reporting described the record as the first male record from Melghat.

The taxonomic importance of this record is greater than a simple locality addition. Documentation of both sexes improves understanding of sexual dimorphism, species diagnosis and distribution. It also demonstrates that targeted sampling in Melghat can produce taxonomically significant results even when the broader regional fauna has been studied previously.

The 2025 Report of *Hybrosystis chikhaldaraensis*

A 2025 regional news report described the discovery of a jumping spider referred to as *Hybrosystis chikhaldaraensis* from the Melghat/Chikhaldara region.

However, during preparation of this review, a directly accessible primary taxonomic paper confirming this name could not be located with sufficient confidence. Therefore, **the record should not be treated as a confirmed species citation in a journal manuscript until the original taxonomic publication is obtained and checked.**

This precaution is particularly important in spider taxonomy because genus names, species combinations and authorship can change following taxonomic revisions.

For the present review, the 2025 report is therefore treated as an **unverified recent report**, rather than as evidence for an officially confirmed new Melghat species.

This approach prevents the review from introducing an incorrect scientific name into the peer-reviewed literature.

Family-Level Diversity

Historical surveys demonstrate that Melghat supports a diverse assemblage of spider families.

The comparative Maharashtra survey documented 25 families from Melghat.

A separate study in the Wan Sanctuary of Melghat Tiger Reserve recorded spiders belonging to **17 families**. The families reported as particularly abundant included Araneidae, Lycosidae, Salticidae, Thomisidae, Tetragnathidae, Nephilidae, Uloboridae and Eresidae.

The difference between 17 and 25 families does not necessarily indicate a change in biodiversity. Rather, it likely reflects differences in:

- Geographical coverage,
- Habitat types sampled,
- Duration of sampling,
- Collection methods,
- Seasonal coverage,
- Taxonomic identification, and
- Sampling completeness.

Families commonly associated with structurally complex forest habitats include Araneidae, Tetragnathidae, Salticidae, Thomisidae, Lycosidae and Oxyopidae. Their different hunting strategies allow them to exploit different structural layers of the environment.

Ecological Guilds of Melghat Spiders

Spider diversity should not be evaluated only by species counts. Functional guilds provide additional information about ecological roles.

The major guilds likely represented in the Melghat landscape include:

Orb-web builders

Orb-weaving spiders, particularly Araneidae and Tetragnathidae, construct characteristic circular webs between vegetation structures. Their abundance is strongly affected by vegetation architecture and availability of web-supporting structures.

Space-web and cob-web builders

These spiders construct three-dimensional or irregular webs and frequently occupy vegetation, tree cavities and sheltered microhabitats.

Ground runners

Lycosidae and several other groups actively hunt on the ground. Their abundance may be associated with litter depth, soil moisture, vegetation cover and ground disturbance.

Foliage runners and stalkers

Salticidae and Oxyopidae include visually oriented active hunters frequently associated with leaves, shrubs and grasses.

Ambush hunters

Thomisidae and related groups use vegetation to ambush prey. Their abundance may therefore depend on flowering plants and structural complexity.

A guild-based assessment would be particularly valuable in Melghat because habitat alteration may affect functional groups differently even when total species richness appears relatively stable.

Habitat Heterogeneity and Spider Diversity

Habitat heterogeneity is one of the most important factors likely to explain spider diversity in Melghat.

The landscape contains:

- Mature deciduous forest,
- Teak-dominated forest,
- Secondary vegetation,
- Grasslands,
- Meadows;
- Riparian habitats,
- Rocky areas,
- Forest edges and
- Human-modified landscapes.

Each habitat provides different combinations of vegetation structure, prey availability, temperature and humidity.

The earlier relocated-area study recorded 254 species from only three meadow/locality complexes, illustrating the potential importance of habitat heterogeneity and sampling intensity.

The ecological principle is also supported by regional spider research showing that structurally complex habitats tend to support more spider species because they provide more niches and web-building opportunities.

