



## Two new fig wasp species of genus *Sycoscapter* Saunders, 1883 (Hymenoptera: Chalcidoidea: Pteromalidae) with a key to species of the genus from India

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**ABSTRACT:** Two new species of non-pollinating fig wasp genus *Sycoscapter* Saunders, 1883 namely *Sycoscapter benghalensis* Pramanik & Dey, sp. nov. collected from *Ficus benghalensis* and *S. benjaminae* Pramanik & Dey, sp. nov. collected from *F. benjamina* are described and illustrated. A diagnostic key is presented to distinguish both sexes of 11 known *Sycoscapter* species reported from India including the new species. Further the affinity of males and females of *Sycoscapter* species to closely related genera of subfamily Sycoryctinae is also discussed.

**KEY WORDS:** *Ficus benghalensis*, *F. benjamina*, India, Non-pollinating fig wasp, Sycoryctinae, Sycoryctini, Taxonomy.

### INTRODUCTION

*Sycoscapter* Saunders, 1883 belongs to tribe Sycoryctini which is represented by six closely related genera viz. *Adiyodiella* Priyadarsanan, *Arachonia* Joseph, *Sycorycteridea* Abdurahiman & Joseph, *Sycoryctes* Mayr, *Sycoscapter* Saunders and *Sycoscapteridea* Ashmead in India as well as in the world (van Noort and Rasplus, 2017). Since the last five genera are separated based on slightly outstanding characters, earlier Bouček (1988) recommended synonymization of four genera viz. *Arachonia*, *Sycoryctes*, *Sycoscapteridea* and *Sycorycteridea* under the single genus *Sycoscapter*. Recently Segar *et al.* (2012) studied the global phylogeny of the subfamily Sycoryctinae and reversed the oversimplification proposed by Bouček (1988) since these genera are difficult (but not impossible) to distinguish based on male morphology and formed well-supported molecular clades in their analyses. Moreover, female of all the six genera have distinctive morphologies.

The cosmopolitan genus *Sycoscapter* Saunders is globally represented by 26 species (Noyes, 2017; van Noort and Rasplus, 2017). With nine reported species it is the most diverse genus under tribe Sycoryctini and second most species rich genus of fig wasp in India (Pramanik and Dey, 2016). In the present study two new species viz. *S. benghalensis* sp. nov. and *S. benjaminae* sp. nov. are described and illustrated. While the first one was collected from *F. benghalensis* in Delhi and West Bengal, the latter was reared from *F. benjamina* in Arunachal Pradesh.

Earlier Priyadarsanan (2000) prepared a key to separate six *Sycoscapter* species reported from Kerala. Here we provide a comprehensive key to distinguish all females of 11 *Sycoscapter* species reported from India

including two new species described in this study. The key is also useful to separate males of nine *Sycoscapter* species reported from India (since males are not yet known for *S. kathuriensis* and *S. nayashorum*).

### MATERIALS AND METHODS

Near mature figs (syconia) of *Ficus benghalensis* and *F. benjamina* were collected and studied following the procedure described by Pramanik and Dey (2014). Field collected mature 'D' phase fig syconia were dissected and kept in transparent plastic jars covered with a fine mesh for one week to allow emergence of all wasps. Among the emerging fig wasp species mating pairs were isolated and labeled separately for subsequent confirmation of male female association. Later all other emerged wasps were collected with fine brush and preserved in 70% ethanol. To retain the original shape of specimens, ethanol dried fig wasp samples were further critical point dried in an EMITECH K850 Critical Point Drier and subsequently mounted on small black card points for morphological studies. Fig wasp specimens were observed and measured under Leica DFC 425C stereo-zoom microscope with 160 × magnification. For measurements an ocular scale was attached on to the eyepiece and measurements were recorded in terms of number of ocular scale units. Relative measurements were used for all characters except length of head, mesosoma and metasoma where absolute measurements (in millimeter) were used. For this purpose, ocular scale reading was converted into absolute measurements (mm) after calibrating with stage micrometer reading at respective magnification. Microphotography was performed with LEICA DFC 425C stereo-zoom microscope using LAS V3.8 software for combining



stacked images of different depths. All figures and photographs were edited with Adobe Photoshop Elements version 15 for better clarity. Figure plates were arranged and annotated in Microsoft Office Publisher 2007.

Abbreviations used are- SM: submarginal vein; M: marginal vein; PM: postmarginal vein; ST: stigmal vein; POL: distance between lateral ocelli; OOL: ocellar ocular distance; F1: first funicular segment.

