



Revision of *Hindumanes* Logunov, 2004 (Araneae: Salticidae: Lyssomaninae), with description of a new species from the Western Ghats of Kerala, India

PUTHOOR PATTAMMAL SUDHIN^{1,2}, KARUNNAPPILLI SHAMSUDHEEN NAFIN^{1,4}
& AMBALAPARAMBIL VASU SUDHIKUMAR^{1,3}

¹Centre for Animal Taxonomy and Ecology, Department of Zoology, Christ College, Irinjalakuda, Kerala, 680 125, India.

E-mail: ²sudhinpp@gmail.com, ³avsudhi@rediffmail.com

⁴Corresponding author. E-mail: nafinks5@gmail.com

Abstract

The monotypic genus *Hindumanes* Logunov, 2004 is revised. We present fresh specimens of *Hindumanes karnatakaensis* (Tikader & Biswas, 1978), the type species, and describe *Hindumanes wayanadensis* sp. nov. from the Wayanad Wildlife Sanctuary, a part of the Western Ghats, Kerala, India. This paper provides the first description of the male of *H. karnatakaensis* and a redescription of its female. We also transfer the genus from Asemoneinae Maddison, 2015 to Lyssomaninae Blackwall, 1877. The relationship between *Hindumanes* and *Lyssomanes* Hentz, 1845 and the zoogeography of the subfamily are discussed. The distribution records of the genus are mapped.

Key words: long-legged jumping spider, subfamily placement, zoogeography, relict, Wayanad Wildlife Sanctuary, biodiversity hotspot

Introduction

The subfamily Lyssomaninae Blackwall, 1877 is one of the most distinct groups in Salticidae Blackwall, 1841. It includes unusual long-legged, foliage dwelling jumping spiders with mostly green, translucent bodies and eyes arranged in four separate rows. Currently, Lyssomaninae comprises three genera: *Lyssomanes* Hentz, 1845, *Chinoscopus* Simon, 1901 and *Sumakuru* Maddison, 2016, with 99 nominal species, mostly restricted to Neotropical forests (World Spider Catalog 2017). Recent molecular phylogenetic studies suggest the monophyly of Lyssomaninae, with two recently radiated sister taxa, *Lyssomanes* and *Chinoscopus*, and a deeply diverging group, *Sumakuru* (Su *et al.* 2007; Maddison *et al.* 2014; Maddison 2016).

The monotypic genus *Hindumanes* Logunov, 2004 was erected by Logunov (2004) to accommodate a misplaced species, *Lyssomanes karnatakaensis* Tikader & Biswas, 1978, described from the state of Karnataka, India. The genus was based only on a female and suggested to be closer to *Lyssomanes* and *Pandisus* Simon, 1900, which was also included in Lyssomaninae at that moment, due to their similar minute posterior median eyes. Subsequently, in a recent revision of Salticidae, *Hindumanes* was placed with *Pandisus* in the new subfamily Asemoneinae Maddison, 2015, based on the same feature (Maddison 2015). However, freshly collected, undescribed males of *H. karnatakaensis* from the Wayanad Wildlife Sanctuary in the Western Ghats of India provide support for the placement of *Hindumanes* in the subfamily Lyssomaninae, given the similarities of its male palp with that of *Lyssomanes*.

In the present paper we provide the first description of the male of *H. karnatakaensis*, a detailed redescription of the female, and the description of a new species based on specimens collected from the Wayanad Wildlife Sanctuary in Kerala, a biodiversity hotspot in the Western Ghats of India (Myers *et al.* 2000). We also transfer the genus to Lyssomaninae. The relationships between *Hindumanes* and *Lyssomanes* and the zoogeography of Lyssomaninae are discussed. A map with records of *Hindumanes* is also given.

Materials and methods

Field photos were taken with a Canon EOS 5D Mark-III using Canon EF 100mm f/2.8 Macro USM Lens, Canon MP-E 65mm 1–5x Macro Lens and Canon MT-24EX Macro Twin Lite Flash. Spiders were collected by hand and beating vegetation. The specimens were stored in 70% ethanol and studied under a Magnus MSZ TR stereo microscope. The micro photographic images were taken with an Olympus EPL-3 digital camera attached to a Magnus MSZ TR stereo microscope, and photographs were stacked using Combine ZP for final image (www.hadleyweb.pwp.blueyonder.co.uk). All measurements are in millimeters. Description of length of palp and leg articles is as follows: total length [femur, patella, tibia, metatarsus (except palp), tarsus]. The specimens are deposited in a reference collection housed at the *Centre* for Animal Taxonomy and Ecology (CATE), Department of Zoology, Christ College, Irinjalakuda, Kerala, India.

Abbreviations used in the text: ALE—anterior lateral eyes, AME—anterior median eyes, do—dorsal, MOQ—median ocular quadrangle, pl—prolateral, PLE—posterior lateral eyes, PME—posterior median eyes, plv—prolateral ventral, rl—retrolateral, rlv—retrolateral ventral, v—ventral, ZSI—Zoological Survey of India.

Taxonomy

Salticidae Blackwall, 1841

Lyssomaninae Blackwall, 1877

Hindumanes Logunov, 2004

Type species. *Lyssomanes karnatakaensis* Tikader & Biswas, 1978.

Subfamily placement. Subfamily Lyssomaninae currently comprises three genera, *Lyssomanes*, *Chinoscopus* and *Sumakuru*, supported by the presence of a membraneous conductor in the male palp (Wanless 1980: figs 2G, H; Maddison 2016: figs 6, 7; Galvis 2017: figs 7d–g). The presence of this structure (Figs 5A–C, E) and the general conformation of the palpal bulb strongly support its placement in the subfamily Lyssomaninae.

Diagnosis. *Hindumanes* can be easily distinguished from most of the lyssomanine genera by the following characteristics: Carapace relatively high and oval (carapace low and virtually flat in *Chinoscopus* and elongate in *Sumakuru*); the relative width of the eye field is small (it is much wider in the other genera, see Logunov 2004); AME directed anteriorly (in *Sumakuru*, they are tilted to the sides); ALE situated directly behind AME, almost on the optical axis of AME (ALE widely separated in *Chinoscopus* and most *Lyssomanes*; in *Sumakuru* and some species of *Lyssomanes*, such as *L. anchicaya* Galiano, 1984 and *L. elongates* Galiano, 1980, ALE are situated directly behind AME). *Hindumanes* is morphologically closer to *Lyssomanes*, by having similar body, presence of paired ventral spines on tibia and metatarsi of legs I & II, and similar palpal organization. It can be distinguished from *Lyssomanes* by the following combination of characters: ALE situated directly behind AME, almost in the optical axis of the AME (in most *Lyssomanes*, ALE widely separated behind AME) (Figs 4A–B; see also Tikader & Biswas 1978: fig. 1; Logunov 2004: fig. 3); relative width of the eye field is narrower: the ratio of “carapace width at PME/PME–PME distance” is around 3:1 (the relative width of the eye field is much wider, see Logunov 2004); patellae I & II with a dorsal macrosetae distally and a dorsal spine on the patellae III & IV (*Lyssomanes* has both lateral and dorsal spines on all patellae). The female of *Hindumanes* can be easily recognized from *Lyssomanes* by the distinctive female copulatory organ: large spermathecae with no glandular ducts (in true *Lyssomanes*, spermathecae are smaller, with well-developed glandular ducts) (Figs 7A–B; see also Galiano 1980; Logunov & Marusik 2003; Logunov 2004, 2014).

The male palp of *Hindumanes* is characteristic of the Lyssomaninae and surprisingly similar to the palpal structure of most *Lyssomanes*. The structure of the palp can be characterized as follows: 1. Long palp with an elongated cymbium and well developed tutaculum (Fig. 5C), femur and patella devoid of any apophyses; 2. Tibia with a distal process and a long retrolateral outgrowth in the distal mid-section (Figs 5A–D). Different types of retrolateral tibial modifications have been found in some species of *Lyssomanes*, but most of them are brush-like formed by long and strong bristles (Galiano 1980: figs 63, 89, 147; Logunov 2014: fig. 27); 3. Membraneous conductor is present (Figs 5A–C, E), which is considered as a synapomorphy in Lyssomanine (Wanless 1980); 4. Spermophore configuration almost similar to that of *Lyssomanes* (Galiano 1980; Logunov 2014; Maddison 2016).

