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CHECKLIST OF SPIDERS FROM THE SACRED GROVES OF NORTHERN KERALA, INDIA

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AUTHORS' CONTRIBUTIONS
This work was carried out in collaboration between both authors. Author NVS designed the study, wrote the protocol and first draft of the manuscript. Author AVS managed the literature searches and analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

Sacred groves are important gene pools and the first major effort of the society to recognize and conserve biodiversity. In addition to preserving the biodiversity, they help in soil and water conservation. At present, the area covered by sacred groves in India is gradually declining owing to various socioeconomic factors. Like other groves of Kerala, Sacred groves of North Malabar region are also facing the threat of extinction from increasing anthropogenic activities. Sacred groves of Northern Kerala have rich and diverse flora that supports an important array of fauna. This study presents a checklist of the spider fauna in 15 the sacred groves. It is a pioneering study and no other studies done in this area. The sampling methods such as line transect method; handpicking in ground and strata, and beating were used to catch specimens. The caught specimens were preserved and identified to species and genus level using available literature. A total of 257 species of spiders belonging to 130 genera and 28 families were identified from the study area. The dominant family was Araneidae followed by Salticidae, Theridiidae, and Thomisidae, these families represent roughly the 47% of the total abundance. Five families were observed as rare in the study area with less than 2 individuals.

Keywords: Araneofauna; India; richness; sacred natural sites.

1. INTRODUCTION

Appropriate documentation of biodiversity is vital for its sustainable management and conservation by the timely monitoring of the rate of species loss. Checklists form a fundamental part of systematic documentation. Species identified from different parts of the world are added to global databases and catalogues, which form a core of taxonomy and indirectly contribute to the conservation of

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biodiversity. Taking into consideration the rising level of anthropogenic threats to biodiversity, an inventory and proper documentation of biodiversity is indeed urgently [1]. The World Spider Catalog [2] documented a total of 48,624 species belonging to 4,172 genera and 128 families. India has around [3] 60 of the 128 spider families and 1,842 of the 48,624 species known worldwide. More number of species undoubtedly await discovery. A world without spiders would have serious problems affecting the whole food chain and cause an imbalance in the ecosystem [4] however; their study has always remained neglected in sacred groves.

India is exceptionally rich in sacred groves with around 13,720 sacred groves spread across 19 States [5]. The state of Kerala harbours 1500 to 2000 sacred groves, the extent of which varies from 0.004ha to >20 ha [6]. As reported by Induchoodan [7] 361 sacred groves in Kerala having an area of more than 0.02ha. Many small sacred groves have been lost in recent years and no recent data are available to assess their status [8]. Sacred groves are supposed to be relics of ancient vegetation and remnants of larger forest tracts [9]. Documenting and understanding spider assemblages in tropical forests in the present context of rapid loss is an important task [10].

Certain spiders have the ability to indicate habitat alteration in rain forest fragments of the Western Ghats [10]. Spider guilds specific to microhabitats like bark, foliage and ground did also show strong association levels with potential to indicate changes in these micro habitats [11].

Sacred groves play an important role in ensuring smooth ecosystem services such as clean environment that is, air, soil and water conservation, flora and fauna conservation, temperature control and conservation of traditional knowledge. Microclimatic features, soil cover, litter cover, water resources, highly diverse flora of these areas supports varied array of fauna. So that they are of central importance as far as ecological conservation and policy regarding conservation and management of forest at state and national levels are concerned [9].

The reports of Jayarajan [12] recorded 8 species of spiders from the sacred groves of northern Kerala. Sivaperuman [13] conducted a study in Kerala during 1997-1998 over a period of 4 months in 3 sacred groves. This study was recorded only 14 species by visual search method. A correlation between size of the sacred grove and spider species richness was expected but not found. Another studies conducted in the South Western Maharashtra [14] seven sacred groves were surveyed once each for spiders among potential indicator taxa. The enlisting of spiders of groves of Rathnagiri, Maharashtra [15] recorded 377 species belonging to 39 families from 102 groves. Sarmistha [16] recorded 5 species of spiders from sacred trees of Sherampore, Hoogly, and West Bengal. Report of Palita [17] recorded 81 species of spiders from six sacred groves of Odisha.

The sacred groves in Kerala are known as in different names depending upon the ownership and deities to whom these groves are dedicated. They are Ayyappan kavu or Sasthan kavu, Bhagavathy kavu or Amman kavu, Vanadevatha and Cheema or Cheerumba depending upon the ownership and deities to whom these groves are dedicated. The kavu's are two kinds - some are in the midst of human habitation and in most cases attached to households or not far away from them. In Kerala, based on management systems, sacred groves can be categorised into three types [18]. They are, managed by individual families, by groups of families and by the statutory agencies for temple management (Devaswom Board). The key question is how habitat of sacred groves influences spider diversity. The aim of the present study is to provide data on the spider assemblages in sacred groves of Kannur and Kasargod Districts of Kerala, India; to produce a checklist of spiders of from sacred groves of Northern Kerala.

