





Research article

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New species of *Palpimanus* Dufour, 1820 from India (Araneae: Palpimanidae, Palpimaninae), with a catalogue of the Indian palpimanid fauna

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Abstract. Two new species of *Palpimanus* Dufour, 1820 are described from India: *P. godawan* Tripathi & Sankaran sp. nov. (♂♀), collected from the Thar Desert in Rajasthan, and *P. maldhok* Kuni, Tripathi & Sankaran sp. nov. (♂♀), collected from Maharashtra. Images of the endogyne and male palp of the holotype and paratype of *P. narsinhmehtai* Parajapati, Hun & Raval, 2021 are presented to facilitate its identification. A key to Indian species of *Palpimanus* and a catalogue of Indian palpimanid spiders are provided. The current distribution of all the known Indian palpimanid spiders is mapped.

Keywords. Distribution, grassland ecosystem, Great Indian Bustard, taxonomy, Thar Desert.

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Introduction

Palpimanus Dufour, 1820, the second largest species-rich genus after *Otiotrops* MacLeay, 1839 of the family Palpimanidae Thorell, 1869, currently comprises 40 nominal species distributed in Africa, Mediterranean, and central and southwest Asia (World Spider Catalog 2023). Platnick (1981) redefined *Palpimanus*, and proposed three species groups: *gibbulus*, *maroccanus*, and *vultuosus*,

based on the features of the sclerites in the male palps. In the same work, Platnick (1981) mentioned a fourth species group for undescribed African species with similarities to *P. processiger* Strand, 1913, but did not formally name it. Spiders of the genus *Palpimanus* are poorly documented in India, and are currently represented with only two nominal species: *P. narsinhmehtai* Parajapati, Hun & Raval, 2021 and *P. vultuosus* Simon, 1897; the former is known from both sexes with illustrations of copulatory organs, while the latter is known only from the female without published image of the endogyne (Simon 1897; Prajapati *et al.* 2021; Caleb & Sankaran 2023; World Spider Catalog 2023). Even though no endogyne illustration of *P. vultuosus* is available for a comparative purpose, Platnick (1981), who might have examined the holotype, assigned *P. vultuosus* to the *vultuosus* species group that is characterised by the absence of a prolateral male palpal prong (= sclerite) and having complex internal female genitalia. He also mentioned that descriptions of several additional species of *Palpimanus* from India, Pakistan and adjacent regions were to be dealt with in a later study, which, however, were never published. In this paper, we describe two new species of *Palpimanus* from India and provide a key to Indian *Palpimanus* together with a catalogue and distribution map of Indian palpimanid fauna.

Material and methods

All measurements are in millimeters (mm). Lengths of palp and leg segments are given as: total (femur, patella, tibia, metatarsus (except for palp), tarsus). The micrographic images were taken with a Leica DMC4500 and a Leica DFC500 digital camera attached to a Leica M205A stereo microscope with the software package Leica Application Suite (LAS, ver. 3.8) for stacking images taken at different focal planes. Terminology of male and female copulatory organs mostly follows Zonstein & Marusik (2019), Prajapati *et al.* (2021) and Zamani & Marusik (2021). The specimens examined are deposited in the research collections of the National Centre for Biological Sciences, Bengaluru, Karnataka, India (NRC).

Abbreviations

Morphology

AG	=	accessory gland
ALE	=	anterior lateral eye
AME	=	anterior median eye
AMS	=	anterior median spinneret
B	=	bulb
Cy	=	cymbium
DAE	=	dorsal arm of embolic stalk
DMS	=	dot-like median scutum
ES	=	epigastral scutum
MAE	=	median arm of embolic stalk
MFE	=	mediolateral fold of epigastral scutum
PAE	=	prolateral arm of embolic stalk
PFE	=	posterior fold of epigastral scutum
PLE	=	posterior lateral eye
PME	=	posterior median eye
PRE	=	posterior part of receptacle
RAE	=	retrolateral arm of embolic stalk
RE	=	receptacle
SS	=	stripe-like scutum
I–IV	=	1 st to 4 th leg

Institutions

ADSH	=	Division of Arachnology, Sacred Heart College, Kerala, India
GEER	=	Gujarat Ecological and Educational Research Foundation, Gujarat, India
MNHN	=	Muséum national d'histoire naturelle, Paris, France
NRC	=	National Centre for Biological Sciences, Karnataka, India
ZSI-SRC	=	Zoological Survey of India, Southern Regional Centre, Tamil Nadu, India

Results

Description of new species

Class Arachnida Lamarck, 1801
Order Araneae Clerck, 1757
Family Palpimanidae Thorell, 1869
Subfamily Palpimaninae Thorell, 1869

Genus *Palpimanus* Dufour, 1820

Type species

Palpimanus gibbulus Dufour, 1820, by monotypy.

Diagnosis

For genus diagnosis, see Platnick (1981).

Palpimanus godawan Tripathi & Sankaran sp. nov.

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Figs 1A–B, G, 2–6, 13

Diagnosis

Males of *P. godawan* sp. nov. are similar to those of *P. persicus* Zamani & Marusik, 2021 as they both share the embolic stalk originating in the proximal half of the bulb and broad prolateral arm of the embolic stalk, but can be separated from the latter species by embolic stalk with sharp prolateral curvature in ventral view (vs smoother curvature in *P. persicus*), dorsal arm of embolic stalk with sharply pointed distomedian process (vs less prominent in *P. persicus*), and retrolaterally directed median arm of embolic stalk in ventral view (vs prolaterally in *P. persicus*) (cf. Figs 5B, 6A–C; Zamani & Marusik 2021: figs 15d–f, 16a–d). Females of the new species resemble those of *P. narsinhmehtai* as both share elongate-oval and wrinkled receptacles, and accessory glands, but can be separated by receptacles with flat and highly twisted posterior parts (vs cylindrical and weakly twisted in *P. narsinhmehtai*), and accessory glands originate distolaterally to posterior parts of receptacles (vs medial in *P. narsinhmehtai*) (cf. Figs 5F, 6E, 12D; Prajapati *et al.* 2021: fig. 20). Females of *P. godawan* sp. nov. can be distinguished from those of *P. vultuosus* by the absence of long whitish setae on the sternum (vs present in *P. vultuosus*; Simon 1897).

Etymology

The specific epithet ‘Godawan’ is the vernacular name of the Great Indian Bustard or Indian Bustard (*Ardeotis nigriceps* (Vigors, 1831)) in Rajasthan, the state bird of Rajasthan State. It is the flagship species of the arid grassland ecosystems in the Thar Desert. The population of this bird has drastically declined and is thus currently considered as a Critically Endangered species (IUCN 2022). It is now protected in the Desert National Park Wildlife Sanctuary of Thar Desert, where the type locality of the new species is located. The specific epithet is a noun in apposition.

Type material

Holotype

INDIA • ♂; Rajasthan, Jaisalmer, Thar Desert, Desert National Park Wildlife Sanctuary, Gajaimata area; 26.68922° N, 70.59791° E; 235 m a.s.l.; 14 Nov. 2018; R. Tripathi and A.K. Jangid leg.; from under rock; by hand; NRC-AA-4169.

Paratypes

INDIA • 1 ♂; same collection data as for holotype except Sudasri area; 26.7304° N, 70.61888° E; 247 m a.s.l.; 15 Mar. 2018; NRC-AA-4171.

INDIA • 1 ♂, 3 ♀♀; same collection data as for holotype except Chauhani area; 26.63413° N, 70.58211° E; 265 m a.s.l.; 2 Jan. 2020; NRC-AA-4172–4175.

INDIA • 1 ♀; same collection data as for holotype except Myajlar area; 26.281° N, 70.40755° E; 269 m a.s.l.; 1 Dec. 2020; NRC-AA-4170.

Description

Male (holotype, NRC-AA-4169; Figs 2, 4A–D)

COLOUR. In alcohol: prosoma, leg I and scuta maroon; opisthosoma creamy-white; legs II–IV and spinnerets yellowish brown.

GENERAL MORPHOLOGY. Carapace, clypeus, dorsum of chelicerae, coxae and trochanters of legs and abdominal scuta thickly clothed with fine white setae; carapace, sternum, chelicerae and leg I clothed with scattered black setae. Carapace rugose, broad-oval in dorsal view, with indistinct cephalic groove (Fig. 2A, C); cephalic part noticeably elevated than thoracic part (Fig. 2A, C); thoracic part gently sloping (Fig. 2C). Fovea short, prominent, bipartite, with two separate sulci closely located side by side (Fig. 2F). Clypeus rugose. Chelicerae lack prolateral concavity, surface covered with numerous small tubercles (Fig. 4A); cheliceral promargin with a broad keel, with a single row of short setae, retromargin without tooth or keel (Fig. 4A). Sternum rugose, rebordered, clothed with fine setae, with coxal and intercoxal extensions, truncated between coxae IV (Fig. 2H); intercoxal extensions fused with carapace (Fig. 2H). Femur, patella and tibia of leg I prolaterally with numerous tubercles, scattered on femur, clustered along entire length on patella, restricted to proximal part of tibia (Fig. 4B), tibia, metatarsus and tarsus with well-developed prolateral scopula, that on tarsus proximally restricted (Fig. 4C); patella I very long, longer than tibiae I–III and metatarsi I–III (Fig. 4B); all tibiae and metatarsi provided with scattered long and short trichobothria; metatarsi II–IV with distal preening brush (Fig. 4D, arrow); tarsi with paired claws, scopulate, with less-developed claw tufts (Fig. 4D). Pedicel completely encircled with collar that is fused with abdominal scuta (Fig. 2B–C, H, J). Opisthosoma oval, hirsute (Fig. 2I); abdominal scuta remain fused together; dorsal part of abdominal scuta small, restricted anteriorly, with irregular posterior margin (Fig. 2I; DS). Epigastral scutum nearly circular, with strongly sclerotised posterior edge, partly encircled by six thin scuta, two stripe-like laterals and two tiny and two slightly large dot-like medians (Fig. 2J; ES, SS, DMS). Tracheal spiracle prominent (Fig. 2K). AMS short, bi-segmented, cylindrical, not encircled by sclerotised ring (Fig. 2K).

MEASUREMENTS. Body length 7.66. Carapace 3.86 long, 3.10 wide. Opisthosoma 3.80 long, 2.68 wide. Eye sizes and interdistances: ALE 0.09, AME 0.18, PLE 0.08, PME 0.06; AME–ALE 0.12, AME–AME 0.07, AME–PME 0.52, PME–PLE 0.55, PME–PME 0.44. Clypeus height at ALEs 0.30, at AMEs 0.35. Chelicerae 1.30 long. Measurements of palp and legs: palp 2.21 [0.82, 0.21, 0.48, 0.70], I 7.81 [2.62, 1.96, 1.81, 0.75, 0.67], II 6.69 [2.09, 1.20, 1.68, 1.07, 0.65], III 5.70 [1.82, 0.85, 1.39, 1.07, 0.57], IV 7.72 [2.33, 1.18, 1.89, 1.61, 0.71].