Description. Members of *Hindumanes* are green to yellowish-green, long-legged, medium-sized spiders (male = 5.57–6.13, female = 6.72–6.92). Sexes are alike in general body form, but dimorphism is evident in color markings. Females are uniformly green without distinct markings (Figs 1C–D); male carapace yellowish-orange with light reddish-brown lateral markings, abdomen dorsally with paired longitudinal stripes, similar stripes ventrolaterally (Figs 1A–B, 2A, E); Female legs light green, tibia I with apical retrolateral black mottling; male legs with black longitudinal lines on the femur I and black bands on all tibiae (Figs 1A–B). Carapace oval, covered with colorless setae, with well-defined longitudinal fovea (Figs 1A, 2A, C, 3A, 4A–B, 6A); cephalic region truncated anteriorly, moderately high, highest at PLE; thoracic region gently sloping backwards margin almost rounded with concave posterior margin (Figs 2E, 3D, 6D). Eye field slightly raised, narrow, covered with lustrous appressed scales (Figs 1A–D, 2A, C, E, 3A, 4A–B, 6A). Eyes in four rows, anterior row widest, ALE positioned directly behind the first row, at the optical axis of AME; PME very small, closer to and situated at the optical axis of ALE; PLE almost same size as ALE; MOQ longer than wide and wider in front. Clypeus rather low, vertical and hairless. Chelicerae short, sub-vertical and parallel in females (Figs 1D, 3B–C, 4A, 6C); moderately long and slightly diverging in males (Figs 1B, 2A–D, 4B); with two prolateral spines; promargin with three teeth, retromargin with five to six teeth (Figs 4D–F). Endites sub-parallel, rectangular, elongate, anteriorly rounded with inconspicuous scopulae (Figs 2B, 3B). Labium almost rectangular, about as long as wide, almost half the length of endites (Figs 2B, 3B). Sternum sub-pentagonal, posteriorly narrowing, with a triangular projection between coxae III & IV (Figs 2B, 3B). Pedicel short. Abdomen elongate, ovoid, narrowing posteriorly. Spinnerets sub-equal in length, posterior spinnerets robust than others. Legs long, slender; legs with spines on all articles, except tarsi of all legs, patella I, II and metatarsus IV; tibia I & II with 4 pairs of ventral spines, metatarsi I & II with 3 pairs of ventral spines, patella I & II distally with a dorsal macrosetae and patellae III & IV with a dorsal spine; leg formula 1243. Female palpal articles light green, all articles with spines.

Male palp long, with spines on all articles, femur and patella without any apophysis; tibia with a distal tibial process and a long retrolateral tibial outgrowth joined to a stalk on the distal mid-section of tibia, slightly bent at the middle, the tip of which is flat and wide with uneven edges (Figs 5A–D). Cymbium highly elongated, covered with long and medium-sized setae, basally with a pair of elongated dorsal spines, distally with one prolateral and retrolateral spine (Figs 5A, C); tutaculum medium-sized, oval (Fig. 5C); bulb almost ovoid, occupying almost two fifths of cymbium; tegulum in the disto-retrolateral part of bulb; subtegulum occupies one third of the bulb; the retrolateral descending loop of sperm duct closely arranged (Fig. 5E); median apophysis long, wide, with an apical finger-like projection directed disto-prolaterally, with tip slightly bent downwards (Fig. 5E); conductor clam-shaped (Fig. 5A); embolus base wide, the thin spermophore forming a twist in the embolus base before entering the embolus (Fig. 5A), embolus thin and elongated, initially oriented distally in an upward angle, then bending disto-retrolaterally with the pointed tip slightly bent forward (Fig. 5E).

Epigyne simple and transparent; spermathecae large, longer than wide, with no glandular ducts, touching each other in *H. karnatakaensis* (see Logunov 2004: figs 1–2) or widely separated, as in *H. wayanadensis* **sp. nov.** (Figs 7A–B); posterior outgrowth overhanging the epigastric furrow only in *H. karnatakaensis* (see Logunov 2004: figs 1–2); copulatory duct varies from moderately long to very short; fertilization duct small and acuminate, anterolaterally oriented, posterior to spermathecae (Fig. 7A; Logunov 2004: fig. 2).

Distribution. Known only from western India (Fig. 9).

Species included. *Hindumanes karnatakaensis* (type species) and *H. wayanadensis* **sp. nov.**

***Hindumanes karnatakaensis* (Tikader & Biswas, 1978)**

Figs 1–4A–E, 5

Lyssomanes karnatakaensis Tikader & Biswas, 1978: 257, figs 1–3.

Hindumanes karnatakaensis: Logunov 2014: 74, figs 1–3; Prószyński 2017: 125, fig. 54K; World Spider Catalog 2017.

Type material. Holotype female from Kottigehara, District of Chikmagalur, Karnataka, India, 1978, Tikader & Biswas, deposited at ZSI, Kolkata, NOT EXAMINED.

New material examined. INDIA: Kerala: Wayanad Wildlife Sanctuary, Bathery range: 2 ♂ (11°42′09.8″N 76°20′39.6″E, 868 m asl) (CATE 8411A); 1 ♀ (11°42′01.7″N 76°20′28.1″E, 866 m asl) (CATE 8411B), all P.P. Sudhin & K>S. Nafin, 31.V.2015.

Diagnosis. The female of *H. karnatakaensis* is similar to that of *H. wayanadensis* **sp. nov.**, but can be separated by the following combination of characters: chelicerae with two mid-dorsal spines (absent in *H. wayanadensis*); epigyne with posterior outgrowth overhanging the epigastric furrow (absent in *H. wayanadensis*); spermathecae nearly oblong, touching each other (in *H. wayanadensis*, it is almost kidney-shaped, widely separated and anteriorly narrowed, with a lateral hump); copulatory ducts moderately long and copulatory openings at the middle of the epigyne (in *H. wayanadensis*, copulatory ducts are very short and copulatory openings are anteriorly located) (compare Figs 3C, 4C, 6C, 7A–B; Logunov 2004: figs 1–2).

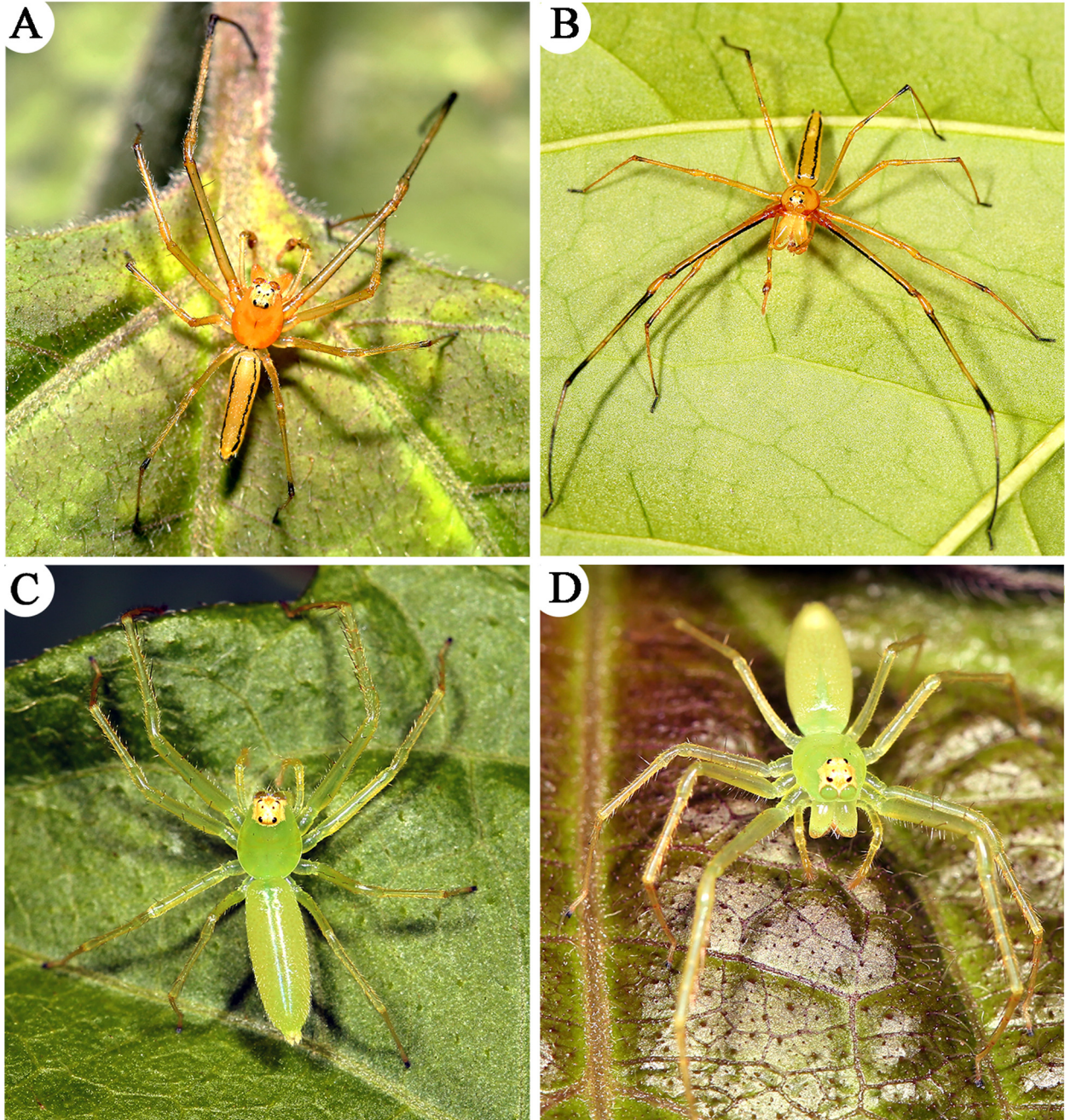


FIGURE 1A–D. Photographs of *Hindumanes karnatakaensis* from Wayanad Wildlife Sanctuary, Kerala, India. **A** Male, dorsal view; **B** Same, frontal view; **C** Female, dorsal view; **D** Same, frontal view. Photo credit A–D Karunnapilli S. Nafin.