2. MATERIALS AND METHODS

The study areas were located in Kasargod and Kannur districts of northern Kerala. Kannur is one of the 14 districts along the west coast in the state of Kerala, it is located between is 11°52′8.04′′ North latitude and 075° 21′19.66′′ East longitude and an area of 2,966 km^2. Kasargod district is one of the 14 districts in the Southern Indian state of Kerala. It is located between is 12°30′0′′ North latitude and 075° 0′0′′ East longitude and an area of 1,992 km^2. The following 15 sacred groves were selected for the study according to the area and habitat type. Details are given in Fig. 1 and Table 1.

The general floristic composition and physiognomy of vegetation of the sacred grove are typically like the low level evergreen forest. The vegetation in undisturbed groves is luxuriant and comprises several stories of trees mixed with shrubs, lianas, herbs, macro fungi, algae and water plants. The soil is rich in humus and covered with thick litter. Floristic variations have occurred in many sacred groves exposed to human and animal interferences and climatic and edaphic changes [18].

Table 1. Details of sites covered for spider inventory in sacred groves of Kasargod and Kannur Districts

Sl. no	Name of sacred groves	Location	Co-ordinates	Area of sacred grove (ha)	Vegetation	Diety	District
1	Edaylakadu	Thrikkarippoor	12°08'10.72'' N 75°09'23.88'' E	6.40	Evergreen type	Bhagavathynagam	Kasrgod
2	Kammadom Kavu	West elery	12°18'41.0''N 75°18'55.8'' E	24.00	Evergreen with fresh water myristica swamp	ThayyiParadevatha	Kasrgod
3	Koyithatta Sree Dharma Sastha Kavu	Koyithatta	12°17'11.4'' N 075°14'53.88'' E	3.00	Evergreen type	Sasthavu	Kasrgod
4	Mannam Purathukavu	Neeleswaram	12°15'27.6'' N 75°07'59.4'' E	2.83	Semi ever green type	Thaipardhevatha,Nagam	Kasrgod
5	Malliyodan Kavu	Konnakkad	12°22'1.24'' N 75°19'22.8'' E	3.00	Semi ever green type	Malliyodandevasthanam	Kasrgod
6	Payyamkulam Kavu	Kinaur,Karinthalam	12°17'41.7' N 75°12'18.96'' E	5.00	Evergreen type	Poomalabhagavthy	Kasrgod
7	Periyanganam Sree Dharma Sastha Kavu	Periyanganm	12°18'36.0'' N 75°15'52.56'' E	2.00	Semi ever green type	Sasthavu	Kasrgod
8	Puthiya Parambathukavu	Puthukky, Neeleswaram	12°15'34.56'' N 75°07'41.16.'' E	3.00	Semi ever green type	Bhagavathy	Kasrgod
9	Chama Kavu	Vellur, Payyannur	12°09'07.03'' N 75°12'35.5'' E	3.640	Evergreen type	ThayyiParadevatha	Kannur
10	Konginichal Kavu	Thulluvadakkam, Alappadambu	12°8'36.41'' N 75°14'18.76'' E	3.320	Evergreen type	NarambilBhagavathy	Kannur
11	Madayi Kavu	Eripuram, madayi	12°02'05.5'' N 75°21'50.0'' E	6.06	Moist deciduous	ThayyiParadevatha	Kannur
12	Neeliar Kottam	Morazha, Anthoor	11°56'03.8'' N 75°21'50.0'' E	8.7	Evergreen type	Neeliamma	Kannur
13	Palathara Kavu	Karivellur	12°10'07.0'' N 75°12'07.9'' E	1.00	Evergreen type	Bhagavathy	Kannur
14	Poongottu Kavu	Mattannur, Poongottu	11°55'14.7'' N 75°36'58.9'' E	14.60	Fresh water myristica swamp	Sasthavu	Kannur
15	Thazhe Kavu	Thekkumbadam, Mattul	11°57'59.3'' N 75°17'50.9'' E	7.52	Mangrove	Bhagavathy	Kannur