TAXONOMIC TREATMENT

Genus *Sycosapter* Saunders, 1883

Diagnosis. Female: Body bluish-green with metallic tinge (Fig. 1A). Antenna with 2 anelli (Fig. 1F); proximal funicular segments symmetric, not dilated on ventral side. Forewing ventrally with some long, outstanding setae below the marginal vein, but otherwise pilosity reduced (Fig. 1I); stigmal knob unusually produced downwards (Fig. 1J) (Bouček, 1988). Pronotum rather short. Scutellum almost rounded posteriorly (Fig. 1G). Fore femur not swollen. Tail undivided (Fig. 1B), thin, only base and apex usually appearing a little thicker; whole length of ovipositor covered by thin epipygium (Bouček, 1988).

Male: Hypostomal margin usually straight, at most shallowly emarginate in the middle (Fig. 2D). Antennae inserted slightly above lower clypeal margin (Fig. 2B). Toruli separated only by a narrow inter-antennal ridge; each torulus on inner side slightly covered by a fold, as if base of antenna was pushed towards median line (Fig. 2B) (Bouček, 1988). Antenna with anellus; funicular segments asymmetric; F1 often unusually larger than the second (Fig. 2E). Pronotum large, shield-like, wider than the remaining part of mesosoma (Fig. 2F). Mesosoma dorsally with only two apparent terga as mesonotum fused to metanoto-propodeum (Fig. 2F) (Bouček, 1988). One or both wings represented by long filamentous pubescent wing remnants (Fig. 2G). Basal segments of hind tarsus small, but the last one sometimes enlarged. Hind tibia and basitarsus never with very long setae (Bouček, 1988).

Key to the Indian species of genus *Sycosapter* Saunders (\*Males are not yet known for *S. kathuriensis* and *S. nayoshorum*)

- 1a. Female ..... 2
1b. Male ..... 12
2a. Tail 7 x as long as metasoma; stigmal knob rather short, only 0.2 x as long as ST ..... 3
2b. Tail never > 6 x as long as metasoma; stigmal knob longer, at least 0.3 x as long as ST ..... 4
3a. POL 3.2 x OOL; M 2 x as long as ST; alar setae before ST 15 in number, distributed in 4 rows ..... ♀ S. hirticola
3b. POL 11 x OOL; M 1.5 x as long as ST; alar setae before ST 10 in number, distributed in single row ..... ♀ S. vijayaii
4a. POL at least 9 x OOL ..... 5
4b. POL never beyond 7 x OOL ..... 6
5a. Alar setae before ST 23 in number, distributed in at least 4 rows (Fig. 11); ST with 8 setae; ovipositor 4.7 x as long as metasoma ..... ♀ S. benghalensis sp. nov.
5b. Alar setae before stigmal vein 10 in number, arranged in single