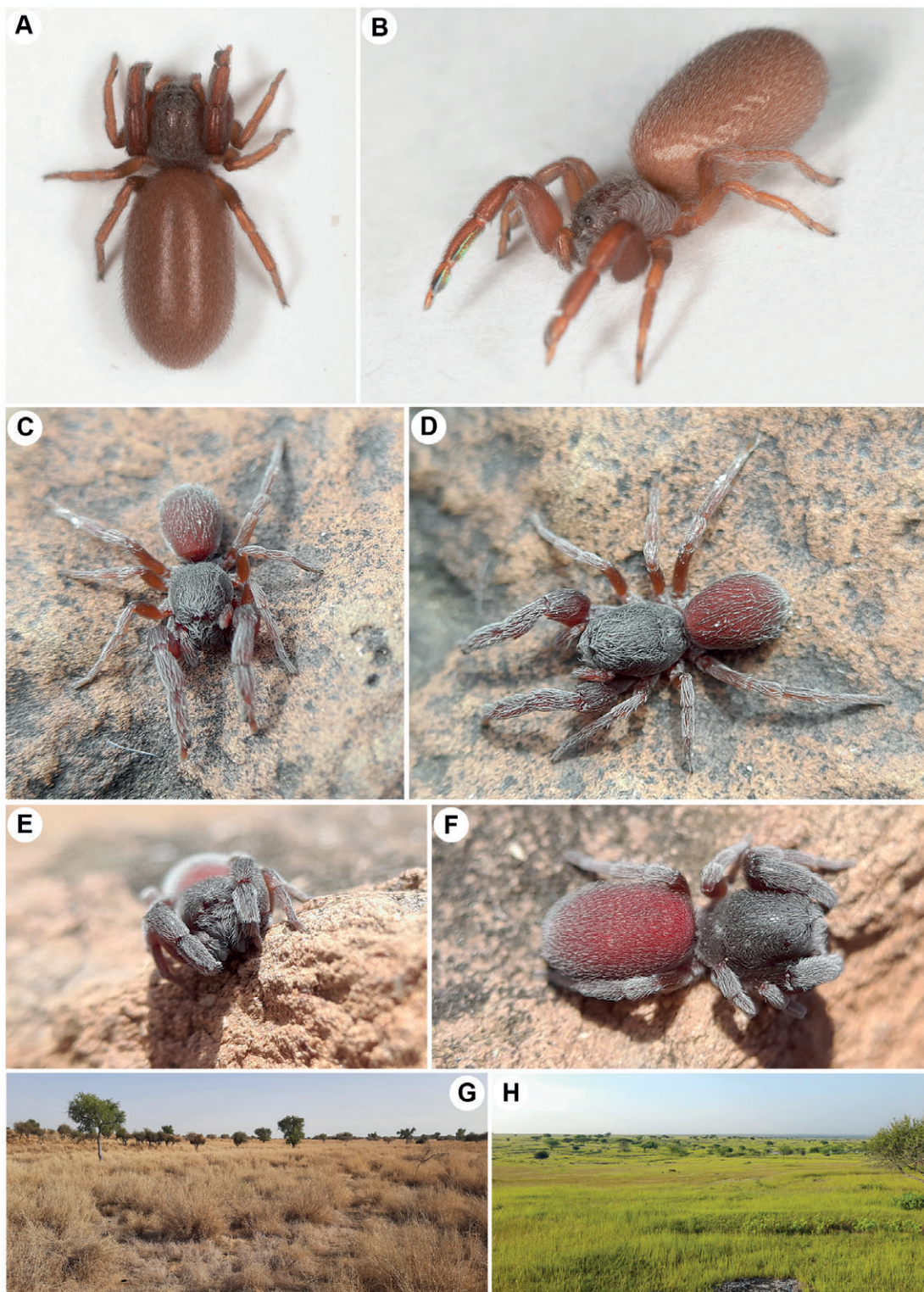


Fig. 1. Field photographs of *Palpimanus* spp. (A–F) and images of their collecting localities (G–H). A–B, G. *Palpimanus godawan* Tripathi & Sankaran sp. nov. A–B. Female. G. Distant view of collecting locality (Myajlar). C–F, H. *Palpimanus maldhok* Kuni, Tripathi & Sankaran sp. nov. C–D. Male. E–F. Female. H. Distant view of collecting locality (Boramani). Figures are not to scale. Photo credits: A–B, G, Rishikesh Tripathi, C–F, H, Nikhil Kuni.

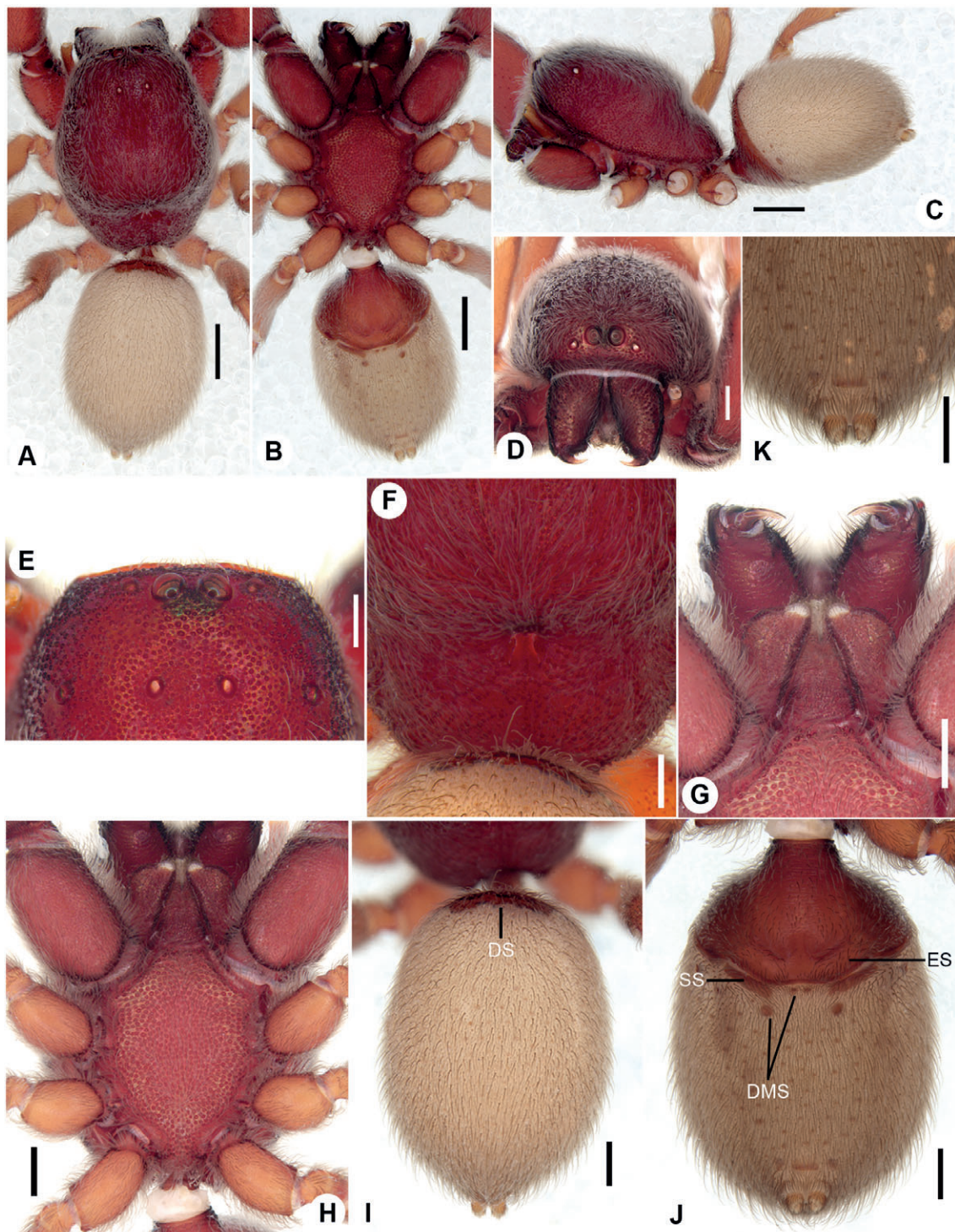


Fig. 2. *Palpimanus godawan* Tripathi & Sankaran sp. nov., holotype, ♂ (NRC-AA-4169). **A–D.** Habitus. **A.** Dorsal view. **B.** Ventral view. **C.** Retrolateral view. **D.** Frontal view. **E.** Eye group, dorsal view. **F.** Fovea, dorsal view. **G.** Labium and endites, ventral view. **H.** Prosoma showing sternum, ventral view. **I.** Opisthosoma, dorsal view. **J.** Same, showing ventral scuta, ventral view. **K.** Posterior part of opisthosoma showing spinnerets, ventral view. Abbreviations: DMS = dot-like median scutum; DS = dorsal scutum; ES = epigastric scutum; SS = stripe-like scutum. Scale bars: A–C = 1 mm; D–K = 0.5 mm.