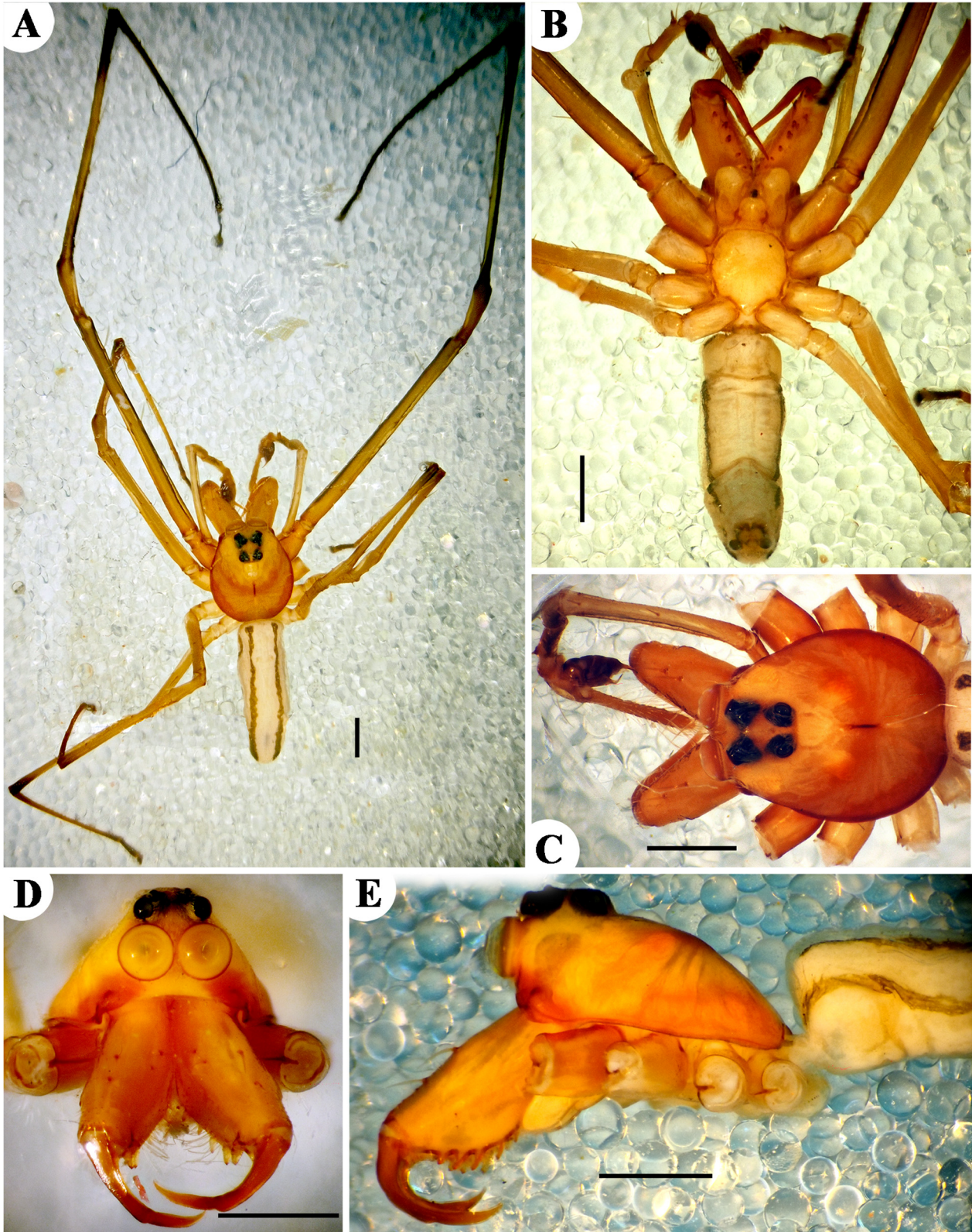


FIGURE 2A–E *Hindumanes karnatakaensis*, male. **A** Dorsal view; **B** Ventral view; **C** Carapace, dorsal view; **D** Same, frontal view; **E** Same, lateral view. Scale bar: A–E: 1 mm.

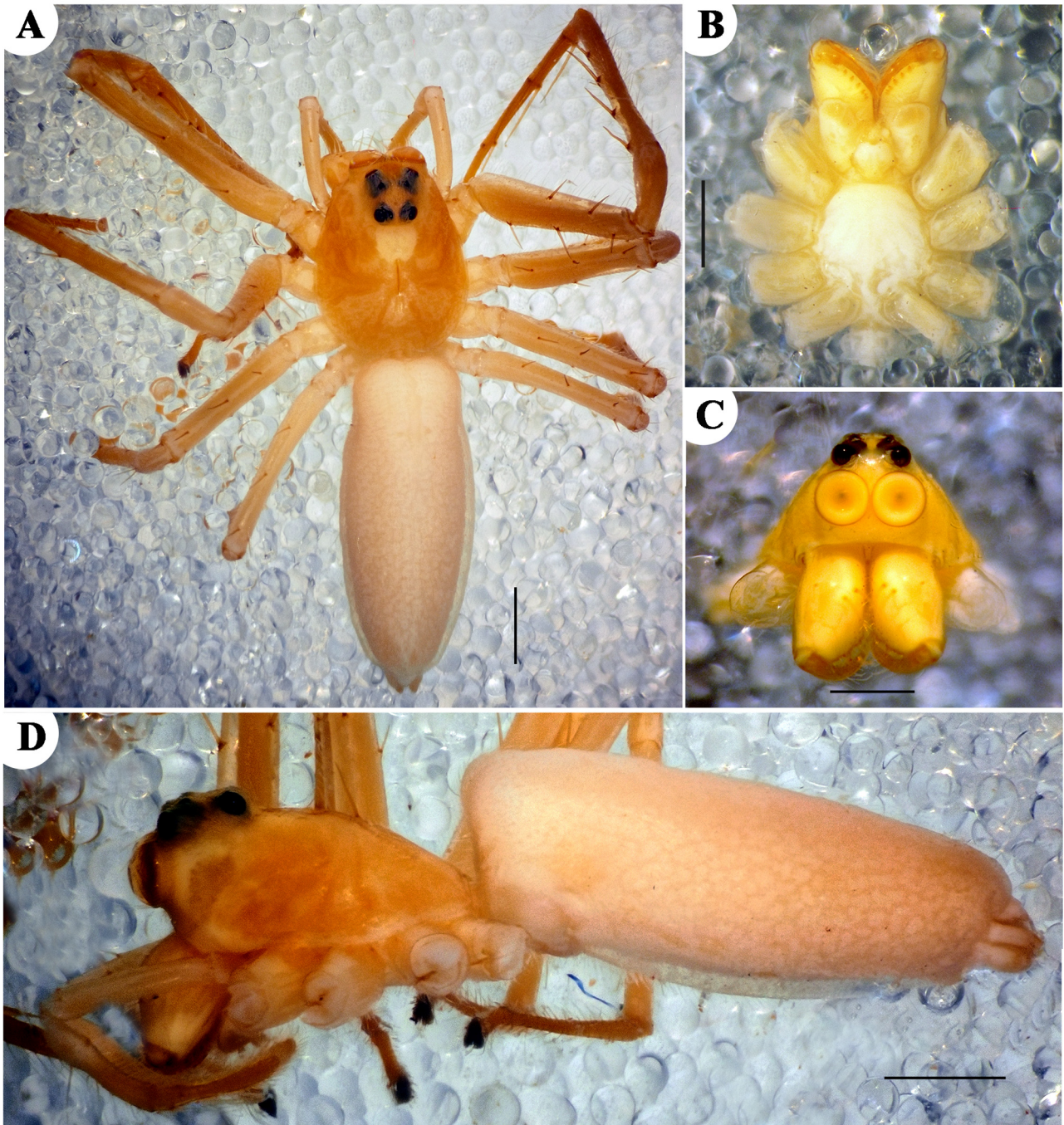


FIGURE 3A–D *Hindumanes karnatakaensis*, female. **A** Dorsal view; **B** Carapace, ventral view; **C** Same, frontal view; **D** Lateral view. Scale bar: A–D: 1 mm.