- row; ST with 2-3 setae; ovipositor 5.3 x as long as metasoma ..... ♀ S. stabilis
6a. POL never less than 5 x OOL ..... 7
6b. POL never beyond 4 x OOL ..... 9
7a. Ovipositor 4 x as long as metasoma; PM 2 x as long as ST; POL 5 x OOL ..... ♀ S. punctatus
7b. Ovipositor > 4 x as long as metasoma; PM > 2 x as long as ST; POL > 6 x OOL ..... 8
8a. Alar setae before ST 11 in number, distributed in 2 rows (Fig. 3I), ST with 10 setae; ovipositor 4.6 x as long as metasoma; POL 6 x OOL ..... ♀ S. benjaminae sp. nov.
8b. Alar setae before ST 15 in number, distributed in 3 rows; ST with 3 setae; ovipositor 5.6 x as long as metasoma; POL 6.7 x OOL ..... ♀ S. infectorius
9a. POL 4 x OOL ..... 10
9b. POL < 3 x OOL ..... 11
10a. Scape 4.1 x as long as wide; M 1.7 x as long as ST; ovipositor 3.5 x as long as metasoma ..... ♀ S. kathuriensis\*
10b. Scape 3.5 x as long as wide; M 1.5 x as long as ST; ovipositor 2.3 x as long as metasoma ..... ♀ S. nayoshorum\*
11a. Scape 3.75 x as long as wide; ovipositor 3.3 x as long as metasoma; alar setae before ST 20 in number, distributed in 4 rows ..... ♀ S. arnottianus
11b. Scape 5 x as long as wide; ovipositor 6 x as long as metasoma; alar setae before ST 9 in number, distributed in single row ..... ♀ S. triformis
12a. Head longer than wide or at least as long as wide; posterior margin of head either parallel or subparallel (Fig. 2B, 4B) ..... 13
12b. Head distinctly wider than long; posterior margin of head more or less convex ..... 16
13a. Antennal club 2 segmented; antenna 10 segmented; mandible 3.3 x as long as wide; pronotum as long as wide ..... ♂ S. vijayaii
13b. Antennal club 3 segmented; antenna 11 segmented; mandible less than 3 x as long as wide; pronotum wider than long ..... 14
14a. Head as long as wide; eye 2.3 x as long as wide; longest spur on fore tibia not reaching up to tip of 5th tarsomere; malar space as long as eye length ..... ♂ S. benghalensis sp. nov.
14b. Head longer than wide; eye at most 1.5 x as long as wide; longest spur on fore tibia reaching at least up to tip of 5th tarsomere; malar space longer than eye length ..... 15
15a. Scape 4.6 x as long as wide; head 5 x as long as eye length; mandible 1.9 x as long as wide; longest fore tibial spur not exceeding the tip of 5th tarsomere (Fig. 4H) ..... ♂ S. benjaminae sp. nov.
15b. Scape 3.3 x as long as wide; head 5.5 x as long as eye; mandible 2.4 x as long as wide; longest fore tibial spur exceeding the tip of 5th tarsomere ..... ♂ S. infectorius
16a. Forewing remnant either absent or reduced to stub ..... 17
16b. Forewing remnant long, at least as long as meso- and metanoto-propodeum combined ..... 18
17a. Scape 3.5 x as long as wide; head 4.5 x as long as eye; pronotum wider than long; longest fore tibial spur reaching up to 0.5 x length of 5th tarsomere; forewing remnant reduced to stub ..... ♂ S. arnottianus
17b. Scape 2.5 x as long as wide; head 2.5 x as long as eye; pronotum as wide as long; longest fore tibial spur not reaching even base of 5th tarsomere; forewing remnant not visible ..... ♂ S. hirticola
18a. Mandible 1.7 x as long as wide; scape 3.2 x as long as wide; wing remnant 1.4 x as long as meso- and metanoto-propodeum combined; longest fore tibial spur reaching up to tip of 5th tarsomere ..... ♂ S. stabilis
18b. Mandible at least 2.2 x as long as wide; scape 4 x as long as wide; wing remnant 1.9 x meso- and metanoto-propodeum combined; longest fore tibial spur never exceeding 0.5 x length of 5th tarsomere ..... 19
19a. Head 4 x longer than eye; malar space shorter than eye; longest fore tibial spur reaching up to 0.25 x length of 5th tarsomere; eye 2 x as long as wide ..... ♂ S. punctatus
19b. Head about 5 x longer than eye; malar space 1.5 x as long as eye; longest fore tibial spur reaching up to 0.5 x length of 5th tarsomere; eye 1.3 x as long as wide ..... ♂ S. triformis



*Sycosapter benghalensis* Pramanik & Dey, *sp. nov.*

**Figs 1 & 2**

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**Type Material:** **Holotype** ♀: INDIA, New Delhi, IARI, N28°37'56.95" E77°9'41.224", 22 Sep. 2013, ex. *Ficus benghalensis*, Coll. A. Pramanik. **Paratypes:** 3 ♀ card mounted, same data as holotype; 1 ♀ card mounted, same data except, N28°38'29.22" E77°10'9.224", 16 Dec. 2011; 7 ♀, 2 ♂, series ♀, ♂ preserved in 70% ethanol, same data except, N28°38'10.514" E77°9'40.59", 6 Mar. 2012; 5 ♀, 4 ♂ same data except, N28°38'12.109" E77°9'43.175", 24 Mar. 2012; 2 ♀, same data except, W.B, Uluberia, N22°25'19.474" E88°2'35.837", 21 Apr. 2012; 4 ♀, same data except, 21 Apr. 2012; 3 ♀, same data except, N22°23'44.506" E88°2'39.595", 22 Oct. 2012; 9 ♀, same data except, N28°38'28.943" E77°10'9.487", 13 Dec. 2012. All type specimens have been deposited in National Pusa Collection, IARI, New Delhi.