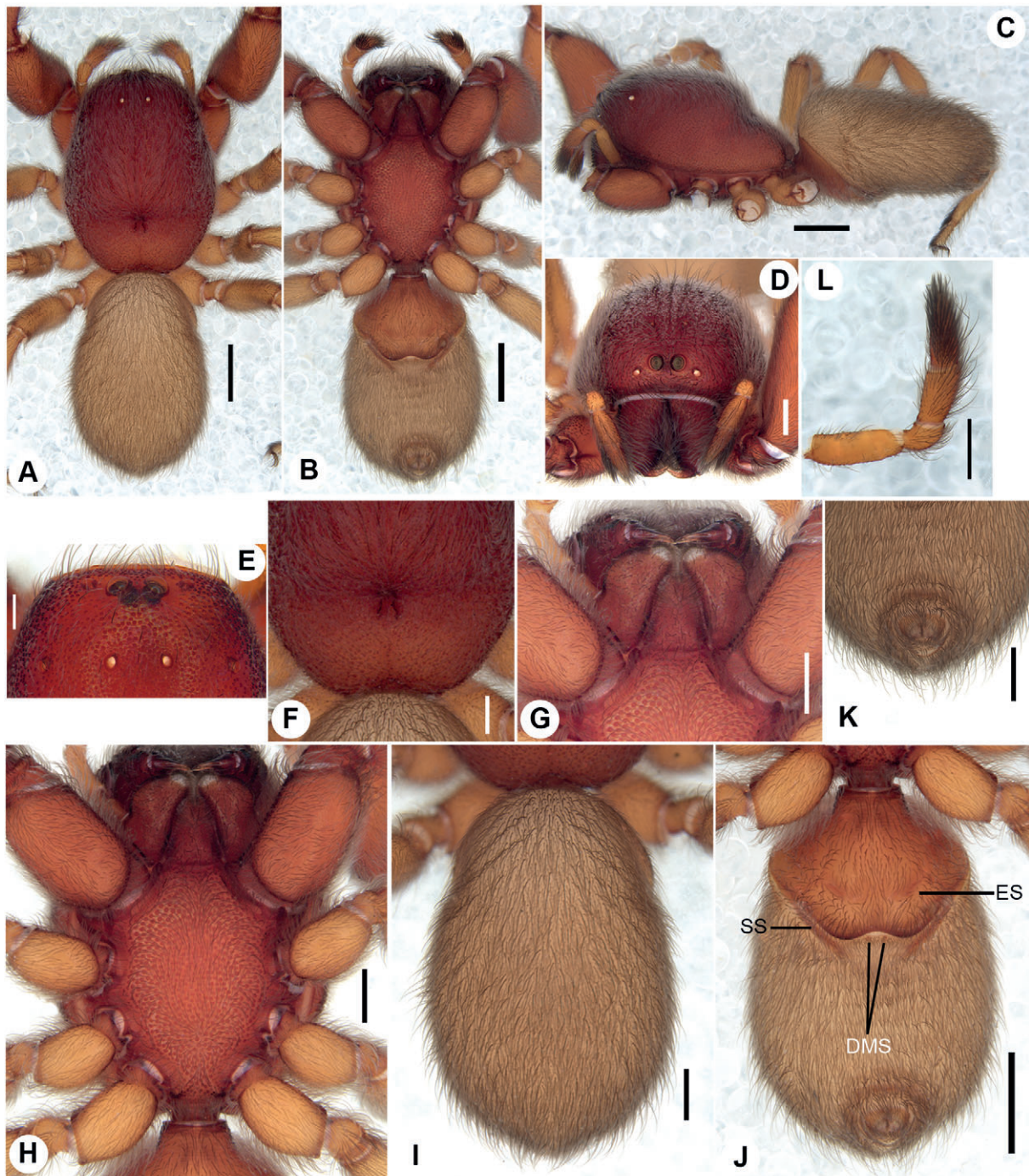


Fig. 3. *Palpimanus godawan* Tripathi & Sankaran sp. nov., paratype, ♀ (NRC-AA-4170). **A–D.** Habitus. **A.** Dorsal view. **B.** Ventral view. **C.** Retrolateral view. **D.** Frontal view. **E.** Eye group, dorsal view. **F.** Fovea, dorsal view. **G.** Labium and endites, ventral view. **H.** Prosoma showing sternum, ventral view. **I.** Opisthosoma, dorsal view. **J.** Same, showing various ventral scuta, ventral view. **K.** Posterior part of opisthosoma showing spinnerets, ventral view. **L.** Left palp, retrolateral view. Abbreviations: DMS = dot-like median scutum; ES = epigastral scutum; SS = stripe-like scutum. Scale bars: A–C, J = 1 mm; D–I, K–L = 0.5 mm.

PALP (Figs 5A–C, 6A–C). Tibia swollen, as wide as long. Cymbium narrow (Figs 5A–C, 6A–C; Cy). Bulb oval (Figs 5A–C, 6A–C; B). Embolic stalk originates in proximal half of bulb (Figs 5B–C, 6B–C; ES), with nearly same width along entire length in retrolateral view (Figs 5C, 6C), with sharp prolateral curvature in ventral view (Figs 5B, 6B), with dorsal, prolateral, retrolateral and median arms (Fig. 6B; DAE, PAE, RAE, MAE); dorsal arm broad, slightly folded laterally, with one long distomedian and two short distolateral processes (Fig. 6B); prolateral arm broad with sharply pointed edges (Fig. 6A–C); retrolateral arm hyaline, semi-circular and wrinkled, with smooth edges (Fig. 6B–C); median arm tongue-shaped, hyalin, flat, retrolaterally directed ventrally (Fig. 6B–C).

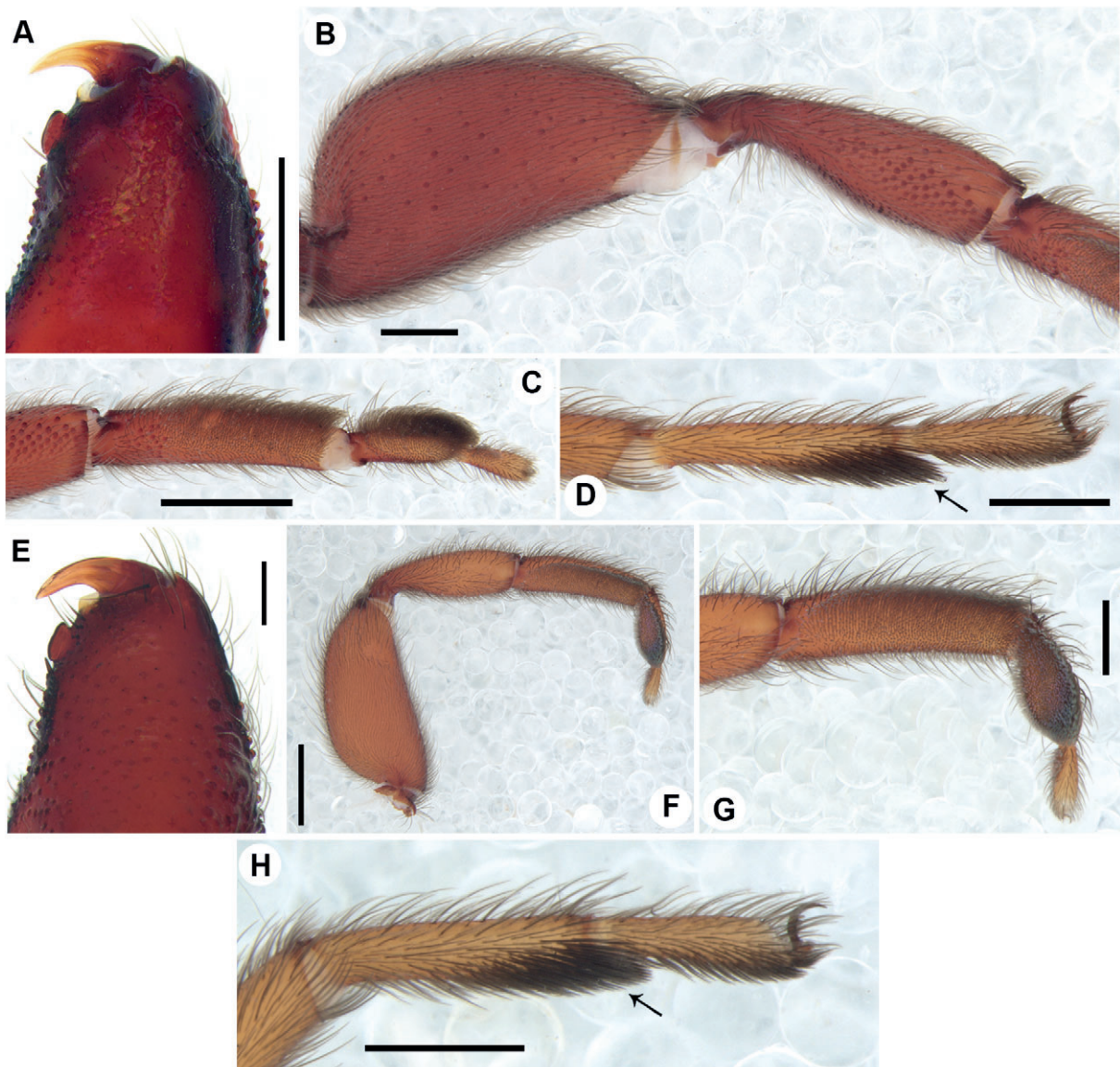


Fig. 4. *Palpimanus godawan* Tripathi & Sankaran sp. nov., chelicera and legs of holotype, ♂ (NRC-AA-4169) (A–D) and paratype, ♀ (NRC-AA-4170) (E–H). **A, E.** Left chelicera showing keel, retrolateral view. **B.** Enlarged view of left leg I showing tubercles, prolateral view. **C, G.** Left leg I showing prolateral scopula on tibia, metatarsus and tarsus, prolateral view. **D, H.** Left leg II showing preening brush. **F.** Left leg I, prolateral view. Arrows indicate preening brush. Scale bars: A, E = 0.2 mm; B, D, G–H = 0.5 mm; C, F = 1 mm.



Fig. 5. *Palpimanus godawan* Tripathi & Sankaran sp. nov., left palp of holotype, ♂ (NRC-AA-4169) (A–C) and epigastral scutum and endogyne of paratype, ♀ (NRC-AA-4170) (D–F). **A.** Prolateral view. **B.** Ventral view. **C.** Retrolateral view. **D.** Epigastral scutum intact, ventral view. **E.** Same, after clearing, ventral view. **F.** Endogyne, dorsal view. Scale bars: A–C, F = 0.2 mm; D–E = 0.5 mm.

Female (paratype, NRC-AA-4170; Figs 3, 4E–H)

Like male except for the following:

COLOUR. In alcohol: legs light brown.