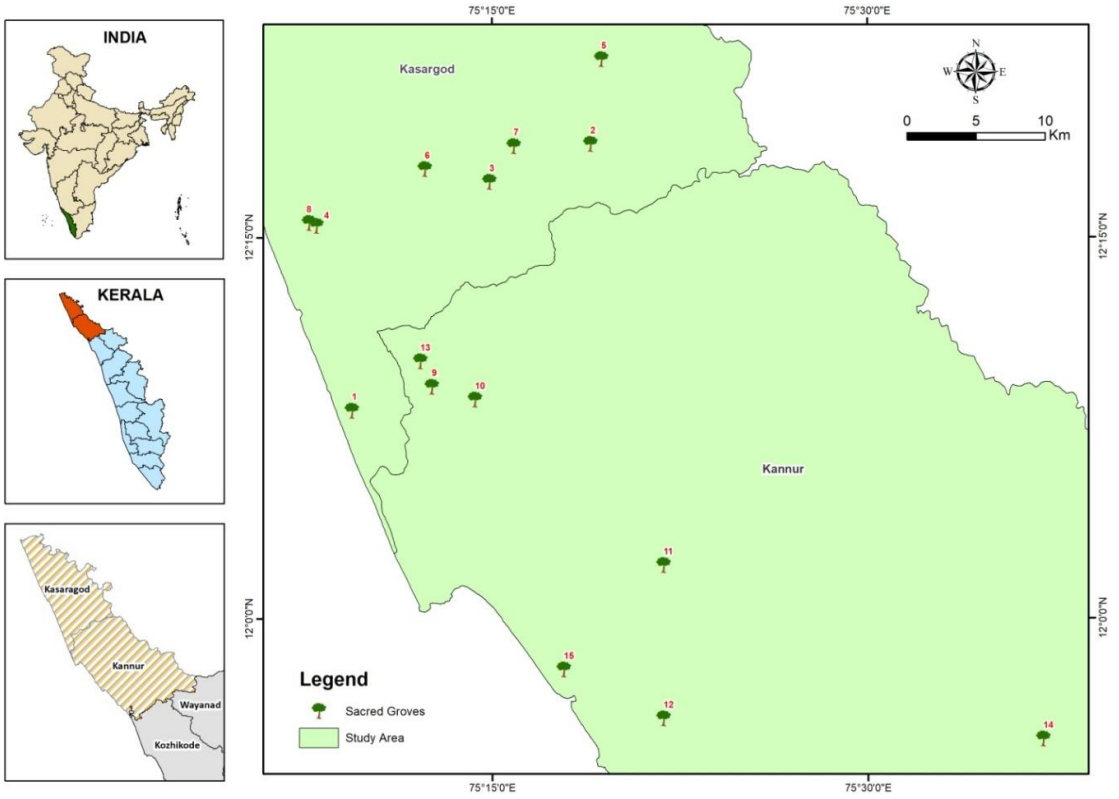

Fig. 1. Map showing the study area

Generally vegetation of the study area divided into evergreen, semi-evergreen, freshwater myristica swamp, moist deciduous and mangroves. General climatological factors in sacred groves like average annual rainfall is in between 2500 and 2680 mm. May and October are the wet months while November to April is relatively dry, Relative humidity is always greater than 55% and attain 100% during rainy season. Mean maximum temperature is between 25°C and 30°C while mean minimum temperature is about 18°C. The soil is sandy loam to laterite and acidic with pH value ranging from 4.8 to 5.2.

Spider sampling was carried out from 2016 February till 2018 January. The study period is divided into Pre-monsoon, Monsoon and Post monsoon seasons and samples collected from each season. A total of 90 samples collected during the study from 15 sacred groves. Spiders were collected in the morning from 7.00 am to 10 .00 am and evening from 4.00 pm to 7.00 pm. Line transect method [19] were adopted in this study. A total of 30 fixed transects (100 m in length) were established across the 15 sacred groves. Spiders were collected along 100 m transect length of two transects per habitat. Each transect was sampled 1 hour, thus adding up to 1-2 hours for a study area. Standard sampling techniques such vegetation beating, litter sampling, ground hand collection, aerial hand collection and sweep netting were employed to collect the spiders from their own habitats. To avoid the edge effect transects were fixed 25 m inside from the boundary.

All specimens were kept in separate vials with proper labeling and other notes of taxonomic importance. They were sorted and an effort was made to identify live specimen using reference books like Sebastian [20] up to at least family or genus level and recorded from the field itself. They were preserved in 70% ethyl alcohol. Some adults of each species or morphospecies were preserved as voucher specimen with proper cataloguing. They were subjected to detailed taxonomic examination. Adult specimens identified by the detailed examination of genital structures like epigyne and palp. Juveniles also identified by morphological examination. Other methods like standard taxonomic keys, standard literatures [20,21,22,23] and expert advice. (Mrs. Sarah J. Kariko, Associate of the Department of Organismic and Evolutionary Biology, Harvard University and John Caleb, Reasearch Associate, Zoological Survey of India, Kolkata) also used. They will be retained at Centre for Animal Taxonomy and

Ecology, Department of Zoology, Christ College (Autonomous) Irinjalakuda, Thrissur, Kerala. For future reference it will be deposited in appropriate collections.

Collected specimens were transported to Centre for Animal Taxonomy and Ecology, Department of Zoology, Christ College (Autonomous) Irinjalakuda, Thrissur, Kerala, India. Comparatively large specimens were photographed in the field itself before collection with the help of special digital camera and lens (Canon EOS 5D digital SLR and Canon 180 mm macro lens). Preserved specimens were examined under a stereo zoom microscope (Leica-M205C) in the laboratory for taxonomic identification. Identification and classification was also done on the basis of morphometric characters of various body parts. Most of the literature for this purpose was sourced from [2] which have an almost complete global repository of taxonomic literature on spiders. Similarly, websites such as spiders of Europe [24]. Aranea of India [3] etc. were helpful for the study.