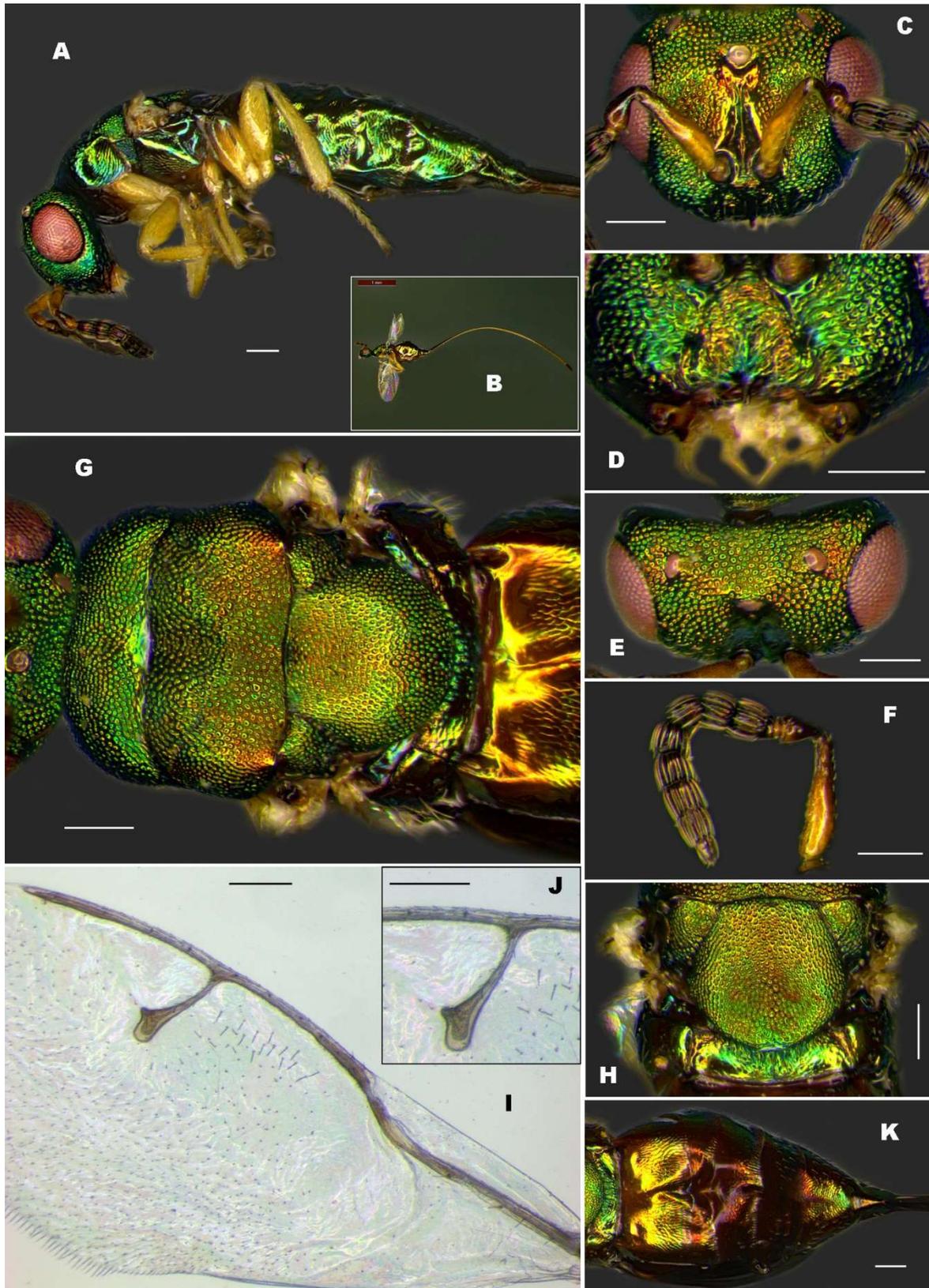
**Diagnosis: Female.** POL 9 × OOL. SM, M, PM and ST veins in a ratio of 76:45:57:26. Stigmal knob at least 0.3 × as long as ST. Alar setae before ST 23 in number, distributed in 4 rows. ST with 8 setae. Ovipositor 4.7 × as long as metasoma.

**Male.** Head as long as wide. Eye 2.3 × as long as wide. Malar space as long as eye. Antennal formula 11153; scape 3.6 × as long as wide. Mandible 2.7 × as long as wide. Forewing remnant 0.9 × as long as mesonotum, metanotum and propodeum combined. Longest spur on fore tibia not reaching up to tip of 5<sup>th</sup> tarsomere.