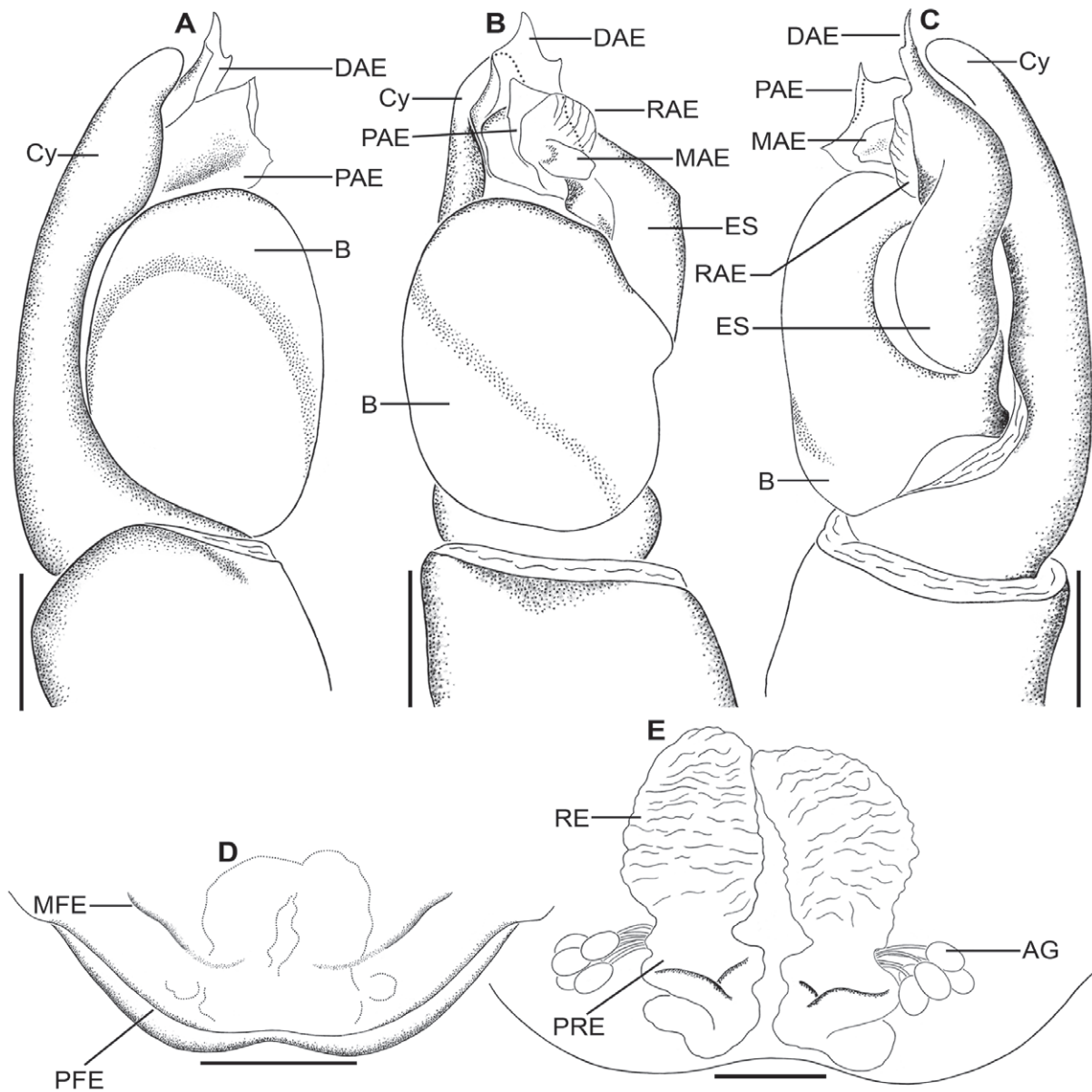


Fig. 6. *Palpimanus godawan* Tripathi & Sankaran sp. nov., left palp of holotype, ♂ (NRC-AA-4169) (A–C) and epigastral scutum and endogyne of paratype, ♀ (NRC-AA-4170) (D–E). **A.** Prolateral view. **B.** Ventral view. **C.** Retrolateral view. **D.** Epigastral scutum, ventral view. **E.** Endogyne, dorsal view. Abbreviations: AG = accessory gland; B = bulb; Cy = cymbium; DAE = dorsal arm of embolic stalk; ES = embolic stalk; MAE = median arm of embolic stalk; MFE = mediolateral fold of epigastral scutum; PAE = prolateral arm of embolic stalk; PFE = posterior fold of epigastral scutum; PRE = posterior part of receptacle; RAE = retrolateral arm of embolic stalk; RE = receptacle. Scale bars: A–C, E = 0.2 mm; D = 0.5 mm.

GENERAL MORPHOLOGY. Opisthosoma elongate-oval (Fig. 3I); venter with two dot-like median scuta (Fig. 3J).

MEASUREMENTS. Body length 7.32. Carapace 3.60 long, 2.69 wide. Opisthosoma 3.72 long, 2.46 wide. Eye sizes and interdistances: ALE 0.08, AME 0.16, PLE 0.07, PME 0.06; AME–ALE 0.12, AME–AME 0.07, AME–PME 0.47, PME–PLE 0.49, PME–PME 0.40. Clypeus height at ALEs 0.26, at AMEs 0.31. Chelicerae 1.25 long. Measurements of palp and legs: palp 1.98 [0.72, 0.21, 0.43, 0.62], I 7.03 [2.29, 1.75, 1.65, 0.88, 0.46], II 5.58 [1.73, 1.11, 1.30, 0.87, 0.57], III 4.87 [1.49, 0.79, 1.21, 0.85, 0.53], IV 6.72 [2.01, 1.01, 1.70, 1.44, 0.56].

GENITALIA (Figs 5D–F, 6D–E). Epigastral scutum hirsute (Fig. 5D), with mediolateral and posterior folds, former one incomplete (Figs 5D–E, 6D; MFE, PFE); posterior edge of epigastral scutum thick, W-shaped (Figs 5E, 6D). Endogyne with large receptacles, elongate-oval, wrinkled, sac-like, longer than wide, lying adjacent to each other, with flat, twisted posterior parts (Figs 5F, 6E; RE, PRE). Accessory glands elongate-oval, arise distolaterally to posterior parts of receptacles, with thin stalks, with varying number from four to five (Figs 5F, 6E; AG).

Variation

Male (n = 3): body length 6.44–7.66. Female (n = 4): body length 6.06–7.36.

Distribution

Currently known only from Rajasthan (Figs 1G, 13).

Natural history

Palpimanus godawan sp. nov. is found under rocks or occasionally under cattle dung. It moves slowly, is shy by nature and always tries to hide under stones when disturbed.

Palpimanus maldhok Kuni, Tripathi & Sankaran sp. nov.
urn:lsid:zoobank.org:act:BFCF6789-CD2B-4FFA-A91F-A44D6FD6FE0EA
Figs 1C–F, H, 7–11, 13

Diagnosis

Males of *P. maldhok* sp. nov. are similar to those of *P. carmania* Zamani & Marusik, 2021 as they both share the embolic stalk having narrow distal half in retrolateral view, and distomedian process of dorsal arm of the embolic stalk with smoothly rounded tip, but can be separated from the latter species by long distomedian process of dorsal arm of the embolic stalk (vs short in *P. carmania*), broad retrolateral arm of embolic stalk (narrow in *P. carmania*), and short, median arm of embolic stalk without serrated margin (vs broad with marginal serration in *P. carmania*) (cf. Figs 10B–C, 11A–C; Zamani & Marusik 2021: figs 15a–c, 16e–g). Females resemble those of *P. godawan* sp. nov. as both share elongate-oval receptacles that are contiguous only anteriorly, and accessory glands being originated distolaterally to posterior parts of receptacles, but can be separated by receptacles without wrinkles (vs wrinkled in *P. godawan*), and receptacles with cylindrical and less twisted posterior parts (vs flat and highly twisted in *P. godawan*) (cf. Figs 5F, 6E/Figs 10F, 11E). Females of *P. maldhok* sp. nov. can be distinguished from those of *P. vultuosus* by the absence of long whitish setae on the sternum (vs present in *P. vultuosus*; Simon 1897).

Etymology

The specific epithet is a noun in apposition and is the vernacular name of the Great Indian Bustard in Maharashtra, where the type locality of the new species is located.

Type material

Holotype

INDIA • ♂; Maharashtra, Solapur, Solapur south, Boramani; 17.763° N, 76.04616° E; 523 m a.s.l.; 29 Jul. 2020; N. Kuni leg.; from under rock; by hand; NRC-AA-4176.

Paratypes

INDIA • 1 ♀; same collection data as for holotype; NRC-AA-4177.

INDIA • 1 ♂, 1 ♀; same collection data as for holotype except 1 km from Boramani; 17.77258° N, 76.04697° E; 532 m a.s.l.; 13 Jun. 2022; NRC-AA-4178, 4179.

Description

Male (holotype, NRC-AA-4176; Figs 1C–D, 7, 9A–D)

COLOUR. In alcohol: prosoma, leg I and scuta maroon; opisthosoma, spinnerets yellowish orange; legs II–IV yellowish brown.

GENERAL MORPHOLOGY. Carapace, clypeus, dorsum of chelicerae, coxae and trochanters of legs and abdominal scuta thickly clothed with fine white setae; carapace, sternum, chelicerae and leg I clothed with scattered black setae. Carapace rugose, sub-oval in dorsal view, with indistinct cephalic groove (Fig. 7A, C); cephalic part evenly rounded and noticeably elevated than thoracic part (Fig. 7A); thoracic part gently sloping (Fig. 7C). Fovea short, prominent, bipartite, with two separate sulci closely located side by side (Fig. 7F). Clypeus rugose. Chelicerae with prolateral concavity, surface covered with numerous small tubercles (Fig. 9A); cheliceral promargin with a broad keel, with a single row of short setae, retromargin without tooth or keel (Fig. 9A). Sternum rugose, rebordered, clothed with fine setae, with coxal and intercoxal extensions, truncated between coxae IV (Fig. 7H); intercoxal extensions fused with carapace (Fig. 7H). Femur, patella and tibia of leg I prolaterally with numerous tubercles, scattered on femur, clustered along the entire length on patella, restricted to proximal part of tibia (Fig. 9B), tibia, metatarsus and tarsus with well-developed prolateral scopula, that on tarsus proximally restricted (Fig. 9C); patella I very long, longer than tibiae I–III and metatarsi I–III (Fig. 9B–C); metatarsi II–IV with distal preening brush (Fig. 9D, arrow); tarsi with paired claws, scopulate, with less-developed claw tufts (Fig. 9D). Pedicel completely encircled with collar that is fused with abdominal scuta (Fig. 7B–C, H, J). Opisthosoma oval, hirsute, with numerous red spots (Fig. 7I); abdominal scuta remain fused together; dorsal part of abdominal scuta absent (Fig. 7C, I). Epigastral scutum nearly circular, with strongly sclerotised posterior edge, partly encircled by six thin scuta, two stripe-like laterals and two tiny and two slightly large dot-like medians (Fig. 7J; ES, SS, DMS). Tracheal spiracle prominent (Fig. 7K). AMS short, bi-segmented, cylindrical, not encircled by sclerotised ring (Fig. 7K).

MEASUREMENTS. Body length 5.52. Carapace 2.49 long, 2.07 wide. Opisthosoma 3.03 long, 2.05 wide. Eye sizes and interdistances: ALE 0.08, AME 0.13, PLE 0.07, PME 0.06; AME–ALE 0.13, AME–AME 0.10, AME–PME 0.42, PME–PLE 0.35, PME–PME 0.26. Clypeus height at ALEs 0.13, at AMEs 0.18. Chelicerae 0.98 long. Measurements of palp and legs: palp 1.61 [0.56, 0.19, 0.32, 0.54], I 5.37 [1.79, 1.26, 1.19, 0.59, 0.54], II 4.13 [1.35, 0.68, 1.01, 0.65, 0.44], III 3.57 [1.17, 0.55, 0.87, 0.66, 0.32], IV 4.97 [1.46, 0.77, 1.24, 1.06, 0.44].