Consequently, maintaining only mature forest canopy is insufficient for conserving the full spider assemblage. Leaf litter, understory vegetation, grasses, shrubs, dead wood and riparian vegetation may all contribute to regional spider richness.

Seasonal Variation

Seasonality is another major factor that must be incorporated into future Melghat spider surveys.

Melghat experiences marked seasonal changes in rainfall, humidity, temperature and vegetation condition. These environmental changes influence both spider activity and the abundance of their prey.

During the monsoon, increased vegetation growth and humidity may create favourable conditions for many web-building spiders. Post-monsoon conditions may provide high prey availability and increased visibility of webs. During the hot summer period, reduced moisture and vegetation changes may alter activity patterns.

Therefore, a survey conducted during only one season cannot be assumed to represent annual spider diversity.

The most reliable future sampling design should include at least four sampling periods:

1. Pre-monsoon,
2. Monsoon,
3. Post-monsoon and
4. Winter.

Spider Diversity as an Ecological Indicator

Spiders are potentially useful indicators of habitat condition because they respond to relatively small-scale changes in environmental structure.

Their communities may respond to:

- Vegetation loss,
- Fragmentation,
- Fire,
- Changes in litter,
- Pesticide exposure,
- Changes in humidity,
- Prey abundance,
- Grazing,
- Invasive plants and

- Climate variability.

The use of spiders as ecological indicators is particularly relevant in protected landscapes where monitoring programs traditionally emphasize large vertebrates.

Melghat's conservation program has historically emphasized tigers and other vertebrates, but recent activities have increasingly included insects and arachnids. A 2022 report described efforts by the reserve to increase attention to smaller organisms, including insects and arachnids, as part of broader biodiversity awareness and monitoring.

This represents an important opportunity to integrate spider monitoring into existing forest-management programs.

Ecological Importance of Spiders

Spiders perform several important ecosystem functions.

Natural biological control

Spiders consume large numbers of insects and can contribute to suppression of herbivorous and pest arthropods.

Food-web interactions

Spiders themselves serve as prey for birds, reptiles, amphibians, insects and other predators. They therefore occupy an important intermediate position in terrestrial food webs.

Ecosystem monitoring

Because spider communities respond to habitat structure and environmental conditions, changes in their diversity may provide early indications of ecosystem disturbance.

Biodiversity value

Rare and geographically restricted spider species contribute to the overall biological uniqueness of the Melghat landscape.

Conservation Concerns

Although specific population trends for individual Melghat spider species are poorly documented, several potential threats deserve consideration.

Forest fires

Fire can substantially modify leaf litter, soil structure, understory vegetation and microclimate. These changes may affect ground-dwelling spiders and species associated with vegetation.

Habitat fragmentation

Fragmentation can alter vegetation structure and create edge effects that affect spider communities.

Agricultural pressure

Pesticide use and agricultural intensification around protected-area boundaries may affect spiders directly or indirectly through reductions in prey populations.

Changes in vegetation

Removal of shrubs, grasses, fallen wood and litter can eliminate important spider microhabitats.

Climate change

Changes in temperature and rainfall may alter spider activity, reproduction, prey availability and habitat suitability.

Insufficient taxonomic attention

A major conservation problem is the lack of reliable baseline data. Species cannot be effectively monitored when their distribution, taxonomy and abundance are poorly known.

Research Gaps Identified for 2015–2025

Absence of a continuous decade-long dataset

The literature does not currently demonstrate systematic annual sampling of Melghat spiders from 2015 through 2025.

Therefore, it is scientifically inappropriate to claim that spider diversity increased or decreased during the decade solely from published species totals.

Inconsistent sampling methods

Historical studies used different combinations of visual searches, hand collection, vegetation sampling and other methods. Future studies should use standardized protocols.

Incomplete spatial coverage

The available evidence is concentrated in selected localities. A reserve-wide survey is required.

Incomplete seasonal coverage

Several existing records do not provide sufficient information for annual population comparisons.

Taxonomic updating

Historical species names should be checked against current databases before being incorporated into a modern checklist. The *Araneae of India* database explicitly emphasizes the importance of revising historical names.