3. RESULTS

Present study shows richness of 257 species, consist of 130 genera belonged to 28 families, including morphospecies. Details of family and genus richness represented in Fig. 2 & Table 2. It was observed that 19% species comes under family

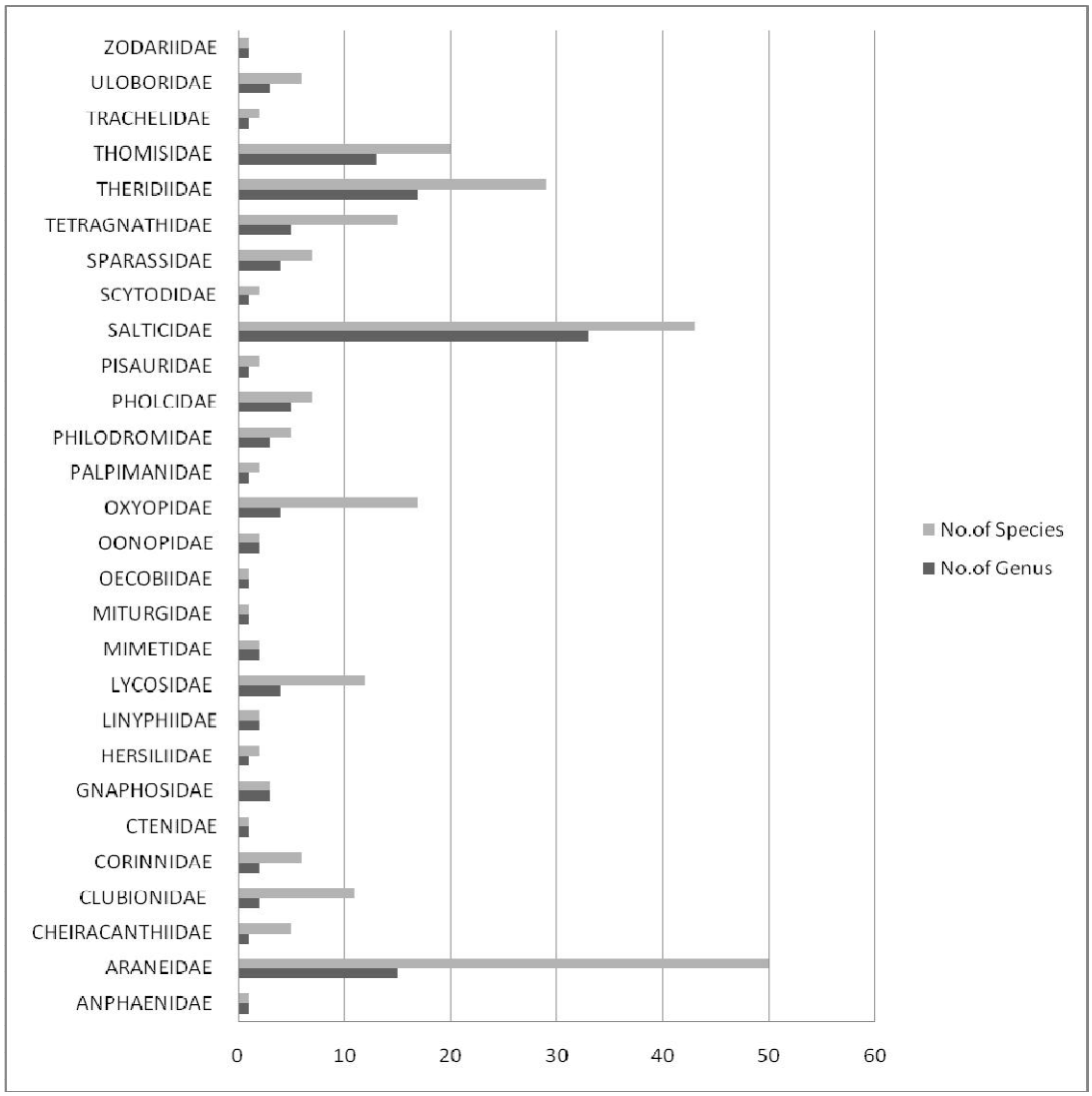

Fig. 2. Representation of genera and species in different spider families of the entire spider assemblage recorded in the study area

Araneidae was dominant in terms of taxonomic richness with 15 genera, 50 species. 16% species comes under family Salticidae with 33 genera, 43 species. Followed by 7% comes under family Theridiidae with 17 genera, 29 species and 5% Thomisidae with 13 genera, 20 species. Families like, Anphaenidae, Ctenidae, Miturgidae, Oceobidae and Zodariidae were least dominant with a single genus and species. Most abundant species in these study areas were *Nephila pilipes*, *Oxyopes birmanicus, Pholcus phalangioides, Epeus indicus, Epeus tener, Indopadilla insularis, Hyllus semicupreus, Phintella vittata, Rhene flavigera, Stenaelurillus lesserti, Telamonia dimidiata, Tylorida striata. Tylorida ventralis, Oxytate virens, Strigoplus netravati, Tmarus kotigeharus, Xysticus audax, Xysticus minutus.*