PALP (Figs 10A–C, 11A–C). Tibia swollen, as wide as long. Cymbium narrow (Figs 10A–C, 11A–C; Cy). Bulb almost pear-shaped (Figs 10A–C, 11A–C; B). Embolic stalk originates in distal half of bulb (Figs 10B–C, 11B–C; ES), with narrow distal part in retrolateral view (Figs 10C, 11C), with a weak prolateral curvature in ventral view (Figs 10B, 11B), with dorsal, prolateral, retrolateral and median arms (Fig. 11B; DAE, PAE, RAE, MAE); dorsal arm with one large distomedian and two tiny distolateral

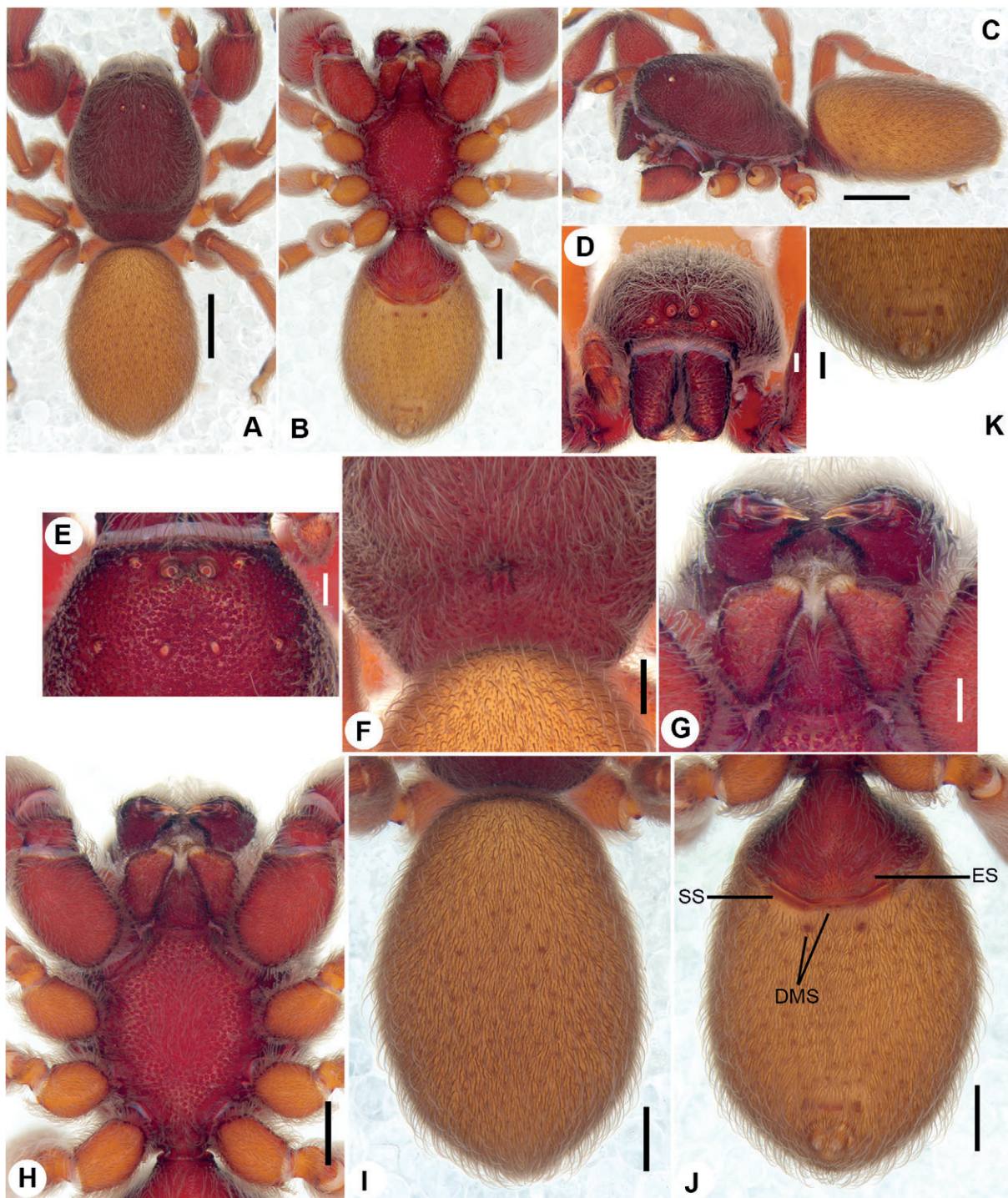


Fig. 7. *Palpimanus maldhok* Kuni, Tripathi & Sankaran sp. nov., holotype, ♂ (NRC-AA-4176). **A–D.** Habitus. **A.** Dorsal view. **B.** Ventral view. **C.** Retrolateral view. **D.** Frontal view. **E.** Eye group, dorsal view. **F.** Fovea, dorsal view. **G.** Labium and endites, ventral view. **H.** Prosoma showing sternum, ventral view. **I.** Opisthosoma, dorsal view. **J.** Same, showing various ventral scuta, ventral view. **K.** Posterior part of opisthosoma showing spinnerets, ventral view. Abbreviations: DMS = dot-like median scutum; ES = epigastral scutum; SS = stripe-like scutum. Scale bars: A–C = 1 mm; D–E, G, K = 0.2 mm; F, H–J = 0.5 mm.

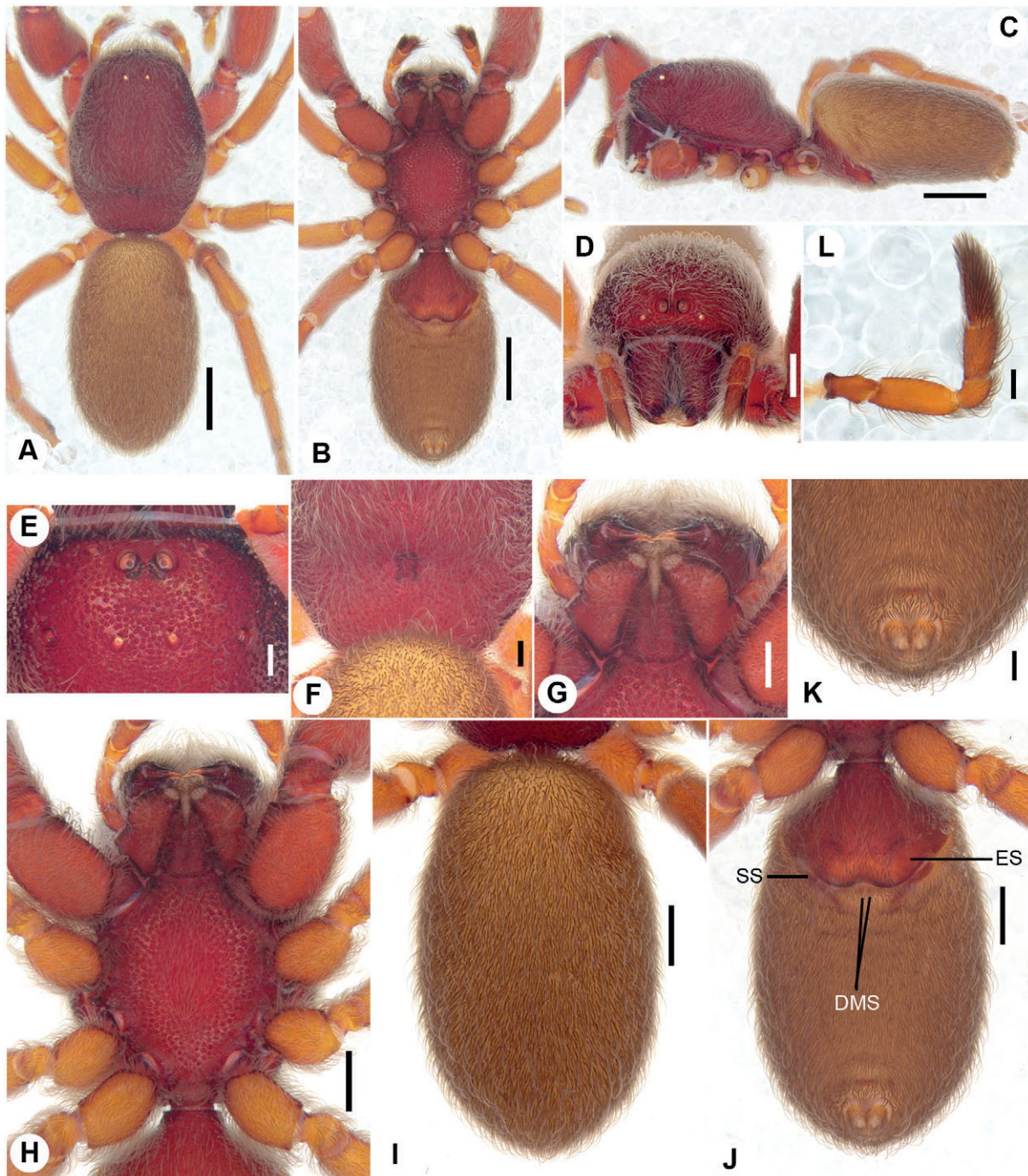


Fig. 8. *Palpimanus maldhok* Kuni, Tripathi & Sankaran sp. nov., paratype, ♀ (NRC-AA-4177). **A–D.** Habitus. **A.** Dorsal view. **B.** Ventral view. **C.** Retrolateral view. **D.** Frontal view. **E.** Eye group, dorsal view. **F.** Fovea, dorsal view. **G.** Labium and endites, ventral view. **H.** Prosoma showing sternum, ventral view. **I.** Opisthosoma, dorsal view. **J.** Same, showing various ventral scuta, ventral view. **K.** Posterior part of opisthosoma showing spinnerets, ventral view. **L.** Left palp, retrolateral view. Abbreviations: DMS = dot-like median scutum; ES = epigastral scutum; SS = stripe-like scutum. Scale bars: A–C = 1 mm; D, H–J = 0.5 mm; E–G, K–L = 0.2 mm.