The palp conformation of the male of *H. karnatakaensis* is closest to true *Lyssomanes* spp., mostly similar to *L. anchikaya* Galiano, 1984. It can be separated from *L. anchikaya* by the following combination of characters: 1. Highly elongated cymbium (medium-sized in *L. anchikaya*); 2. Tibia with a distal process and a long retrolateral outgrowth (both absent *L. anchikaya*); 3. Membranous conductor clam-shaped (mushroom-shaped in *L. anchikaya*); 4. Median apophysis long, wide with an apical finger-like projection (wide with an apical tooth in *L. anchikaya*); 5. Embolus slightly elongated (longer in *L. anchikaya*) (compare Figs 5A–E; Galiano 1984: figs 12–14; Logunov 2014: figs 1–3).

Description. Male (CATE8411A) (Figs 1A–B, 2A–E, 4B, E, 5A–E): Measurements: body length 6.13. Carapace length 2.41, width (at the middle) 1.98, height at PLE 1.06. Abdomen length 3.72, width (at the middle) 1.19. Ocular area length 0.62, width at PLE 0.62. Eye diameters: AME 0.49, ALE 0.16, PME 0.04, PLE 0.16. Eye

interdistances: AME–ALE 0.04, PME–PME 0.26, ALE–ALE 0.36, PME–PLE 0.27, PLE–PLE 0.34, ALE–PME 0.12. Clypeus height 0.15. Length of chelicera 1.47. Measurement of palp and legs: Palp 5.8 [2.28, 0.72, 0.99, 1.81], I 21.87 [6.45, 1.49, 6.13, 6.96, 0.84], II 13.27 [3.93, 1.02, 3.75, 3.81, 0.76], III 10.72 [3.20, 0.86, 2.30, 3.63, 0.73], IV 11.5 [3.36, 0.72, 2.93, 3.83, 0.66]. Leg formula: 1243.

Spination. Palp: femur do 2 pl 1 rl 1, patella do 1, tibia pl 2 do 1, tarsus do 2 pl 1 rl 1. Legs: femur I–IV pl 2 rl 2 do 3; patella I–II spineless, III–IV do 1; tibia I–II pl 1 rl 1 plv 4 rlv 4, III–IV pl 2 rl 1 plv 1 do 2; metatarsi I plv 3 rlv 3, II pl 1 rl 1 plv 3 rlv 3, III pl 1 rl 1 plv 2 rlv 2, IV spineless.

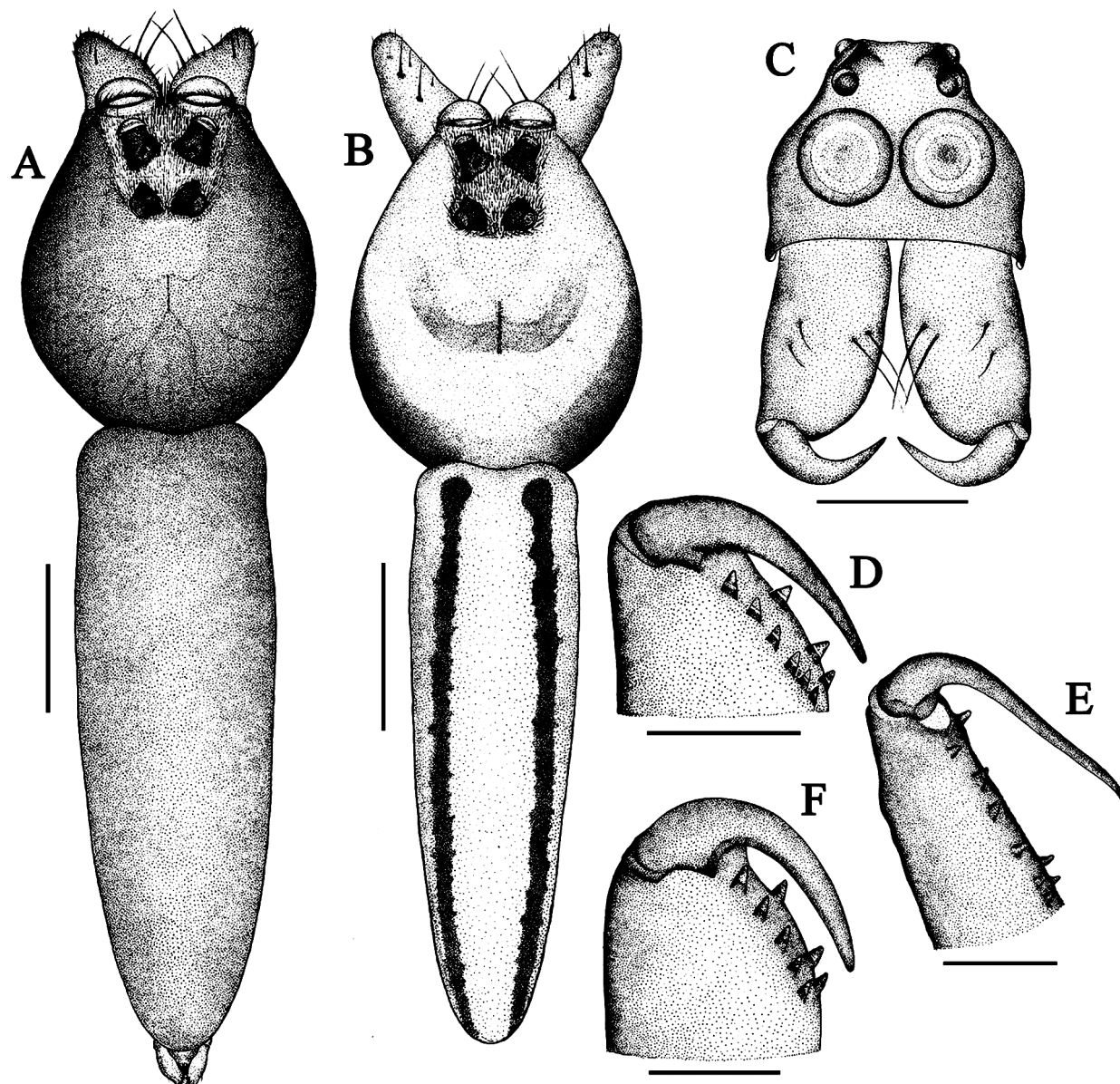


FIGURE 4A–F. *Hindumanes karnatakaensis* & *H. wayanadensis* sp. nov. **A–E** *H. karnatakaensis*. **A** Female, dorsal view; **B** Male, dorsal view; **C** Female, frontal view; **D** Female chelicera, retrolateral view showing teeth; **E** Male chelicera, same; **F** *H. wayanadensis* sp. nov., female chelicera, retrolateral view showing teeth. Scale bar: A–C: 1 mm, D–F: 0.5 mm.

Carapace yellowish-orange, with light reddish-brown lateral markings, except the region near to coxa I, margin of carapace with narrow dark reddish-brown lines, region around fovea with a large U-shaped light reddish-brown marking (Figs 1A–B, 2A, C, 4B); fovea distinct and longitudinal, dark reddish brown (Figs 1A, 2A, C, 4B), with indistinct markings radiating from fovea to lateral margin; eye field slightly raised, narrow, covered with golden yellow, lustrous, appressed scales (Figs 1A–B, 2A, C, 4B); clypeus low, vertical, yellowish-orange, with lateral sides reddish-brown. Chelicera yellowish-orange, moderately long, sub-vertical and slightly diverging (Figs 1B,

2A–D, 4B); inner frontal face with two spines, situated one third from base, outer with two median spines (Figs 2C–D, 4B); promargin with one apical tooth near the fang and two basal teeth, retromargin with six teeth (Fig. 4E); fangs long, reddish-brown. Endites greenish-yellow. Labium greenish-yellow. Sternum pale greenish-yellow, sternal margins reddish-brown (Fig. 2B). Pedicel light greenish-yellow with lateral black stripes. Abdomen light greenish-yellow, elongate, ovoid, narrowing posteriorly, clothed with colorless setae, dorsally with two medio-lateral longitudinal black stripes extending along the entire length of the abdomen; ventral abdomen with similar lateral stripes, terminating just before the spinnerets (Figs 1A–B, 2A–B, E, 4B). Anterior spinnerets black, posterior and median spinnerets reddish-brown. Leg I reddish-brown coxa and trochanter, other articles light greenish-yellow, femur with pro- and retrolateral longitudinal black stripes, patella distally with retrolateral black mottling, proximal tibia with pro- and retrolateral longitudinal black stripes and black distally, distal half of metatarsus black; other leg articles light greenish-yellow with black on the distal areas of tibia, metatarsus and proximal area of femur IV; tibiae I & II with 4 pairs of ventral spines, metatarsi I & II with 3 pairs of ventral spines, patellae I & II distally with one dorsal macrosetae, patellae III & IV with one dorsal spine; all legs with trichobothria on tibia, metatarsus and tarsus. All tarsi black with well-defined claw tufts; tarsal claw with nine teeth.