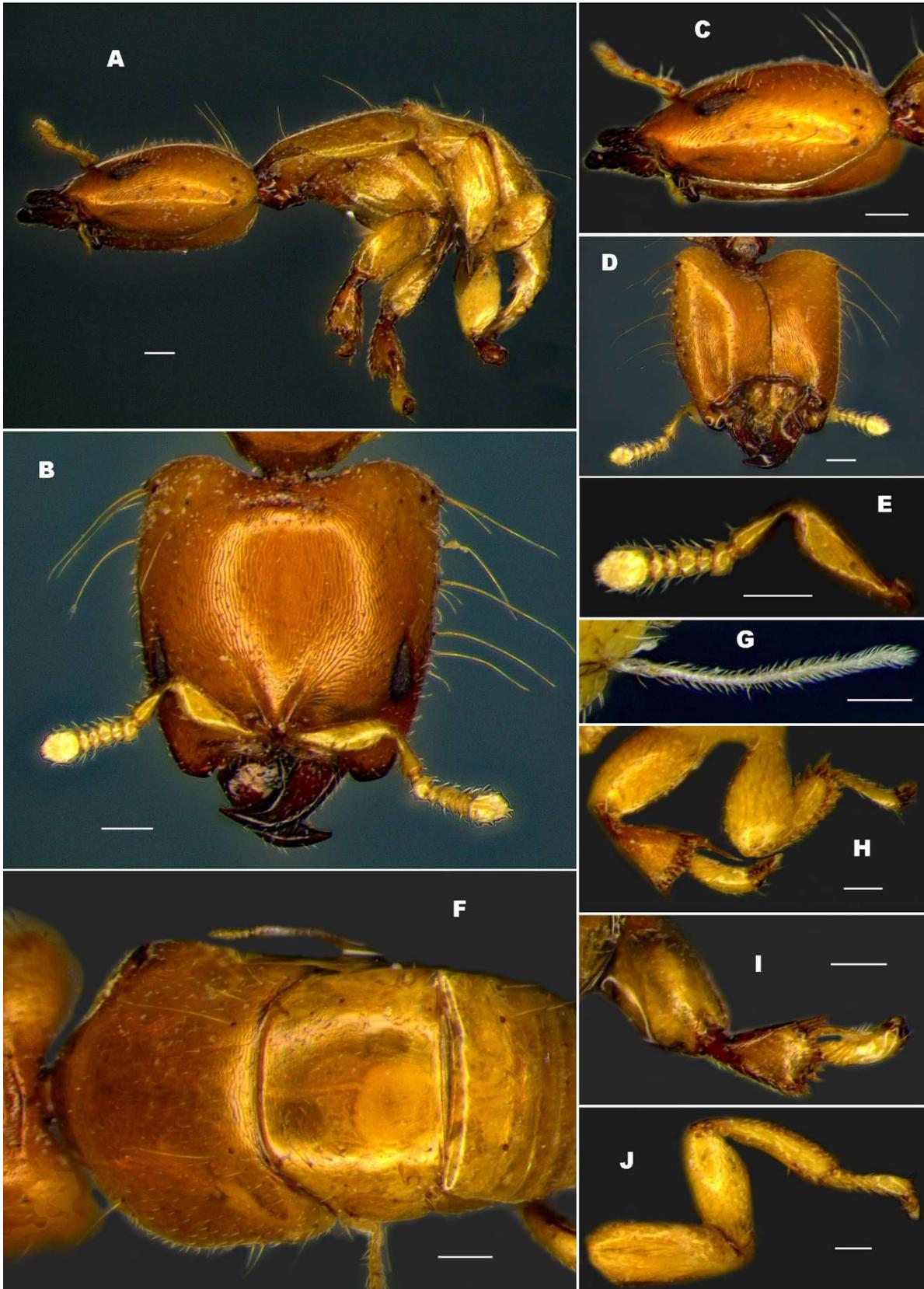
**Description: Female (Fig. 1A-K). Measurements.** Length: Body without tail 1.7 mm, with tail 5.9 mm, head 0.2 mm, mesosoma 0.6 mm, metasoma without tail 0.9 mm. **Colour, sculpture and pilosity.** Body metallic green except antenna testaceous; eyes red, ocelli translucent; wings hyaline, veins darker; legs pale yellow (Fig. 1A). Body weakly sclerotized; mesosoma with fine punctures and reticulations. Metasomal tergites largely bare, very finely carinated. **Head.** Head transverse in dorsal view (Fig. 1D), 2.8 × wider than long; in frontal view (Fig. 1C) 1.3 × wider than high across compound eyes. Mandible bidentate. Lower clypeal margin deeply emarginate with a tooth-like median projection (Fig. 1D). Scrobe very shallow (Fig. 1C). Antenna inserted close together on lower half of face, just below an imaginary line connecting lower margins of compound eyes (Fig. 1C). Distance from upper torular margin to median ocellus 1.4 × distance from torulus to lower clypeal margin; intertorular distance 1 × torular diameter; distance between torulus and inner eye margin 2.4 × intertorular distance. Antennal formula 11253, scape swollen at basal half, 4.5 × as long as wide, 2.7 × as long as pedicel, reaching median ocellus, but not crossing imaginary line connecting upper margin of compound eyes; pedicel 1.7 × as long as its maximum width; funicular segments symmetrical, clearly