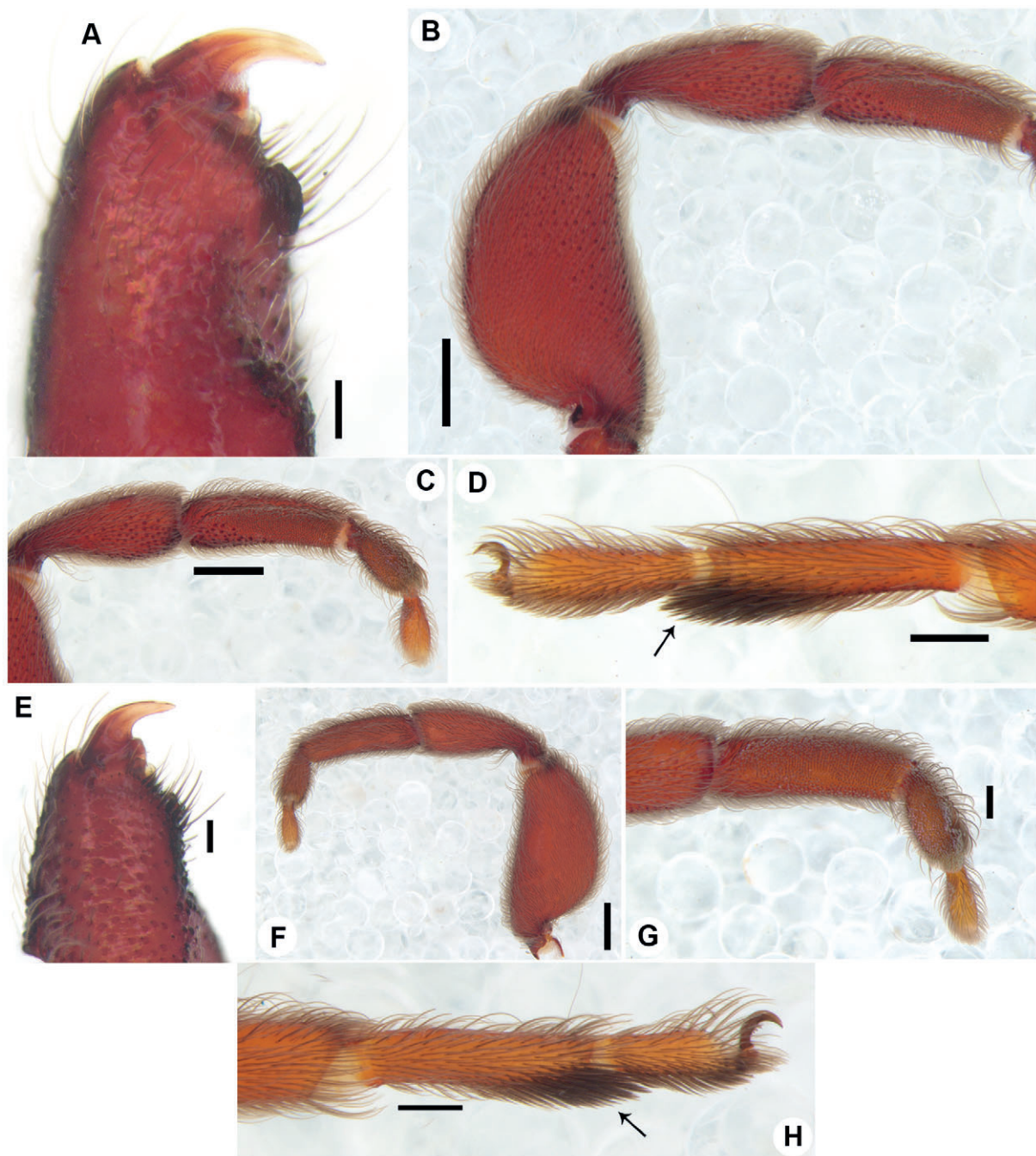


Fig. 9. *Palpimanus maldhok* Kuni, Tripathi & Sankaran sp. nov., chelicera and legs of holotype, ♂ (NRC-AA-4176) (A–D) and paratype, ♀ (NRC-AA-4177) (E–H). **A.** Left chelicera showing keel and concavity, prolateral view. **B.** Enlarged view of left leg I showing tubercles, prolateral view. **C, G.** Left leg I showing prolateral scopula on tibia, metatarsus and tarsus, prolateral view. **D, H.** Left leg II showing preening brush. **D.** Retrolateral view. **H.** Prolateral view. **E.** Left chelicera showing keel, prolateral view. **F.** Left leg I, retrolateral view. Arrows indicate preening brush. Scale bars: A, E = 0.1 mm; B–C, F = 0.5 mm; D, G–H = 0.2 mm.

processes (Fig. 11B–C); prolateral arm with smooth edges (Fig. 11A–C), with a prominent prolateral folding (Fig. 11A–B); retrolateral arm broad and wrinkled (Fig. 11B–C); median arm short, cone-shaped, hyalin, flat, retrolaterally directed ventrally (Fig. 11A–C).

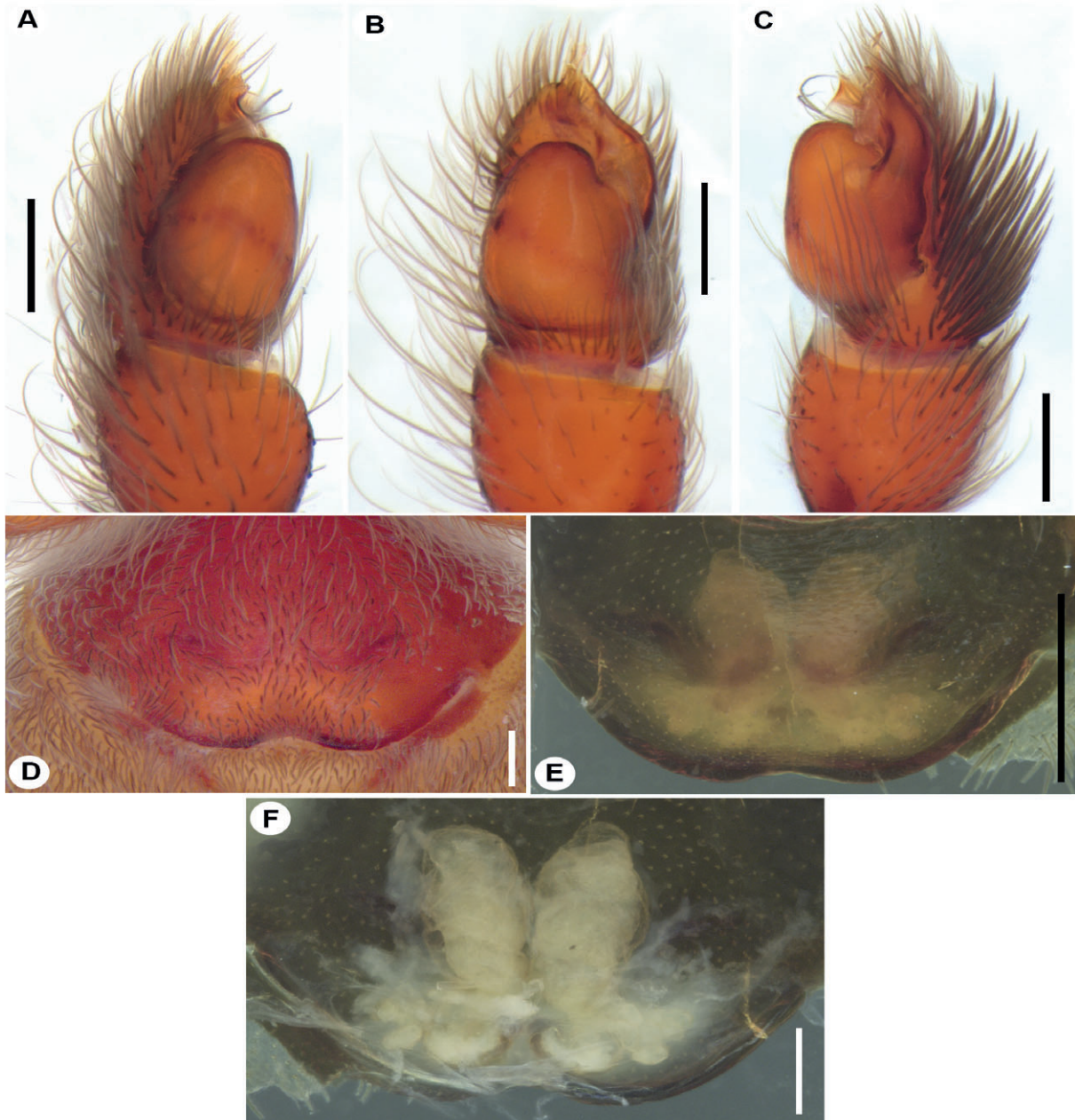


Fig. 10. *Palpimanus maldhok* Kuni, Tripathi & Sankaran sp. nov., left palp of holotype, ♂ (NRC-AA-4176) (A–C) and epigastral scutum and endogyne of paratype, ♀ (NRC-AA-4177) (D–F). **A.** Prolateral view. **B.** Ventral view. **C.** Retrolateral view. **D.** Epigastral scutum intact, ventral view. **E.** Same, after clearing, ventral view. **F.** Endogyne, dorsal view. Scale bars: A–D, F = 0.2 mm; E = 0.5 mm.