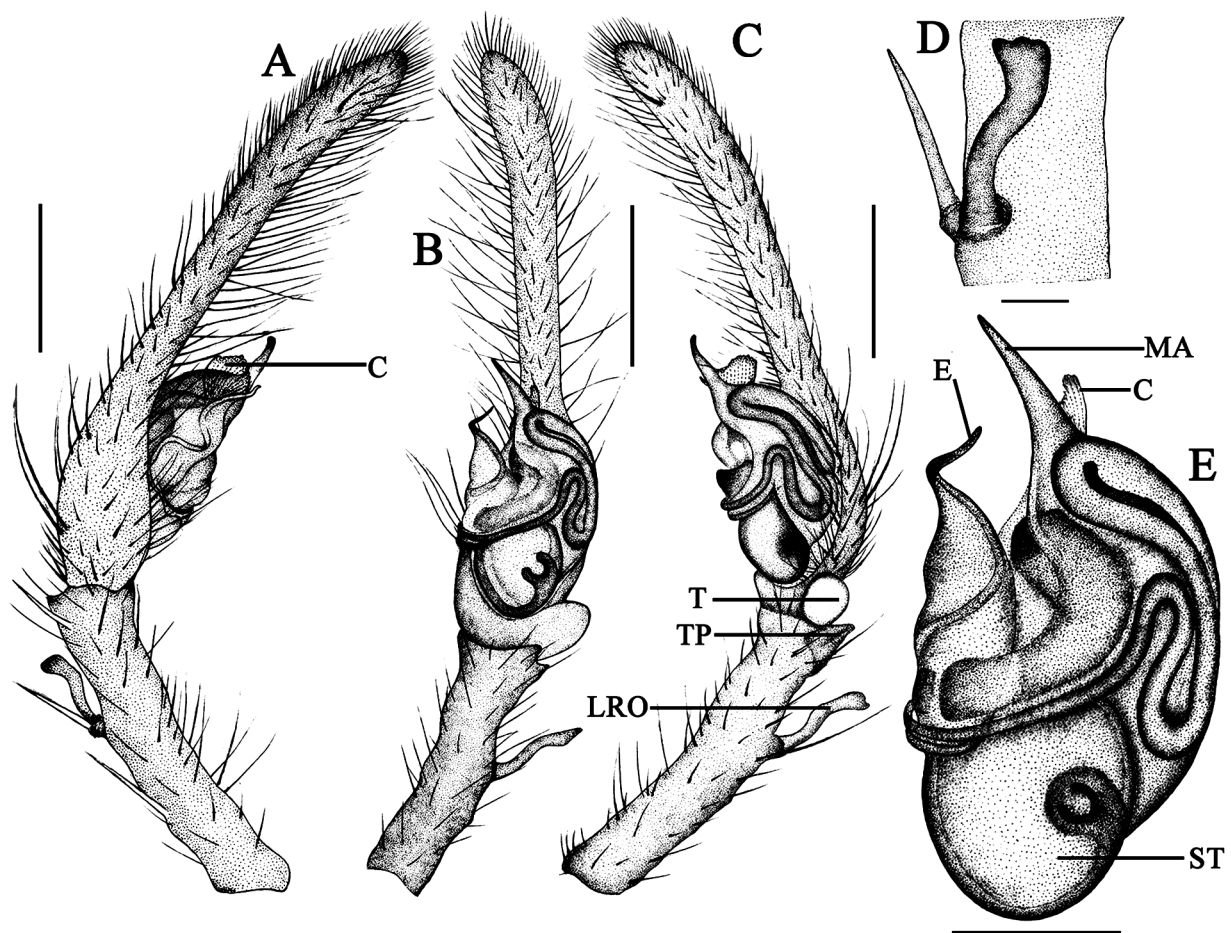


FIGURE 5A–E. *Hindumanes karnatakaensis*. **A** Male left palp, prolateral view; **B** Same, ventral view; **C** Same, retrolateral view; **D** Detail of LRO, dorsal view; **E** Bulb, ventral view. Abbreviations: C—conductor, E—embolus, LRO—long retrolateral outgrowth, MA—median apophysis, ST—subtegulum, T—tutaculum, TP—tibial process. Scale bar: A–C: 0.5 mm, D–E: 0.25 mm.

Palp (Figs 5A–E). Palpal articles long and slender, coxa and trochanter light reddish-brown, cymbium light brown, bulb dark brown, other articles greenish-yellow; femur prolaterally with longitudinal black stripes; patella black prolaterally; tibia basally with black mottling retrolaterally. Tibia slightly longer than patella, clothed with long setae, with a long, flat retrolateral tibial outgrowth, joined to a basal stalk on the distal mid-section of tibia,

which is slightly bent at the middle, tip is wide with uneven edges, and flanked by a strong spine at the base (Figs 5A–C); tibial process reddish-brown, stout, wide at the base, distally sub-acute (Fig. 5C); cymbium highly elongated, basally with a pair of elongated dorsal spine, distally with pro- and retrolateral spines (Figs 5A, C); cymbium with several long and medium-sized setae; tutaculum medium-sized, oval (Fig. 5C); bulb nearly ovoid, almost two fifths the length of cymbium; tegulum occupies distal retrolateral part of the bulb; subtegulum equals almost one third of the bulb; the retrolateral descending loops of spermophore closely arranged, median apophysis long, wide with an apical finger-like projection slightly bent disto-prolaterally, tip slightly bent downwards (Figs 5B–C, E); embolus base wide, the thin spermophore forms a twist in the embolus base before entering the embolus, embolus thin and elongated, situated prolaterally, initially oriented distally in an upward angle, then bending disto-retrolaterally with the pointed tip slightly bent forward (Figs 5A, E).

Redescription. Female (CATE8411B) (Figs 1C–D, 3A–D, 4A, C–D): Measurements: body length 6.92. Carapace length 2.60, width (at the middle) 2.02, height at PLE 1.19. Abdomen length 4.32, width (at the middle) 1.82. Ocular area length 0.60, width 0.60. Eye diameters: AME 0.66, ALE 0.25, PME 0.04, PLE 0.16. Eye interdistances: AME–ALE 0.06, PME–PME 0.21, ALE–ALE 0.46, PME–PLE 0.25, PLE–PLE 0.31, ALE–PME 0.78. Clypeus height 0.15. Length of chelicera 0.95. Measurement of palp and legs: Palp 3.55 [1.27, 0.52, 0.71, 1.05], I 11.35 [3.28, 1.23, 3.17, 2.94, 0.73], II 9.24 [2.93, 0.96, 2.39, 2.32, 0.64], III 8.43 [2.55, 0.87, 2.00, 2.35, 0.63], IV 8.71 [2.54, 0.79, 2.18, 2.57, 0.62]. Leg formula: 1243.

Spination. Palp: femur do 2 pl 1 rl 1, patella do 1, tibia pl 2 do 1, tarsus do 2 pl 1 rl 1; Legs: femur I–IV pl 2 rl 2 do 3; patellae I–II spineless, III–IV do 1; tibia I plv 4 rlv 4, II pl 1 rl 1 plv 4 rlv 4, III pl 2 rl 1 v 1 do 2, IV pl 1 rl 1 do 2; metatarsi I plv 3 rlv 3, II pl 1 rl 1 plv 3 rlv 3, III pl 1 plv 2 rlv 1, IV spineless.

In all details as male, except the following: carapace little longer and wider, greenish with no color markings (Figs 1C–D). Clypeus green. Chelicera medium-sized, light green, not diverging (Fig. 3C); cheliceral teeth arrangement different (Fig. 4D), fangs medium-sized, light brownish-green. Endites and labium light green. Sternum greenish (Fig. 3B). Pedicel light green. Abdomen slightly longer and wider, light green. Spinnerets cloudy white. Legs and palp light green, color varies from light green to light greenish-yellow towards the distal articles; tibia I with apical retrolateral black mottling.

Epigyne (Logunov 2004: figs 1–2). Simple, transparent, with posterior outgrowth overhanging the epigastric furrow. Spermathecae nearly oblong, close together, anteriorly narrowing. Copulatory opening situated mediolaterally, almost in the middle of epigyne (Logunov 2004: fig. 1). Copulatory duct moderately long, extending along the anterolateral margins of the spermatheca and entering spermatheca anteriorly. Fertilization duct short, anterolaterally oriented, located almost in the mid-posterior half of spermatheca (Logunov 2004: fig. 2).

Habitat: Specimens collected from under the leaves of *Chromolaena odorata* (Asteraceae) in the moist mixed deciduous forest of Wayanad Wildlife Sanctuary, Kerala, India (Fig. 8A).