Limited molecular research

DNA barcoding has considerable potential for identifying cryptic species and resolving uncertain historical records. ZSI's Western Regional Centre, which is involved in Maharashtra faunal research, has DNA-barcoding capacity and maintains extensive zoological collections.

Recommended Standardized Monitoring Protocol for Melghat

A future long-term project should establish permanent sampling stations representing the principal habitat types.

Suggested design

At least 8–12 representative sites should be selected, including:

- Forest interior,
- Forest edge,
- Teak-dominated forest,
- Mixed deciduous forest,
- Grassland,
- Meadow,
- Riparian habitat,
- Rocky habitat,
- Disturbed habitat, and
- Agricultural/forest interface.

Sampling should be repeated seasonally.

Sampling methods

The following techniques should be combined:

1. Visual encounter surveys,
2. Nocturnal searches,
3. Hand collection,
4. Sweep-net sampling,
5. Vegetation beating,
6. Pitfall trapping,
7. Leaf-litter sampling,
8. Web surveys, and
9. Photographic documentation.

No single method can adequately sample all spider guilds.

Recommended Statistical Analysis

Future studies should calculate:

Species richness

$[S = \text{number of species recorded}]$

Shannon-Wiener diversity

$[H' = -\sum p_i \ln p_i]$

where (p_i) is the proportional abundance of species (i).

Simpson diversity

$$[D=1/\sum p_i^2]$$

Pielou's evenness

$$[J'=\frac{H'}{\ln S}]$$

In addition, species accumulation curves and rarefaction analysis should be used to determine whether sampling effort is sufficient.

Beta-diversity analysis should compare spider communities among forest, meadow, grassland and riparian habitats.

Multivariate techniques such as NMDS or PCA/ordination can then be used to examine relationships between spider assemblages and environmental variables.

Molecular Taxonomy and Digital Biodiversity Documentation

Modern spider research should combine classical morphology with molecular methods.

For difficult specimens, DNA barcoding can help to determine whether apparently similar specimens represent separate species. Molecular information should, however, complement rather than replace morphological diagnosis.

Every voucher specimen should ideally include:

- GPS coordinates,
- Elevation,
- Date,
- Habitat,
- Microhabitat,
- Collector,
- Sex,
- Developmental stage,
- Photographic record,
- Preservation information, and
- Accession number.

A digital database for Melghat spiders should be developed in collaboration with the Forest Department, universities, Zoological Survey of India and specialist arachnologists.

The current *Araneae of India* database provides an appropriate national framework because it integrates published taxonomic papers and distributional records and is updated according to the World Spider Catalog.

DISCUSSION

The available evidence confirms that Melghat is an important region for spider diversity, but it also demonstrates the difficulties involved in estimating total richness.

The historical literature reports markedly different numbers. One study recorded 25 families from Melghat, while the relocated-area study reported 254 species, 113 genera and 27 families. Another older source cited 517 species from Melghat Sanctuary. More recent reporting has referred to more than 204 species in the reserve.

These values should **not** be interpreted as a sequence of 25 → 204 → 254 → 517 species.

The first figure is a family-level count. The 254-species result came from particular relocated areas. The 517 figure comes from an older survey and is cited secondarily in later literature. The approximately 204 figure is a contemporary report associated with the reserve. Differences may arise from survey design, geographic extent, sampling intensity and taxonomic revisions.

This issue emphasizes the need for a standardized Melghat checklist.

The 2021 *Tropizodium viridurbium* study provides an example of why taxonomic work remains essential. The species was described in 2016, and the subsequent Melghat material allowed documentation of the male. The World Spider Catalog continues to recognize the species as valid.

The record demonstrates that species-level knowledge is still incomplete even in a landscape with a long history of faunal investigation.

Another important development is the increasing institutional recognition of invertebrate diversity. The Melghat Tiger Reserve maintains a dedicated publication resource containing *Spiders of Melghat*, while the Zoological Survey of India continues to update the national Araneae checklist.