Table 2. Checklist of spiders collected from the study area

	I) ANYPHAENIDAE (Bertkau, 1878)
1	*Anyphaena* sp.(Sundewall, 1833)
	II) ARANEIDAE (Clerck, 1757)
2	*Anepsion maritatum* (O. Pickard-Cambridge, 1877)
3	*Arachnura* sp. (Vinson, 1863)
4	*Araneus* sp. I (Clerck, 1757)
5	*Araneus* sp. II (Clerck, 1757)
6	*Araneus sp.* III (Clerck, 1757)
7	*Araneus* sp. IV(Clerck, 1757)
8	*Araneus* sp. V (Clerck, 1757)
9	*Argiope aemula* (Walckenaer, 1841)
10	*Argiope catenulata* (Doleschall, 1859)
11	*Argiope pulchella* (Thorell, 1881)
12	*Porcataraneus bengalensis* (Tikader, 1975)
13	*Chorizopes* sp. (O. P. Cambridge, 1870)
14	*Chorizopes quadrituberculata* (Roy et al., 2014)
15	*Cyclosa argenteoalba* (Bösenberg & Strand, 1906)
16	*Cyclosa confraga* (Thorell,1892)
17	*Cyclosa hexatuberculata* (Tikader, 1982)
18	*Cyclosa spirifera* (Simon, 1889)
19	*Cyclosa* sp. (Menge, 1866)
20	*Cyrtarachne* sp. (Thorell, 1868)
21	*Cryptaranea* sp. (Court & Forster, 1988)
22	*Cyrtophora cicatrosa* (Stoliczka, 1869)
23	*Cyrtophora citricola* (Forsskal, 1775)
24	*Eriovixia excelsa* (Simon, 1889)
25	*Eriovixia laglaizei* (Simon, 1877)
26	*Eriovixia palawanesis* (Barrion&Litsinger, 1995)
27	*Eriovixia sakiedaorum* (Tanikawa, 1999)
28	*Eriovixia* sp. I (Archer, 1951)
29	*Eriovixia* sp. II (Archer, 1951)
30	*Eriovixia* sp. III (Archer, 1951)
31	*Gasteracantha dahli* (Sundevall, 1833)
32	*Gasteracantha geminata* (Fabricius, 1798)
33	*Gasteracantha hasselti* (C. L. Koch, 1837)
34	*Gasteracantha kuhli* (C. L. Koch, 1837)
35	*Gea subarmata* (Thorell, 1890)
36	*Gea* sp. (C. L. Koch, 1843)
37	*Herennia multipuncta* (Doleschall, 1859)
38	*Nephila pilipes* (Fabricius, 1793)
39	*Neoscona crucifera* (Lucas, 1838)
40	*Neoscona molemensis* (Tikader & Bal, 1980)
41	*Neoscona mukerjei* (Tikader, 1980)
42	*Neoscona* sp. I (Simon, 1864)
43	*Neoscona* sp. II (Simon, 1864)
44	*Neoscona* sp. III (Simon, 1864)

45	*Neoscona theisi* (Walckenaer, 1841)
46	*Neoscona vigilans* (Blackwall, 1865)
47	*Parawixia dehaani* (Doleschau, 1859)
48	*Parawixia* sp. (F.O Pickard-Cambridge ,1904)
49	*Paraplectana* sp. (BritoCapello, 1867)
50	*Poltys* sp. (C. L. Koch, 1843)
51	*Zygiella indica* (Tikader & Bal, 1980)
	III) CLUBIONIDAE (Wagner, 1887)
52	*Clubiona bilobata* (Dhali et al., 2016)
53	*Clubiona drassodes* (O. Pickard-Cambridge, 1874)
54	*Clubiona hexadentata* (Dhali et al., 2016)
55	*Clubiona modesta* (L. Koch, 1873)
56	*Clubiona pila* (Dhali et al., 2016)
57	*Clubiona tridentata* (Dhali et al., 2016)
58	*Clubiona* sp. I (Latreille, 1804)
59	*Clubiona* sp. II (Latreille, 1804)
60	*Clubiona* sp. III (Latreille, 1804)
61	*Clubiona* sp. IV (Latreille, 1804)
62	*Pristidia* sp. (Deeleman-Reinhold, 2001)
	IV) CORINNIDAE (Karsch, 1880)
63	*Castianeria zetes* (Simon, 1897)
64	*Castianeira* sp. I (Keyserling, 1879)
65	*Castianeira* sp. II (Keyserling, 1879)
66	*Castianeira* sp. III (Keyserling, 1879)
67	*Castianeira* sp. IV (Keyserling, 1879)
68	*Corinna* sp. (C. L. Koch, 1841)
	V) CTENIDAE (Keyserling, 1877)
69	*Ctenus cochinensis* (Gravely, 1931)
	VI) CHEIRACANTHIIDAE (Wagner,1887)
70	*Cheiracanthium danieli* (Tikader, 1975)
71	*Cheiracanthium melanostomum* (Thorell, 1895)
72	*Cheiracanthium punctorium* (Villers, 1789)
73	*Cheiracanthium* sp. I (C. L. Koch, 1839)
74	*Cheiracanthium* sp. II (C. L. Koch, 1839)
	VII) GNAPHOSIDAE (Pocock, 1898)
75	*Drassodes* sp. (Westring, 1851)
76	*Scotophaeus blackwalli* (Thorell, 1871)
77	*Zelotes* sp.(Gistel, 1848)
	VIII) HERSILIIDAE (Thorell, 1870)
78	*Hersilia savignyi* (Lucas, 1836)
79	*Hersilia* sp.(Audouin, 1826)
	IX) LINYPHIIDAE (Blackwall, 1859)
80	*Linyphia striata* (Laterile, 1804)
81	*Neriene sundaica* (Simon, 1905)
	X) LYCOSIDAE (Sundevall, 1833)
82	*Hippasa agelenoides* (Simon, 1884)
83	*Hippasa greenalliae* (Blackwall,1867)
84	*Hippasa* sp. (Simon, 1855)
85	*Lycosa phipsoni* (Pocock, 1899)
86	*Lycosa mackenziei* (Gravely, 1924)
87	*Pardosa birmanica* (Simon, 1884)
88	*Pardosa chambaensis* (Tikader & Malhotra, 1976)
89	*Pardosa kupupa* (Tikader, 1970)
90	*Pardosa pseudoannulata* (Bosenberg& Strand, 1906)
91	*Pardosa sumatrana* (Thorell, 1890)
92	*Paradosa* sp. (C. L. Koch, 1847)