***Hindumanes wayanadensis* sp. nov.**

Figs 4F, 6–7

Type material. Holotype: Female (CATE 8412B) from Wayanad Wildlife Sanctuary, Bathery range, 11°45'01.3"N 76°24'43.2"E, 746 m asl, P.P. Sudhin & K.S. Nafin, 02.VI.2015.

Diagnosis. The female of *Hindumanes wayanadensis* sp. nov. is similar to that of *H. karnatakaensis*, but can be separated by the following combination of characters: chelicerae devoid of mid-dorsal spines (two mid-dorsal spines in *H. karnatakaensis*); epigyne without posterior outgrowth overhanging the epigastric furrow (present in *H. karnatakaensis*); spermathecae almost kidney-shaped, widely separated and anteriorly narrowed with lateral hump (in *H. karnatakaensis*, it is nearly oblong, close together); copulatory duct is very short and copulatory opening is anteriorly located (in *H. karnatakaensis*, copulatory duct is moderately long and copulatory opening at the middle of the epigyne) (compare Figs 3C, 4C, 6C, 7A–B; Logunov 2004: figs 1–2).

Description. Female. (CATE8412B) (Figs 4F, 6A–D, 7A–B) Measurements: body length 6.72. Carapace length 2.68, width (at the middle) 1.98, height at PLE 1.19. Abdomen length 4.04, width (at the middle) 1.53. Ocular area length 0.54, width 0.46. Eye diameters: AME 0.45, ALE 0.18, PME 0.03, PLE 0.13. Eye interdistances: AME–ALE 0.05, PME–PME 0.32, ALE–ALE 0.39, PME–PLE 0.31, PLE–PLE 0.34, ALE–PME 0.08. Clypeus height 0.19. Length of chelicera 0.92. Measurement of palp and legs: Palp 3.57 [1.30, 0.52, 0.7,

1.05], leg I 9.59 [2.84, 1.04, 2.70, 2.43, 0.58], II 7.91 [2.48, 0.84, 2.03, 1.94, 0.62], III 7.01 [2.13, 0.69, 1.74, 1.77, 0.68], IV 7.61 [2.23, 0.54, 2.03, 2.19, 0.62]. Leg formula: 1243.

Spination. Palp: femur pl 1 rl 1, patella do 1, tibia pl 2, tarsus pl 2 rl 2 plv 1 rlv 1 v 1; Legs: femur I–II pl 2 rl 2 do 3, III pl 2 rl 1 do 3, IV pl 1 rl 1 do 3; patellae I–II spineless, III–IV do 1; tibia I plv 4 rlv 4, II pl 1 plv 4 rlv 4, III pl 1 rl 1 plv 2 rlv 1 do 2, IV pl 1 rl 1 do 2; metatarsi I–II plv 3 rlv 3, III pl 1 plv 1 rlv 1, IV spineless.

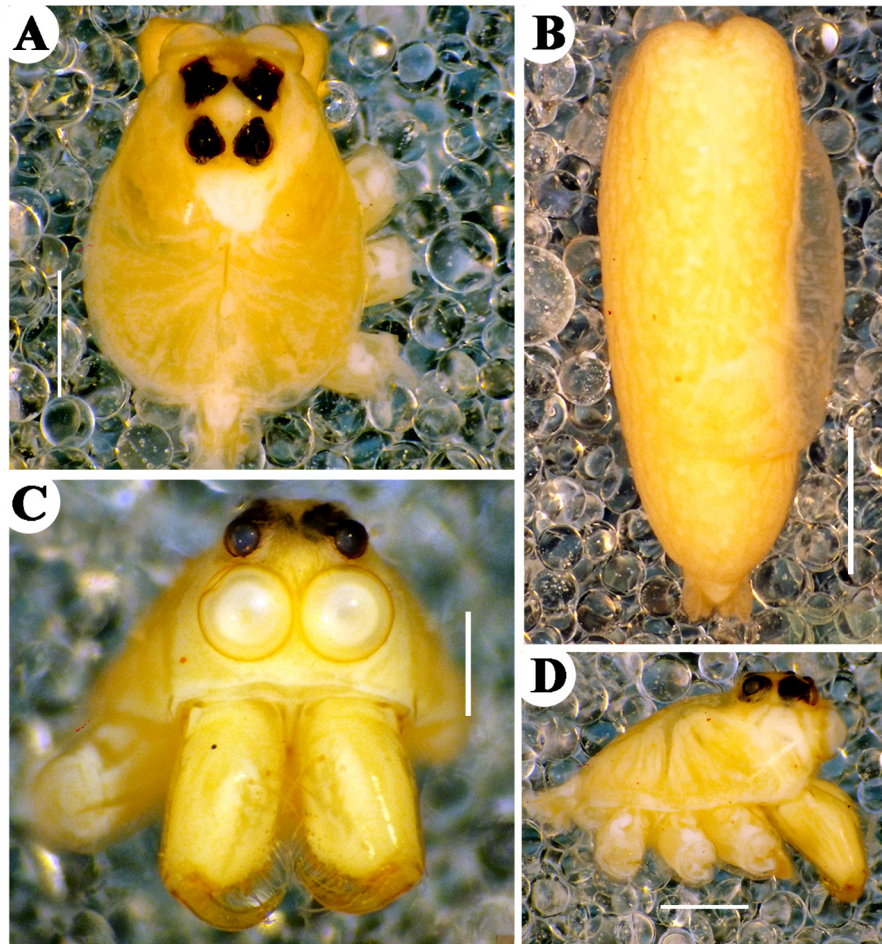


FIGURE 6A–D. *Hindumanes wayanadensis* sp. nov., female. **A** Carapace, dorsal view; **B** Abdomen, dorsal view; **C** Carapace, frontal view; **D** Same, lateral view. Scale bar: A–B, D: 1 mm, C: 0.5 mm.

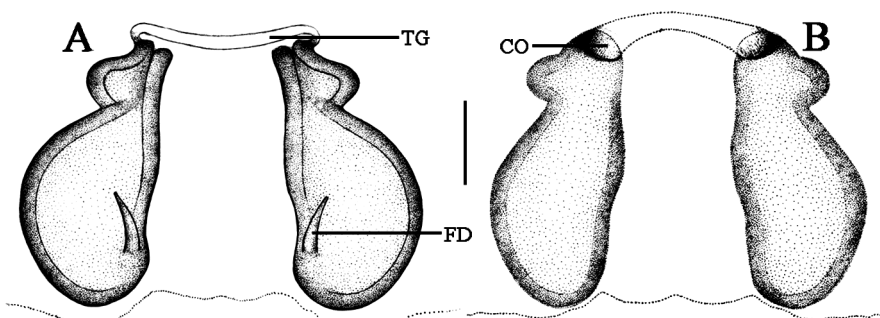


FIGURE 7A–B. *Hindumanes wayanadensis* sp. nov. **A** Epigyne, dorsal view; **B** Same, ventral view. Abbreviations: CO—copulatory opening, FD—fertilization duct, TG—transverse groove. Scale bar: A–B: 0.05 mm.

Carapace green (Fig. 6D); fovea distinct and longitudinal, light reddish-brown with indistinct markings radiating from fovea to lateral margins. Eye field slightly raised, covered with golden yellow lustrous appressed scales (Figs 6A, D). Clypeus low, vertical, light green. Chelicera medium-sized, light green, sub-vertical,

promargin with two spines (Fig. 6C); promargin with one medial and two basal teeth, retromargin with five teeth (Fig. 4F); fangs light greenish-brown. Endites light green. Labium light green. Sternum pale greenish-yellow. Pedicel greenish. Abdomen slender, light green, elongate, ovoid, narrowing posteriorly, clothed with colorless setae (Fig. 6B). Spinnerets cloudy white, sub-equal in length, posterior spinnerets robust than the rest. Legs and palp light green; tibia I with apical retrolateral black mottling; tibiae I & II with 4 pairs of ventral spines, metatarsi I & II with 3 pairs of ventral spines, patellae I & II distally with one dorsal macrosetae and patellae III & IV with one dorsal spine; tarsi with well-defined claw tufts.

Epigyne (Figs 7A–B). Simple, transparent, with an anterior transverse groove, posterior border line with a median invagination (Fig. 7B); spermathecae large, almost kidney-shaped, narrowed anteriorly with a lateral hump and widely separated from each other; copulatory opening located on the lateral sides of the anterior transverse groove of the epigyne, entering a very short copulatory duct, which enters ventrally directly into the anterior region of the spermathecae (Fig. 7B); fertilization duct small, anterolaterally oriented, located on the inner margin of the posterior spermathecae (Fig. 7A).

Male. Unknown.

Habitat. Specimens collected from leaves of *Chromolaena odorata* (Asteraceae) in the riparian habitat of Wayanad Wildlife Sanctuary, Kerala, India (Fig. 8B).