separated, subequal in length, terminal segments becoming progressively narrower toward apex, with trichoid sensilla and setae arranged as in figure (Fig. 1F); F1 1.1 × as long as wide and 0.8 × as long as pedicel; clava three segmented 2.2 × as long as wide and 2.9 × longer than preceding funicular segment. Malar space 0.5 × length of compound eye, malar sulcus hardly visible. Compound eye 1.2 × as long as wide. Vertex flattened. Ocelli arranged in an obtuse triangle (Fig. 1E). POL 9 × OOL; POL 4.5 × median ocellus diameter. **Mesosoma.** Pronotum as in figure (Fig. 1G), 0.3 × longer than wide, 0.5 × as long as mesoscutum. Notauli only indicated, incomplete (Fig. 1G). Scapula 1.8 × as wide as long. Axilla 1.3 × as long as wide, 0.6 × as long as scapula. Mesoscutellum rhomboidal, convex, broadly joined to trans-scutellar line (Fig. 1G), 1.2 × wider than long and 1.1 × as long as mesoscutum. Propodeum narrow (Fig. 1H), 8.1 × wider than long and 0.2 × as long as mesoscutellum; propodeal spiracles separated from each other by 1.3 × distance between spiracle and hind margin of propodeum. Forewing with very short but dense pilosity, 2.3 × longer than wide; SM, M, PM and ST veins in a ratio of 76:45:57:26 (Fig. 1I). SM with 8 widely placed setae; submarginal area with 20 setae; M touching anterior wing border, 1.7 × longer than ST, with 1 seta. PM rather long with 4 small setae; ST narrow at base, swollen and 'shoe hill' shaped at apex (Fig. 1J) with 4 sensilla and 5 setae. Hindwing 3.4 × as long as wide. Fore leg: coxa 2.1 × longer than wide; femur 4.2 × longer than wide and 1.5 × as long as coxa; tibia 0.8 × as long as femur, tibial armature with 1 bifid subapical ventral spur and 5 spines between spur and apex; five tarsal segments in a ratio of 6:4:4:4:10. Mid leg: tarsal segments in a ratio of 12:7:5:4:6. Hind leg: coxa 3 × longer than wide; femur 3.6 × longer than wide and 1.1 × as long as coxa; tibia 6.2 × longer than wide and 1.1 × as long as femur, tibia with 2 subapical ventral spurs in a ratio of 7:4, and 4 spines between spur and apex along with 10 odontoid spines on posterior lateral corner; tarsal segments in a ratio of 13:6:5:5:10, basitarsus 0.2 × as long as tibia. **Metasoma.** Eighth and ninth tergite extremely long forming tail-like part protecting ovipositor (Fig. 1B). Length of abdomen without tail 1.7 × as long as broad. Third tergite 0.2 × as long as abdomen without tail. Tail-like part of abdomen 4.7 × as long as remaining abdomen. Hypopygium wide and very short, 0.9 × as long as hind tibia.

**Male (Fig. 2A-J). Measurements.** Length: Body 1.4 mm, head 0.7 mm, mesosoma 0.8 mm, metasoma 0.6 mm. **Colour, sculpture and pilosity.** Body fundamental honey coloured except eyes red, mandible reddish brown (Fig. 2B). Body well sclerotized. Head and mandible sparsely setose with long setae of variable length; head with fine longitudinal carination. **Head.** Head rectangular, as wide as long; posterior lateral margin of head with long setae (Fig. 2B). Mandible dagger shaped,



**Fig.1.** *Sycosapter benghalensis* sp. nov. Holotype ♀. **A.** lateral view (without tail); **B.** lateral view (with tail); **C.** head; **D.** lower clypeal margin; **E.** head, dorsal view; **F.** antenna; **G.** mesosoma, dorsal view; **H.** propodeum; **I.** forewing venation; **J.** stigmal vein (enlarged); **K.** gaster, dorsal view. Scale bar 0.1 mm.