93	*Trochosa* sp. (C. L. Koch)
	XI) MIMETIDAE (Simon, 1881)
94	*Ero* sp. (C. L. Koch, 1836)
95	*Mimetus* sp. (Hentz, 1832)
	XII) MITURGIDAE (Simon, 1886)
96	*Systaria* sp. (Simon, 1897)
	XIII) OECOBIIDAE (Blackwall, 1862)
97	*Oecobius* sp. (Lucas, 1846)
	XIV) OONOPIDAE (Simon,1890)
98	*Gamasomorpha* sp. (Karsch, 1881)
99	*Opopaea* sp. (Simon, 1892)
	XV) OXYOPIDAE (Thorell, 1870)
100	*Hamadruas sikkimensis* (Tikader,1970)
101	*Hamadruas* sp. I (Deeleman-Reinhold, 2009)
102	*Hamadruas* sp. II (Deeleman-Reinhold, 2009)
103	*Hamataliwa* sp. I (Keyserling, 1887)
104	*Hamataliwa* sp. II (Keyserling, 1887)
105	*Oxyopes birmanicus* (Thorell, 1887)
106	*Oxyopes javanus* (Thorell, 1887)
107	*Oxyopes lineatipes* (C. L. Koch, 1847)
108	*Oxyopes pandae* (Tikader, 1969)
109	*Oxyopes salticus* (Hentz, 1845)
110	*Oxyopes shweta* (Tikader, 1970)
111	*Oxyopes sikkimensis* (Tikader, 1970)
112	*Oxyopes* sp.I (Latreille, 1804)
113	*Oxyopes* sp. II (Latreille, 1804)
114	*Oxyopes* sp. III (Latreille, 1804)
115	*Peucetia ananthakrishnani* (Murugesan et al., 2006)
116	*Peucetia viridana* (Stoliczka, 1869)
	XVI) PALPIMANIDAE (Thorell, 1870)
117	*Palpimanus* sp. I (Dufour, 1820)
118	*Palpimanus* sp. II (Dufour, 1820)
	XVII) PHILODROMIDAE (Thorell, 1870)
119	*Philodromus* sp. I (Walckenaer, 1826)
120	*Philodromus* sp. II (Walckenaer, 1826)
121	*Thanatus parangvulgaris* (Barrion & Litsinger, 1995)
122	*Thanatus* sp. (C. L. Koch, 1837)
123	*Tibellus elongatus* (Tikader, 1960)
	XVIII) PHOLCIDAE C. L. Koch, 1850
124	*Artema atlanta* (Walckenaer, 1837)
125	*Crossopriza lyoni* (Blackwall, 1867)
126	*Pholcus phalangioides* (Fuesslin, 1775)
127	*Pholcus* sp. *I* (Walckenaer, 1805)
128	*Pholcus* sp. II (Walckenaer, 1805)
129	*Smeringopus pallidus* (Blackwall, 1858)
130	*Uthina* sp.(Simon,1893)
	XIX) PISAURIDAE (Simon, 1890)
131	*Dendrolycosa gitae* (Tikader, 1970)
132	*Dendrolycosa* sp. (Doleschall, 1859)
	XX) SALTICIDAE (Blackwall, 1841)
133	*Acragas* sp. (Simon, 1900)
134	*Ajaraneola* sp.(Wesolowska & A. Russell-Smith, 2011)
135	*Asemonea tenuipes* (O. P. Cambridge, 1869)
136	*Attulus* sp. (Simon, 1889)
137	*Bianor narmadaensis* (Tikader, 1975)
138	*Brettus albolimbatus* (Simon, 1900)