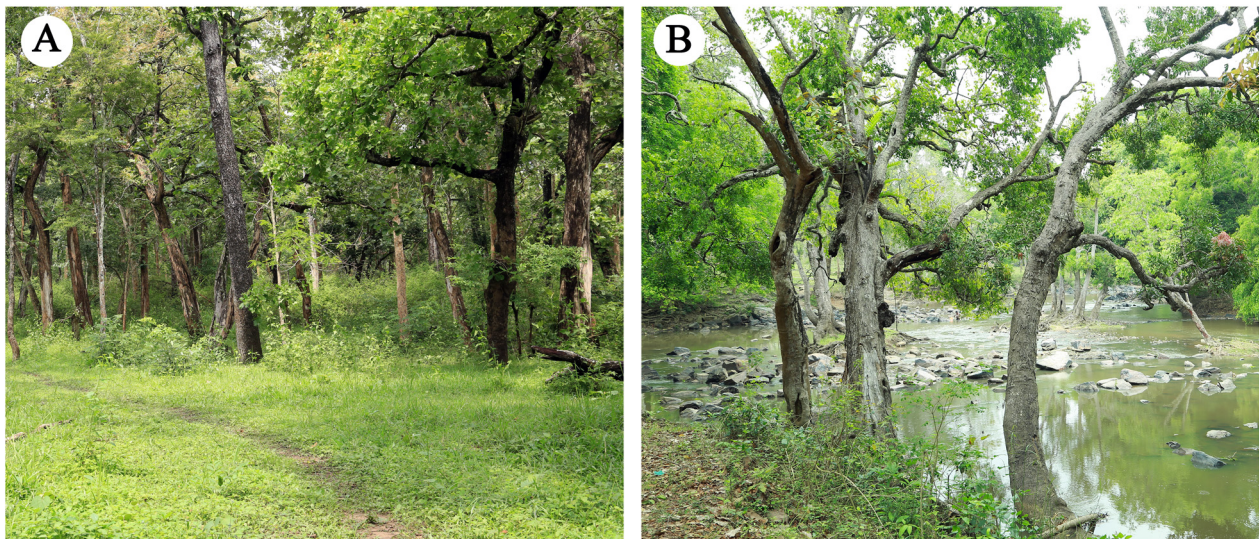


FIGURE 8A–B. *Hindumanes karnatakaensis* and *H. wayanadensis* sp. nov. View of collection sites: **A** *H. karnatakaensis*, moist mixed deciduous forest, Wayanad Wildlife Sanctuary; **B** *H. wayanadensis* sp. nov., riparian habitat, Wayanad Wildlife Sanctuary, Kerala. Photo credit A–B Karunnapilli S. Nafin.

Etymology. The specific epithet is an adjective derived from the name of the sanctuary from where the species was collected.

Natural history. Mature specimens of *H. karnatakaensis* and *H. wayanadensis* sp. nov. were observed/collected during the late pre-monsoon (April–May) and early monsoon (June–July) seasons. Only juveniles of *Hindumanes* were spotted during the post-monsoon (October–January) season.

Discussion

The subfamily Lyssomaninae is supposed to be monophyletic and form an isolated group of Salticidae (Maddison 2016). It consists of two recently radiated genera, *Lyssomanes* and *Chinoscopus*, and a deeply diverging monotypic genus, *Sumakuru*. The molecular phylogenetic studies support the close relationship of *Lyssomanes* and *Chinoscopus*, but not the monophyly of *Lyssomanes*, because of the lack of molecular data or morphological phylogenetic studies on many *Lyssomanes* spp. (Maddison *et al.* 2014; Maddison 2016). Among the 93 nominal *Lyssomanes* spp. (World Spider Catalog 2017), there is a great deal of diversity in genital morphology, with some

species possibly misplaced in the genus and belonging to separate deeply diverging lineages, such as *Sumakuru*. *Hindumanes* is morphologically closer to most true *Lyssomanes* by having similar body form, paired ventral spines on anterior legs, male palp with median apophysis and eye arrangement similar to that seen in few species, such as *L. anchicaya* Galiano, 1984 (Figs 1A–D, 4A–B; Logunov 2014: fig. 4). Also, the long retrolateral tibial outgrowth in male palp of *Hindumanes* resembles the thick cluster of long bristles present in a few *Lyssomanes* spp., such as *L. maddisoni* Logunov, 2014, *L. diversus* Galiano, 1980, *L. protarsalis* O. Pickard-Cambridge, 1900 and *L. dissimilis* Banks, 1929 (Figs 5A–D; see also Logunov 2014: fig. 27; Galiano 1980: figs 63, 89, 147).

The genus *Lyssomanes* is assumed to have originated in South America (Penney & Selden 2011), largely supported by the number of diverse extant species in the region. Also, fossil *Lyssomanes* have been found in the approximately contemporary Oligocene-Miocene amber from Chiapas, Mexico (García-Villafuerte & Penney 2003) and Miocene Dominican Republic amber (Wunderlich 1986, 1988), both of which lie in the same geographical range of its extant species. The current distribution of the New World lyssomanines is mostly restricted to the equatorial Neotropical region, with a few *Lyssomanes* spp. occurring in the lower latitudes of the Nearctic (World Spider Catalog 2017). Its northernmost occurrence, *L. viridis* Walckenaer, 1837, is in the temperate zones of the USA. The present paper extends the known geographical range of the lyssomanines to the southern tropics of India. So, it is assumed that the ancestral lyssomanine probably had a wider distribution across the northern continental area during the warmer Paleogene and early Neogene periods, when most of the region had warm temperate to paratropical climate (Dawson *et al.* 1976; Wolfe 1978; West & Dawson 1978; Kumagai *et al.* 1995). Later cooler periods and/or competition could have possibly led to the disappearance of lyssomanines from higher latitudes and their isolation in the Neotropics and the Indian tropics. Thus, the current disjunct distribution of lyssomanines in these two regions could be relicts (Wheeler 1922; Briggs 1995; Robbins & Duarte 2006) from a pancontinental distribution of the ancestral lyssomanine in the northern hemisphere.

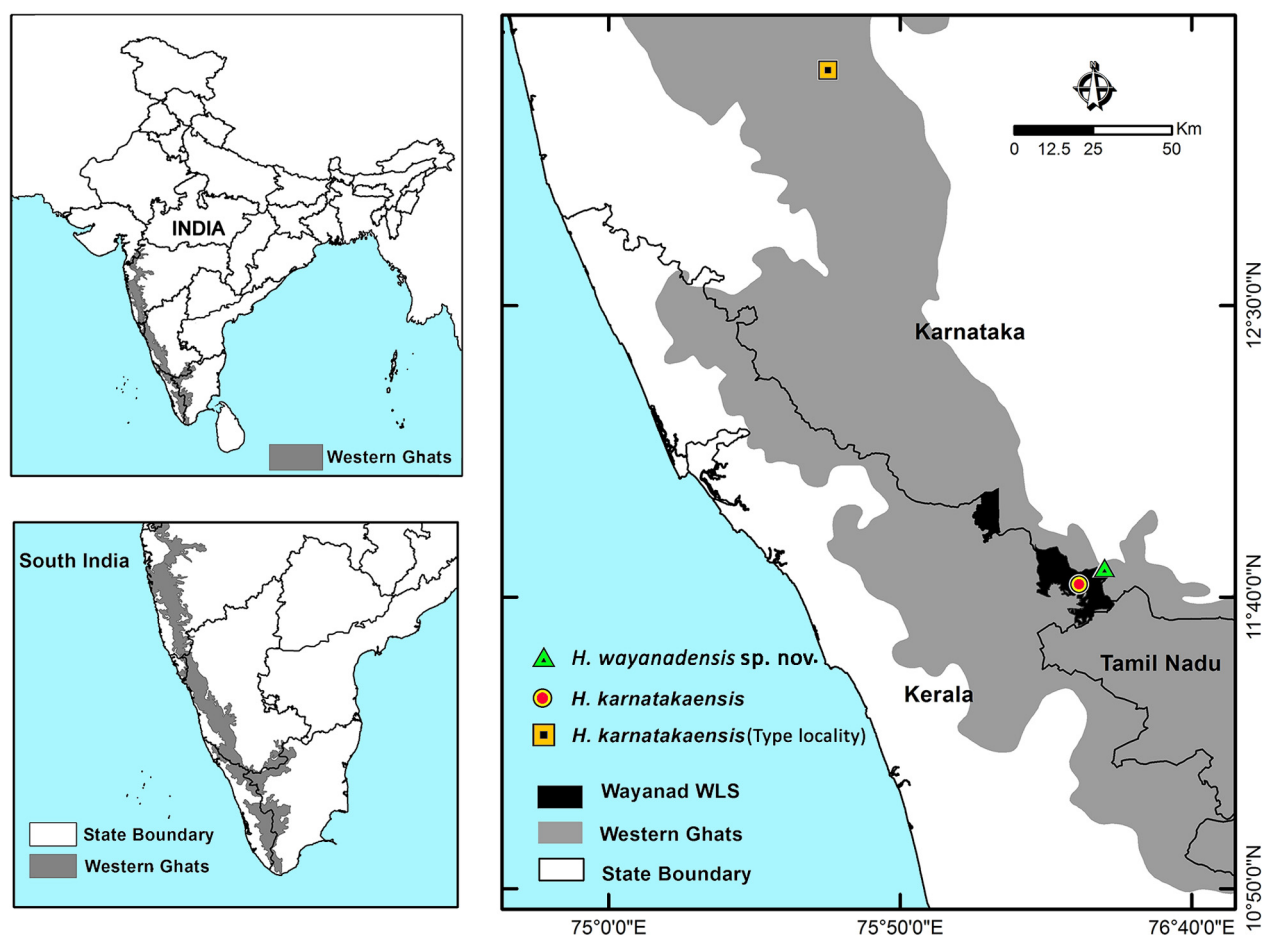


FIGURE 9. Map showing the distribution records of *Hindumanes karnatakaensis* and *H. waynadensis* sp. nov.