**Fig. 2.** *Sycoscapter benghalensis* sp. nov. Paratype ♂. **A.** lateral view; **B.** head, frontal view; **C.** head, lateral view; **D.** head, ventral view; **E.** antenna; **F.** mesosoma, dorsal view; **G.** forewing remnant; **H.** fore leg; **I.** mid leg; **J.** hind leg. Scale bar 0.1 mm.



strongly built,  $2.7 \times$  longer than basal width, curved inwards, unidentate with very sharp tip (Fig. 2B). Lower clypeal margin with shallow median emargination (Fig. 2B). Antenna inserted close together near lower clypeal margin. Each torulus on inner side slightly overroofed by a fold of interantennal ridge, as if base of antenna was pushed towards median line. Antennal formula 11153, scape distally widened,  $3.6 \times$  as long as wide,  $1.9 \times$  as long as pedicel; pedicel  $2.7 \times$  as long as its maximum width; anellus distinct; funicular segments asymmetrical, clearly separated, wider than long, with sensilla and setae as in figure (Fig. 2E); F1 larger than the second (Fig. 2E),  $0.7 \times$  as long as wide and  $0.3 \times$  as long as pedicel; clava  $2.3 \times$  as long as wide and  $4 \times$  as long as preceding funicular segment. Malar space as long as compound eye. Compound eye  $2.3 \times$  as long as wide. **Mesosoma.** Pronotum  $0.7 \times$  as long as wide. Mesonotum, metanotum and propodeum combined  $1.6 \times$  as wide as long (Fig. 2F). Wings vestigial, forewing remnant  $0.9 \times$  as long as mesonotum, metanotum and propodeum combined, slender with numerous delicate macrochaetae (Fig. 2G). Fore leg (Fig. 2H): coxa  $1.8 \times$  longer than wide; femur  $1.9 \times$  longer than wide and  $0.8 \times$  as long as coxa; tibia  $0.8 \times$  as long as femur, tibial armature with 17 odontoid spines; five tarsal segments in a ratio of 1:2:3:4:20. Mid leg (Fig. 2I): tarsal segments in a ratio of 4:4:4:4:17. Hind leg (Fig. 2J): coxa  $2.6 \times$  longer than wide; femur  $2.3 \times$  longer than wide and  $0.8 \times$  as long as coxa; tibia  $4.4 \times$  longer than wide and  $1.1 \times$  as long as femur, tibia with 60 spines; tarsal segments in a ratio of 5:5:4:3:19, basitarsus  $0.1 \times$  as long as tibia. **Metasoma.** Metasoma weakly sclerotized, dorsoventrally flattened,  $1.2 \times$  longer than broad.