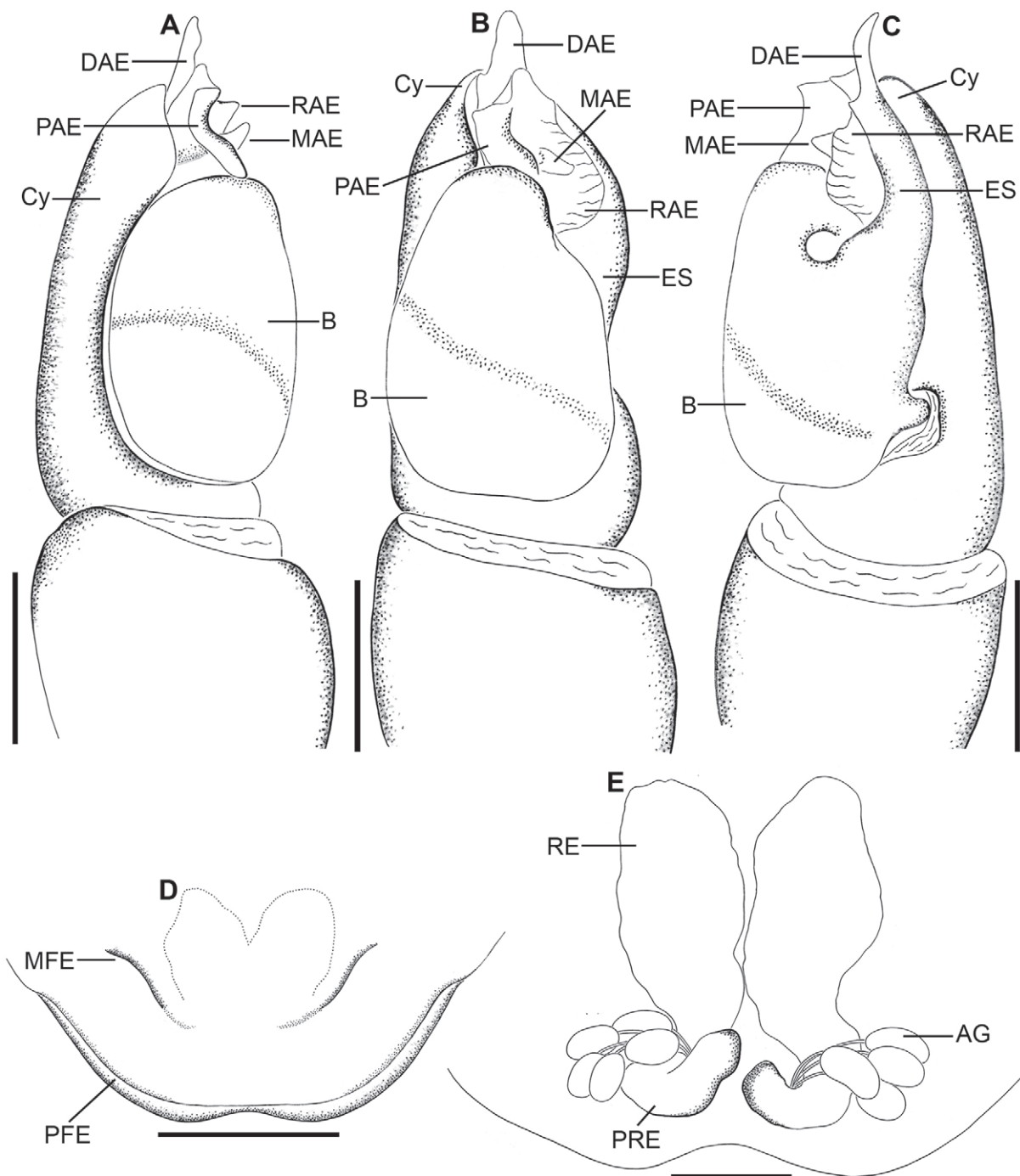


Fig. 11. *Palpimanus maldhok* Kuni, Tripathi & Sankaran sp. nov., left palp of holotype, ♂ (NRC-AA-4176) (A–C) and epigastral scutum and endogyne of paratype, ♀ (NRC-AA-4177) (D–E). **A.** Prolateral view. **B.** Ventral view. **C.** Retrolateral view. **D.** Epigastral scutum, ventral view. **E.** Endogyne, dorsal view. Abbreviations: AG = accessory gland; B = bulb; Cy = cymbium; DAE = dorsal arm of embolic stalk; ES = embolic stalk; MAE = median arm of embolic stalk; MFE = mediolateral fold of epigastral scutum; PAE = prolateral arm of embolic stalk; PFE = posterior fold of epigastral scutum; PRE = posterior part of receptacle; RAE = retrolateral arm of embolic stalk; RE = receptacle. Scale bars: A–C, E = 0.2 mm; D = 0.5 mm.

Female (paratype, NRC-AA-4177; Figs 1E–F, 8, 9E–H)

Like male except for the following:

COLOUR. In alcohol: legs light brown.

GENERAL MORPHOLOGY. Chelicerae with less developed prolateral concavity (Fig. 9E). Opisthosoma elongate-oval, without red spots (Fig. 8I); venter with two dot-like median scuta (Fig. 8J).

MEASUREMENTS. Body length 6.31. Carapace 2.93 long, 2.17 wide. Opisthosoma 3.38 long, 2.05 wide. Eye sizes and interdistances: ALE 0.07, AME 0.12, PLE 0.06, PME 0.05; AME–ALE 0.12, AME–AME 0.07, AME–PME 0.39, PME–PLE 0.36, PME–PME 0.29. Clypeus height at ALEs 0.20, at AMEs 0.26. Chelicerae 0.99 long. Measurements of palp and legs: palp 1.57 [0.52, 0.18, 0.36, 0.51], I 5.49 [1.84, 1.33, 1.25, 0.58, 0.49], II 4.29 [1.32, 0.80, 1.02, 0.70, 0.45], III 3.81 [1.13, 0.70, 0.89, 0.75, 0.34], IV 5.41 [1.56, 0.88, 1.37, 1.15, 0.45].

GENITALIA (Figs 10D–F, 11D–E). Epigastral scutum hirsute (Fig. 10D), with mediolateral and posterior folds, former one incomplete (Figs 10D–E, 11D; MFE, PFE); posterior edge of epigastral scutum thick, W-shaped (Figs 10D–E, 11D). Endogyne with large receptacles, elongate-oval, balloon-like, longer than wide, lying adjacent to each other, with cylindrical, twisted posterior parts (Figs 10F, 11E; RE, PRE). Accessory glands elongate-oval, arise distolaterally to posterior parts of receptacles, with thin stalks, with varying number from four to five (Figs 10F, 11E; AG).

Variation

Male (n = 2): body length 5.29–5.52. Female (n = 2): body length 6.31–7.01.

Distribution

Currently known only from Maharashtra (Figs 1H, 13).

Natural history

Palpimanus maldhok sp. nov. is found under rocks. Like *P. godawan* sp. nov., this species also moves slowly, is shy by nature and always tries to hide under stones when disturbed.

Catalogue of Indian Palpimanidae

Following this study, the Palpimanidae in India now comprises six described species belonging to three genera; all are described from mainland India. The palpimanid fauna of India is dominated by *Palpimanus*, with four species; three species are known from both sexes, while one is known only from the female (World Spider Catalog 2023; present data). Sankaran (2022) concluded that the species *Sarascelis raffrayi* Simon, 1893 is not recorded in India, but the World Spider Catalog (2023) still records this species as being found in India, which may be based on Gravely (1921). However, Gravely (1921) was uncertain about the generic placement of the specimens that he examined from the Barkuda Islands, and considered them to be conspecific with *S. raffrayi*, which he compared only with the original description of this species (Simon 1893), and not with its type. As a consequence, the occurrence of this species in India based on Gravely (1921), cannot be confirmed until a physical specimen from India can be positively collected and recognized as belonging to that species.

Genus *Boagrius* Simon, 1893

Remarks

Sankaran (2022) recorded this genus for the first time from India.

Boagrius tenuisus Sankaran, 2022

Boagrius tenuisus Sankaran, 2022: 2175, figs 1a–k, 2a–j, 3a–j, 4a–g, 5a–f, 6a–e, 7a–c (♂♀).

Type locality

Near Pattani, Kerala, India (Sankaran 2022).

Type repository

ADSH (Sankaran 2022).

Records from India

Kerala (Sankaran 2022) (Fig. 13).

Distribution

Known only from India (World Spider Catalog 2023).

Genus *Palpimanus* Dufour, 1820

Palpimanus godawan Tripathi & Sankaran sp. nov.

Type locality

Gajaimata area, Rajasthan, India.

Type repository

NRC.

Records from India

Rajasthan (Fig. 13).

Distribution

Known only from India.

Palpimanus maldhok Kuni, Tripathi & Sankaran sp. nov.

Type locality

Boramani, Maharashtra, India.

Type repository

NRC.

Records from India

Maharashtra (Fig. 13).

Distribution

Known only from India.

Palpimanus narsinhmehtai Prajapati, Hun & Raval, 2021

Palpimanus narsinhmehtai Prajapati, Hun & Raval, 2021: 542, figs 1–20 (♂♀).

Type locality

Girnar Wildlife Sanctuary, Gujarat, India (Prajapati *et al.* 2021).

Type repository

GEER (Prajapati *et al.* 2021).

Records from India

Gujarat (Prajapati *et al.* 2021) (Fig. 13).

Distribution

Known only from India (World Spider Catalog 2023).

Palpimanus vultuosus Simon, 1897

Palpimanus vultuosus Simon, 1897: 291 (♀).

Type locality

Matheran, Maharashtra, India (Simon 1897).

Type repository

Unknown, probably MNHN.

Records from India

Maharashtra (Simon 1897) (Fig. 13).

Distribution

Known only from India (World Spider Catalog 2023).

Genus *Sarascelis* Simon, 1887

Sarascelis namratae (Pillai, 2006)

Otiathops namratae Pillai, 2006: 134, fig. 1a–g (♂♀).

Palpimanus namratae Prajapati, Hun & Raval, 2021: 544 (Transfer from *Otiathops*).

Sarascelis namratae Sankaran, 2022: 2183 (Transfer from *Palpimanus*).

Type locality

Adhewada, Gujarat, India (Pillai 2006; Sankaran 2022).

Type repository

Unknown, probably ZSI-SRC (Pillai 2006; Sankaran 2022).

Records from India

Gujarat (Pillai 2006) (Fig. 13).

Distribution

Known only from India (World Spider Catalog 2023).

Key to Indian species of *Palpimanus*

Male of *P. vultuosus* is excluded from the key as it is unknown and the detail of its female was taken from Simon (1897). Details of *P. narsinhmehtai* were taken from Prajapati *et al.* (2021).

1. Males..... 2
– Females..... 4
2. Dorsal arm of embolic stalk (DAE) with short distomedian process, median arm of embolic stalk (MAE) tongue-shaped (Fig. 6B)..... *P. godawan* sp. nov.
– Dorsal arm of embolic stalk (DAE) with long distomedian process, median arm of embolic stalk (MAE) cone-shaped (Figs 11B, 12C; Prajapati *et al.* 2021: fig. 17) 3
3. Prolateral arm of embolic stalk (PAE) with lateral folding, median arm of embolic stalk (MAE) short (Fig. 11B)..... *P. maldhok* sp. nov.
– Prolateral arm of embolic stalk (PAE) lacks lateral folding, median arm of embolic stalk (MAE) large (Fig. 12A, C; Prajapati *et al.* 2021: fig. 18)..... *P. narsinhmehtai* Prajapati, Hun & Raval, 2021
4. Sternum covered with long whitish setae (Simon 1897) *P. vultuosus* Simon, 1897
– Sternum lacks covering of long whitish setae (Figs 3H, 8H) 5
5. Receptacles (RE) sac-like, posterior part of receptacles (PRE) flat and strongly twisted (Fig. 6E)....
..... *P. godawan* sp. nov.
– Receptacles (RE) balloon-shaped or reniform, posterior part of receptacles (PRE) cylindrical and weakly twisted (Fig. 11E; Prajapati *et al.* 2021: fig. 20) 6
6. Receptacles (RE) balloon-shaped, accessory glands (AG) originate distolaterally to posterior part of receptacles (PRE) (Figs 10F, 11E)..... *P. maldhok* sp. nov.
– Receptacles (RE) reniform, accessory glands (AG) originate medially to posterior part of receptacles (PRE) (Prajapati *et al.* 2021: fig. 20)..... *P. narsinhmehtai*

Discussion

Even though the Mediterranean species of *Palpimanus* have been revised twice (Kulczyński 1909; Platnick 1981), the genus, as a whole, remains poorly studied as noted by Zamani & Marusik (2021), and no proper illustrations of copulatory organs, particularly those of the endogyne of the genus, are available to identify different species. The illustrations presented in Platnick (1981: figs 10–18) are very schematic and not properly labeled, thus it is very difficult to understand various structures. Recently, Zonstein & Marusik (2019), Zamani & Marusik (2021) and Fomichev *et al.* (2023) attempted to present colour and SEM images of the male palp and endogyne, but did not provide labeled illustrations of the same. Since various sclerites in the male palp and different parts of the endogyne of *Palpimanus* are weakly sclerotised, and thus very difficult to observe, illustrations with proper labeling are much more informative and useful to distinguish various structures. Prajapati *et al.* (2021) attempted to present labeled illustrations of the copulatory organs of *P. narsinhmehtai*, but failed to distinguish various sclerites in the male palp and thus incorrectly illustrated it. Another problem related to the taxonomy of *Palpimanus* is the lack of proper terminology for the copulatory organs of *Palpimanus*. Various authors used different terminologies to denote even similar structures (see Platnick 1981; Zonstein & Marusik 2019; Prajapati *et al.* 2021; Zamani & Marusik 2021; Fomichev *et al.* 2023). We mostly used a combination of terminologies suggested by Zonstein & Marusik (2019), Prajapati *et al.* (2021) and

Zamani & Marusik (2021) to denote various sclerites in the male palp as well as different parts of the endogyne of the new species described in this paper.