Acknowledgements

The authors are grateful to Late Fr Dr Jose Thekkan CMI, former Principal, Christ College, Irinjalakuda, Kerala, for providing all the facilities for this research. We are indebted to Dr Dmitri V. Logunov, University of Manchester, UK for the valuable guidance and inputs that greatly improved this work. We are thankful to Mr Pradeep M. Sankaran, Division of Arachnology, Sacred Heart College, Thevara, for his valuable suggestions. We are immensely grateful to Dr Gustavo Ruiz (Instituto de Ciências Biológicas, Belém, PA, Brazil) for his editorial efforts and to anonymous reviewers for their efforts in finalizing the manuscript. Many thanks to Mr Alex C. J., Kerala Forest Research Institute, Thrissur, Kerala for preparing the distribution map. We are thankful to the Principal Chief Conservator of Forests, Kerala, for the collection permit. The authors are grateful to Mr Dhanesh Kumar P., Wildlife Warden and the field staff of the Wayanad Wildlife Sanctuary, especially, Mr Krishnadas K. Rajan, Assistant Wildlife Warden, Mr Suresh Thenarambath, Forester and Mr Appu, Field watcher for the hospitality and field support. This study was funded by Science & Engineering Research Board (SERB) DST, New Delhi, under Young Scientist Research project: No. SB/YS/LS-86/2013.

References

- Briggs, J.C. (1995) *Global Biogeography. Developments in Palaeontology and Stratigraphy. Vol. 14.* Elsevier, Amsterdam, 452 pp.
- Dawson, M.R., West, R.M., Langston, W. Jr. & Hutchison, J.H. (1976) Paleogene terrestrial vertebrates: northernmost occurrence, Ellesmere Island, Canada. *Science*, 192 (4241), 781–782.
<https://doi.org/10.1126/science.192.4241.781>
- Galiano, M.E. (1980) Revisión del género *Lyssomanes* Hentz, 1845 (Araneae, Salticidae). *Opera Lilloana*, 30, 1–104.
- Galiano, M.E. (1984) New species of *Lyssomanes* Hentz, 1845 (Araneae, Salticidae). *Bulletin of the British Arachnological Society*, 6 (6), 268–276.
- Galvis, W. (2017) New species and records of lyssomanines (Araneae: Salticidae: Lyssomaninae) from the Caribbean and the pacific coasts of Colombia. *Zoology and Ecology*, 27 (2), 133–142.
<https://doi.org/10.1080/21658005.2017.1304188>
- García-Villafuerte, M.A. & Penney, D. (2003) *Lyssomanes* (Araneae, Salticidae) in Oligocene-Miocene Chiapas amber. *Journal of Arachnology*, 31 (3), 400–404.
<https://doi.org/10.1636/02-31>
- Kumagai, H., Sweda, T., Hayashi, K., Kojima, S., Basinger, J.F., Shibuya, M. & Fukaoa, Y. (1995) Growth-ring analysis of Early Tertiary conifer woods from the Canadian High Arctic and its paleoclimatic interpretation. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 116, 247–262.
[https://doi.org/10.1016/0031-0182\(94\)00100-M](https://doi.org/10.1016/0031-0182(94)00100-M)
- Logunov, D.V. (2004) On the taxonomic position of “*Lyssomanes*” *karnatakaensis* and other Indian species formerly assigned to *Lyssomanes* (Araneae, Salticidae). *Bulletin of the British Arachnological Society*, 13, 73–75.
- Logunov, D.V. (2014) New species and records of *Lyssomanes* Hentz, 1845 from Central and South Americas (Aranei: Salticidae). *Arthropoda Selecta*, 23, 57–56.
- Logunov, D.V. & Marusik, Y.M. (2003) Taxonomic and faunistic notes on *Chinoscopus* Simon, 1900 and *Lyssomanes* Hentz, 1845 from the Neotropical Region (Araneae: Salticidae). *Bulletin of the British Arachnological Society*, 12 (9), 415–424.
- Maddison, W.P. (2015) A phylogenetic classification of jumping spiders (Araneae: Salticidae). *Journal of Arachnology*, 43, 231–292.
<https://doi.org/10.1636/ arac-43-03-231-292>
- Maddison, W.P. (2016) *Sumakuru*, a deeply-diverging new genus of Lyssomanine jumping spiders from Ecuador (Araneae: Salticidae). *Zookeys*, 614, 87–96.
<https://doi.org/10.3897/zookeys.614.9368>
- Maddison, W.P., Li, D.Q., Bodner, M.R., Zhang, J.X., Xu, X. & Liu, Q.Q. (2014) The deep phylogeny of jumping spiders (Araneae, Salticidae). *ZooKeys*, 440, 57–87.
<https://doi.org/10.3897/zookeys.440.7891>
- Myers, N., Mittermeier, R.A., Mittermeier, C.G., Fonseca, G.A.B. & Kent, J. (2000) Biodiversity hotspots for conservation priorities. *Nature*, 403, 853–858.
<https://doi.org/10.1038/35002501>
- Penney, D. & Selden, P. (2011) *Fossil Spiders: The Evolutionary History of a Mega-diverse Order. Monograph Series. Vol. 1.* Siri Scientific Press, Manchester, 127 pp.
- Prószyński, J. (2017) Pragmatic classification of the World's Salticidae (Araneae). *Ecologica Montenegrina*, 12, 1–133.
- Robbins, R.K., Duarte, M. (2006) Systematic placement of *Lycaena cogina* schaus (Lepidoptera: Lycaenidae: Polyommatinae),

- a biogeographically disjunct new world species. *Proceedings of the Entomological Society of Washington*, 108 (1), 226–236.
- Su, K.F., Meier, R., Jackson, R.R., Harland, D.P. & Li, D. (2007) Convergent evolution of eye ultrastructure and divergent evolution of vision-mediated predatory behaviour in jumping spiders. *Journal of Evolutionary Biology*, 20, 1478–1489. <https://doi.org/10.1111/j.1420-9101.2007.01335.x>
- Tikader, B.K. & Biswas, B. (1978) Two new species of spiders of the family Lyssomanidae from India. *Proceedings of the Indian Academy of Science, Animal Sciences-3*, 87 B (9), 257–260.
- Wanless, F.R. (1980) A revision of the spider genera *Asemonea* and *Pandisus* (Araneae: Salticidae). *Bulletin of the British Museum of Natural History, Zoology*, 39, 213–257. <https://doi.org/10.5962/bhl.part.13273>
- West, R.M. & Dawson, M.R. (1978) Vertebrate paleontology and the Cenozoic history of the North Atlantic region. *Polarforschung*, 48 (1–2), 103–119.
- Wheeler, W.M. (1922) Observations on *Gigantiops destructor* Fabricius and other leaping ants. *Biological Bulletin*, 42 (4), 185–201. <https://doi.org/10.2307/1536521>
- Wolfe, J.A. (1978) A Paleobotanical Interpretation of Tertiary Climates in the Northern Hemisphere: Data from fossil plants make it possible to reconstruct Tertiary climatic changes, which may be correlated with changes in the inclination of the earth's rotational axis. *American Scientist*, 66 (6), 694–703.
- World Spider Catalog (2017) World Spider Catalog. Version 18.5. Natural History Museum Bern. Available from: <http://wsc.nmbe.ch> (accessed 8 August 2017)
- Wunderlich, J. (1986) *Spinnenfauna gestern und heute. Fossil Spinnen in Bernstein und ihre heute lebenden Verwandten*. Erich Bauer Verlag bei Quelle und Meyer, Wiesbaden, 283 pp.
- Wunderlich, J. (1988) Die Fossilen Spinnen im Dominikanischen Bernstein. *Beiträge zur Araneologie*, 2, 1–378.