139	*Brettus anchorum* (Wanless, 1979)
140	*Brettus* sp. I (Thorell,1895)
141	*Brettus* sp. II (Thorell,1895)
142	*Carrhotus viduus* (C. L. Koch, 1846)
143	*Chalcotropis pennata* (Simon, 1902)
144	*Chrysilla volupe* (Karsch, 1879)
145	*Epeus indicus* (Proszynski, 1992)
146	*Epeus tener* (Simon, 1877)
147	*Epocilla aurantiaca* (Simon, 1885)
148	*Euophrys omnisuperstes* (Wanless, 1975)
149	*Eupoa* sp. (Zabka, 1985)
150	*Evarcha* sp. (Simon, 1902)
151	*Habrocestum* sp.(Simon, 1902)
152	*Hasarius adansoni* (Audouin, 1826)
153	*Hyllus semicupreus* (Simon, 1885)
154	*Indopadilla insularis* (Malamel et al., 2015)
155	*Langona* sp. (Simon, 1901)
156	*Lyssomanes* sp. (Hentz, 1845)
157	*Marpissa decoratedecorata* (Tikader,1974)
158	*Marengo sachintendulkar* (Malamel et al., 2019)
159	*Menemermus bivittatus* (Dufour,1831)
160	*Myrmaplata plataleoides* (O. P. Cambridge, 1869)
161	*Neon reticulatus* (Blackwall, 1853)
162	*Phintella vittata* (C. L. Koch, 1846)
163	*Plexippus paykulli* (Audouin, 1826)
164	*Portia fimbriata* (Doleschall, 1859)
165	*Portia* sp.I (Doleschall, 1859)
166	*Ptocasius yashodharae* (Tikader,1977)
167	*Rhene daitarensis* (Proszynski, 1992)
168	*Rhene flavigera* (C. L. Koch, 1846)
169	*Siler semiglaucus* (Simon, 1901)
170	*Siler* sp. (Simon, 1889)
171	*Stenaelurillus lesserti* (Reimoser, 1934)
172	*Stenaelurillus* sp. (Simon, 1885)
173	*Telamonia dimidiata* (Simon, 1899)
174	*Thiania bhamoensis* (Thorell, 1887)
175	*Thyene* sp. (Simon, 1885)
	XXI) SCYTODIDAE (Blackwall, 1864)
176	*Scytodes fusca* (Walckenaer, 1837)
177	*Scytodes thoracica* (Latreille, 1802)
	XXII) SPARASSIDAE (Bertkau, 1872)
178	*Heteropoda nilgirina* (Pocock, 1901)
179	*Heteropoda venatoria* (Linnaeus, 1767)
180	*Heteropoda* sp. I (Latreille, 1804)
181	*Heteropoda* sp. II (Latreille, 1804)
182	*Pseudopoda straminiosa* (Kundu et al., 1999)
183	*Sinopoda* sp. (Jäger, 1999)
184	*Olios milleti* (Pocock, 1901)
	XXIII) TETRAGNATHIDAE (Menge, 1866)
185	*Guizygiella nadleri* (Heimer, 1984)
186	*Leucauge decorata* (Blackwall, 1864)
187	*Leucauge dorsotuberculata* (Tikader, 1982)
188	*Leucauge pondae* (Tikader, 1970)
189	*Leucauge tessellata* (Thorell, 1887)
190	*Leucauge* sp. (White, 1841)
191	*Opadometa fastigata* (Simon, 1877)
192	*Tetragnatha bituberculata* (L. Koch, 1867)