Both the new species of *Palpimanus* described in this paper are found in semi-arid and arid grassland ecosystems of Maharashtra and Rajasthan respectively (Fig. 1G–H). Though grasslands are one of the most neglected ecosystems and are often treated as wastelands or pastures (Mohan *et al.* 2015), the grassland ecosystems of Rajasthan and Maharashtra are particularly significant as these ecosystems harbour a Critically Endangered bird species, the Great Indian Bustard (*Ardeotis nigriceps* (Vigors, 1831)) of the bustard family Otididae Rafinesque, 1815. The population of this bird species is now declining at an alarming rate, mostly due to habitat loss and degradation, and is now mainly confined to the grasslands of Rajasthan, even though they are rarely spotted in other Indian States such as Andhra

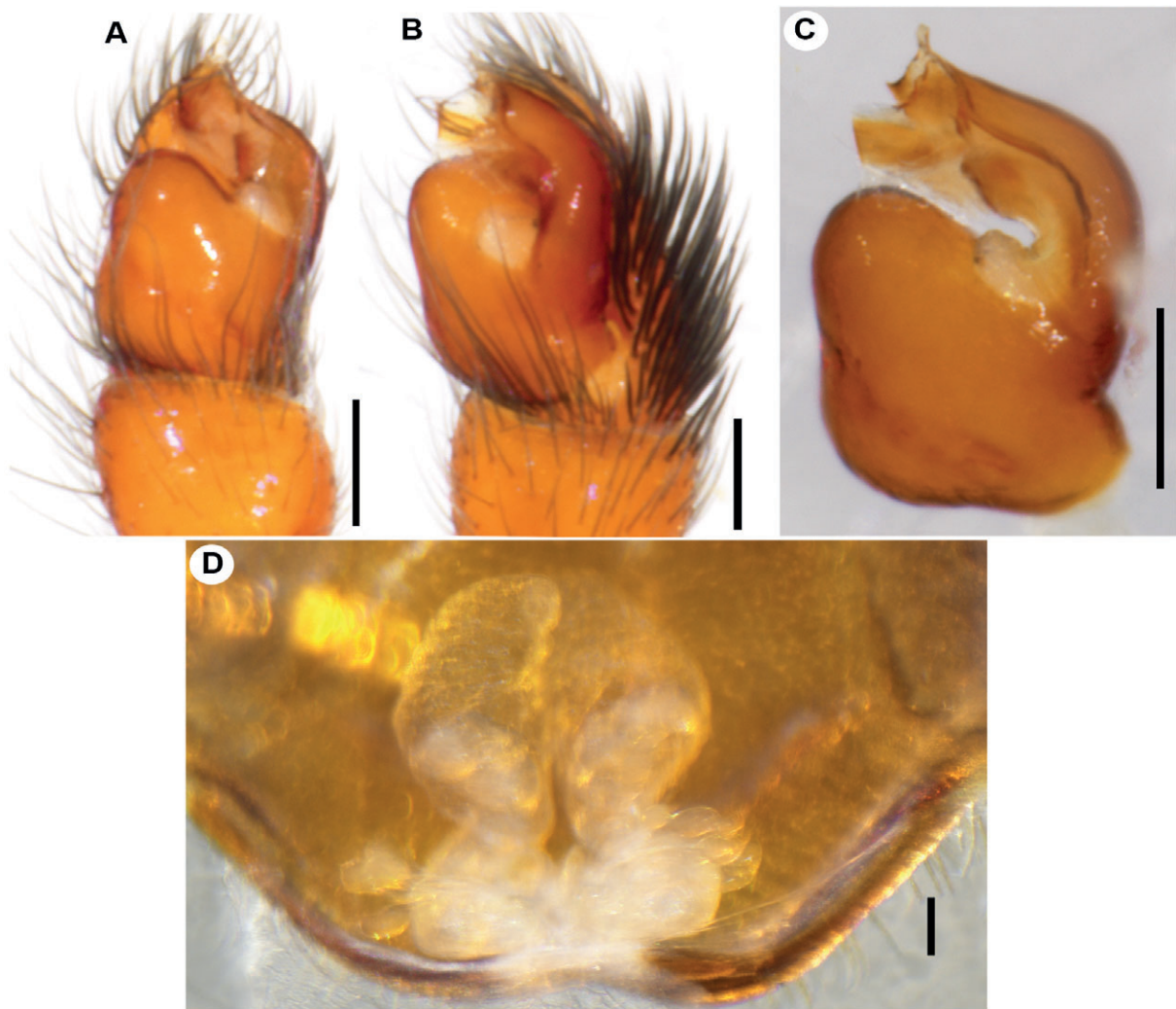


Fig. 12. *Palpimanus narsinhmehtai* Prajapati, Hun & Raval, 2021, copulatory organs of the holotype, ♂ (A–C) and paratype, ♀ (D). A–B. Left palp. A. Ventral view. B. Retrolateral view. C. Left bulb, ventroretrolateral view. D. Endogyne, dorsal view. Scale bars: A–B = 0.5 mm; C–D = 0.1 mm. © Dhruv A. Prajapati.

Pradesh, Karnataka, Gujarat and Maharashtra (Jhala *et al.* 2020). As a result, the Government of India launched the Project Bustard in 2012, a national conservation programme to protect the Great Indian Bustard and its habitats together with other Otididae: the Bengal florican (*Houbaropsis bengalensis* (Gmelin, 1789)) and the lesser florican (*Sypheotides indicus* (Miller, 1782)). The attempt of protecting the Great Indian Bustard and its habitats in turn protects the microhabitats harbouring the new species of *Palpimanus* described here as well as other known, and unknown spider species inhabiting these grassland ecosystems.

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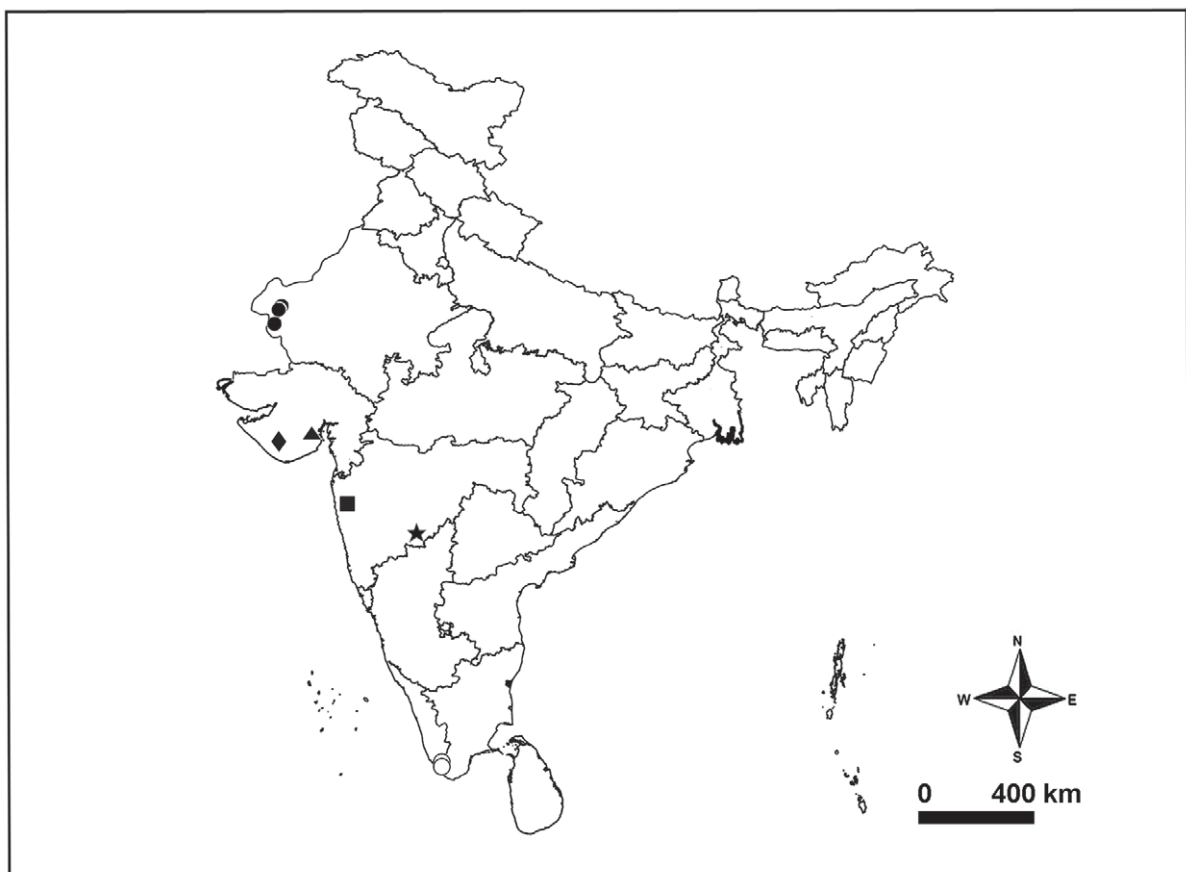


Fig. 13. Distribution of the genera *Boagrius*, *Palpimanus* and *Sarascelis* in India. ○ *Boagrius tenuisus* Sankaran, 2022; ● *Palpimanus godawan* sp. nov.; ★ *P. maldhok* sp. nov.; ◆ *P. narsinhmehtai* Prajapati, Hun & Raval, 2021; ■ *P. vultuosus* Simon, 1897 and ▲ *Sarascelis namratae* (Pillai, 2006).

Germany), who kindly checked the etymology of the new species. We extend our heartfelt thanks to two anonymous reviewers for their constructive comments on the MS that greatly improved it. This study was part of the Bustard Recovery Programme of the Wildlife Institute of India funded by the National Compensatory Afforestation Fund Management and Planning Authority, Government of India.

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