These developments create a favourable environment for a comprehensive modern survey.

However, the absence of a standardized 2015–2025 dataset means that the present review cannot determine whether spider populations increased, decreased or remained stable during the decade. Such conclusions would require repeated sampling using consistent methods.

Proposed Conservation Framework

A spider conservation program for Melghat should be integrated into existing biodiversity management.

Short-term priorities

- Prepare an updated verified checklist.
- Digitize historical records.
- Verify old species names.
- Identify taxonomically uncertain records.
- Establish permanent monitoring sites.

Medium-term priorities

- Conduct seasonal surveys.
- Develop a voucher collection.
- Establish DNA barcoding for difficult taxa.

- Study ecological guilds.
- Compare disturbed and undisturbed habitats.

Long-term priorities

- Establish a 10-year spider monitoring program.
- Assess climate-change responses.
- Develop species-distribution models.
- Identify areas of high spider endemism.
- Integrate spider data into MTR management plans.

CONCLUSION

The Melghat region of Maharashtra represents an important but incompletely investigated centre of spider diversity within the Satpura landscape. Historical research has already demonstrated substantial family- and species-level richness, while subsequent studies and taxonomic investigations have continued to expand knowledge of the fauna.

The review of evidence from 2015–2025 indicates that spider research in Melghat during this period was not characterized by a continuous annual biodiversity census. Instead, the available literature consists mainly of taxonomic contributions, regional surveys, institutional documentation and individual species records.

The documentation of the male of *Tropizodium viridurbium* from Melghat forest in 2021 is the strongest clearly verified taxonomic contribution directly associated with the review period.

The differing historical estimates of spider richness demonstrate that species totals must be interpreted cautiously. A single figure should not be presented as the definitive number of spider species in Melghat unless the geographical area, sampling methods, sampling period and taxonomic authority are clearly stated.

The most important research priority is therefore the establishment of a standardized, long-term spider monitoring program. Such a program should include seasonal sampling across major habitat types, standardized collection methods, ecological-guild analysis, morphological taxonomy, molecular identification and deposition of voucher specimens in recognized collections.

Spiders should be incorporated into biodiversity monitoring and conservation planning in Melghat because they contribute to natural pest regulation, terrestrial food webs and ecological assessment.

Table of Major Evidence Relevant to Review

Study/source	Period	Area	Main contribution	Use in present review
Comparative Maharashtra spider-family survey	Pre-2015	Melghat	25 spider families	Historical baseline
Rithe, <i>Spider Diversity from Relocated Area of Melghat Tiger Reserve</i>	2012	Koha, Kund and Bori	254 species, 113 genera, 27 families	Major species-level baseline
Vairale & Vankhede record cited in later literature	2010	Melghat Sanctuary	517 species reported/cited	Historical comparison; requires original-source verification
Bhatkar, Wan Sanctuary study	2011	Wan Sanctuary	17 families	Habitat/family baseline
Prajapati <i>et al.</i> ,	2016	India	Description of	Taxonomic background

			<i>Tropizodium viridurbium</i>	
Bodkhe <i>et al.</i> ,	2021	Melghat forest	First male record of <i>T. viridurbium</i>	Major 2015–2025 Melghat contribution
MTR institutional resources	Current	Melghat	Spider publication/resources	Conservation and institutional context
ZSI Araneae checklist	2025	India	Updated national taxonomy	Nomenclatural framework
2025 regional report	2025	Chikhaldara/ Melghat	Reported new spider	Requires primary-source verification

Table No. 2

In conclusion, the available evidence strongly supports the view that Melghat possesses a rich and taxonomically significant spider fauna, but the current state of knowledge remains incomplete. The period 2015–2025 should therefore be viewed as a phase of continued discovery and taxonomic refinement rather than as a sufficiently standardized dataset for calculating a decade-long population trend. A coordinated research program beginning with an updated baseline survey would substantially improve understanding and conservation of the spider fauna of the Melghat landscape.

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