193	*Tetragnatha cochinensis* (Gravely, 1921)
194	*Tetragnatha elongata* (Walckenaer,1841)
195	*Tetragnatha javana* (Thorell, 1890)
196	*Tetragnatha mandibulata* (Walckenaer,1842)
197	*Tetragnatha* sp.(Latreille,1804)
198	*Tylorida striata* (Thorell, 1877)
199	*Tylorida ventralis* (Thorell, 1877)
	XXIV) THERIDIIDAE (Sundevall, 1833)
200	*Achaearanea durgae* (Tikader,1970)
201	*Achaearanea* sp. (Strand, 1929)
202	*Argyrodes ambalikae* (Tikader, 1970)
203	*Argyrodes amboinensis* (Thorell, 1878)
204	*Argyrodes flavescens* (O. Pickard-Cambridge, 1880)
205	*Argyrodes gracilis* (L. Koch, 1872)
206	*Argyrodes gazedes* (Tiader, 1970)
207	*Argyrodes kumadai* (Chida et al., 1999)
208	*Argyrodes* sp.(Simon, 1864)
209	*Asagena* sp. (Sundevall, 1833)
210	*Chrysso argyrodiforms* (O. Pickard-Cambridge,1882)
211	*Chrysso* sp. (O. Pickard-Cambridge,1882)
212	*Enoplognatha sp*. (Pavesi, 1880)
213	*Episinus* sp. (Walckenaer, 1809)
214	*Meotipa argyrodiformis* (Yaginuma, 1952)
215	*Meotipa multuma* (Murthappa et al.,2017)
216	*Meotipa picturata* (Simon, 1895)
217	*Molione triacantha* (Thorell, 1892)
218	*Neospintharus trigonum* (Hentz, 1850)
219	*Nesticodes rufipes* (Lucas, 1846)
220	*Nihonhimea mundula* (L. Koch, 1872)
221	*Parasteatoda tepidariorum* (C. L. Koch, 1841)
222	*Phycosoma martinae* (Roberts, 1983)
223	*Phycosoma* sp. I (O.Pickard – Cambridge)
224	*Phycosoma* sp. II (O.Pickard – Cambridge)
225	*Phoroncidia septemaculeata* (O. Pickard-Cambridge, 1873)
226	*Rhomphaea projiciens* (O. Pickard-Cambridge, 1896)
227	*Theridula angula* (Emerton,1882)
228	*Thwaitesia margaritifera* (O. Pickard-Cambridge, 1881)
	XXV) THOMISIDAE (Sundevall, 1833)
229	*Amyciaea albomaculata* (O. Pickard-Cambridge, 1874)
230	*Amyciaea forticeps* (O. P. Cambridge, 1873)
231	*Camaricus formosus* (Thorell, 1887)
232	*Camaricus* sp. (Thorell, 1887)
233	*Ebrechtella* sp.(Dahl, 1907)
234	*Indoxysticus minutus* (Tikader, 1960)
235	*Mastira* sp. (Thorell, 1891)
236	*Misumena* sp.(Latreille, 1804)
237	*Oxytate greenae* (Tikader, 1980)
238	*Oxytate virens* (Thorell, 1891)
239	*Ozyptila* sp. (Simon, 1864)
240	*Runcinia roonwali* (Tikader, 1965)
241	*Strigoplus netravati* (Tikader,1963)
242	*Thomisus projectus* (Tikader, 1960)
243	*Thomisus viveki* (Gajbe, 2004)
244	*Tmarus kotigeharus* (Tikader, 1963)
245	*Xysticus audax* (Schrank, 1803)
246	*Xysticus cristatus* (Clerck, 1757)
247	*Xysticus minor* (Charitonov, 1946)

248	*Xysticus minutus* (Tikader, 1960)
	XXVI) TRACHELIDAE (Simon, 1897)
249	*Utivarachna* sp. I (Kishida, 1940)
250	*Utivarachna* sp. II (Kishida, 1940)
	XXVII) ULOBORIDAE (Thorell, 1869)
251	*Miagrammopes* sp. I (O. P. Cambridge, 1870)
252	*Miagrammopes* sp. II (O. P. Cambridge, 1870)
253	*Uloborus danolius* (Tikader, 1969)
254	*Uloborus glomosus* (Walckenaer, 1841)
255	*Uloborus krishnae* (Tikader, 1970)
256	*Zosis geniculata* (Olivier, 1789)
	XXVIII) ZODARIIDAE (Thorell,1881)
257	*Suffasia* sp. (Jocqué, 1991)

4. DISCUSSION

Results of the present study are close to 14% of the known Araneomorph spider species from India [3]. These 257 species belong to 28 families and 130 genera which come to 46.6% and 27.6% of Araneomorph families and species known from India [3]. A list of species (including morphospecies) recorded.

As discussed by Patil [15] conducted study for 4 years in 102 sacred groves of Maharashtra region and recorded 377 species. Whereas our study, which was conducted in 15 sacred groves of Northern Kerala documented 257 species in two years. This may indicates more rich in diversity of spiders in sacred groves of Kerala.

Vegetation structure could influence spiders through a variety of biotic and abiotic factors, temperature, humidity, level of shade cover, abundance, type of prey, refuges from natural enemies and intra guild predation [25,26]. Different families of spiders may use separate portions of the foliage of different habitat without adversely competing for space, quality of microhabitats for shelter and web building are strongly determined by architectural characteristics of the foliage and branches, which in turn influence family composition and individual spider diversity. The availability of great diversity of plants in the sacred groves might be the major contributing factor for the rich diversity of spiders.

Sacred groves are now facing severe threats due to encroachment, improper management, pollution etc., So, proper silvicultural and horticultural practices should be undertaken to improve the plant diversity in the sacred groves and thereby the faunal diversity. It is very vital to recognize that sacred groves are the 'LUNGS AND RESERVOIRS' of a locality. About 75% of groves are facing the threat of extinction. Considering the limitation of short-term studies and that too in very few selected areas, it will be premature to arrive at any conclusion on the correlation between size of the area and the diversity of species. So, a comprehensive long term study would yield further information to help arrive at conclusive results and to understand the role of sacred groves in biodiversity conservation completely.

5. CONCLUSION

A checklist on the spiders of sacred groves of Northern Kerala is given in this paper with 257 species belonged to130 genera from 28 families. Sacred groves with different habitat show significant variation of spider diversity and family composition. Present study indicates a great diversity of spiders was found in the sacred groves. This is the first ever documentation of the spiders of sacred groves from Kerala. However, this by no means is comprehensive and it only suggests the great diversity of the spider fauna of sacred groves and thus warranting future exploration of the spiders of this indigenously protected areas.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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