**Host plant.** *Ficus benghalensis*.

**Distribution.** Delhi, West Bengal, India.

**Etymology.** This species is named after its fig host.

***Sycoscapter benjaminiae*** Pramanik & Dey, *sp. nov.*

**Figs 3 & 4**

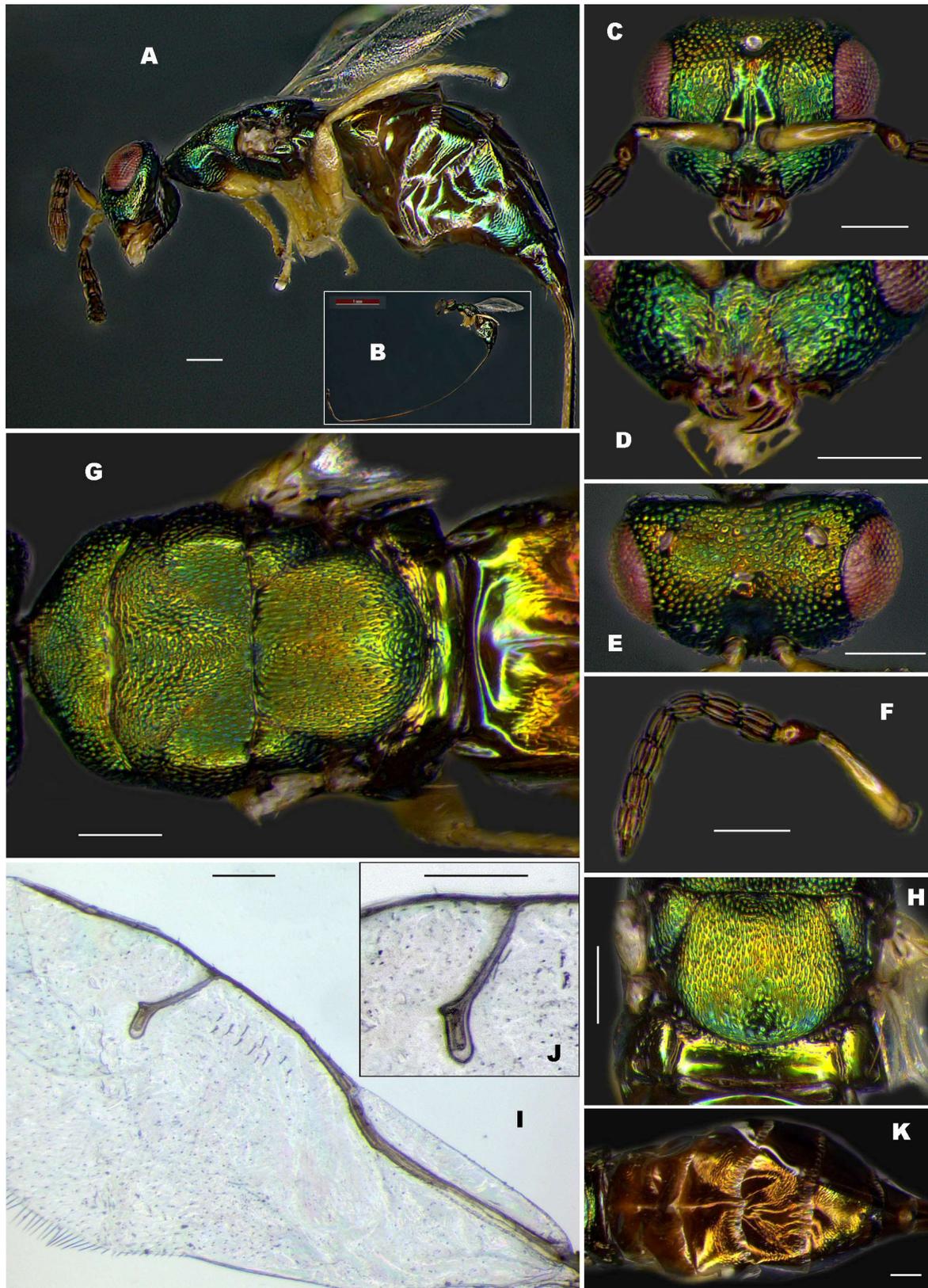
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**Type:** Holotype ♀: INDIA, Arunachal Pradesh, Pasighat, N28°05'37.8" E95°18'01.8", 7 May 2013, ex. *Ficus benjaminia*, Coll. M. M. Kumwat. Paratypes: 7 ♀, 5 ♂ card mounted, same data as holotype. All type specimens have been deposited in National Pusa Collection, IARI, New Delhi.

**Diagnosis. Female.** POL  $6 \times$  OOL. SM, M, PM and ST approximately in a ratio of 63:43:53:25. Stigmal knob  $0.4 \times$  as long as ST. Alar setae before ST 11 in number, distributed in 2 rows. ST with 10 setae. Ovipositor  $4.6 \times$  as long as metasoma. **Male.** Head longer than wide. Compound eye  $1.5 \times$  as long as wide. Malar space  $1.3 \times$  as long as eye. Antennal formula 11153; scape  $4.6 \times$  as long as wide. Mandible  $1.9 \times$  as long as wide. Forewing remnant  $1.7 \times$  as long as mesonotum, metanotum and propodeum combined. Longest fore tibial spur not

exceeding the tip of 5<sup>th</sup> tarsomere.

**Description: Female** (Fig. 3A-K). **Measurements.** Length: Body without tail 1.6 mm, with tail 6.1 mm, head 0.1 mm, mesosoma 0.5 mm, metasoma without tail 1 mm. **Colour, sculpture and pilosity.** Body metallic green except antenna testaceous, eyes red, ocelli translucent, wings hyaline with darker veins; legs light brown (Fig. 3A). Body weakly sclerotized; mesosoma with fine punctures and reticulations. Metasoma tergites largely bare, very finely carinated. **Head.** Head transverse in dorsal view (Fig. 3E),  $3.3 \times$  wider than long; in frontal view (Fig. 3C)  $2 \times$  wider than high across compound eyes. Mandible bidentate. Lower clypeal margin deeply emarginate with tooth-like median projection (Fig. 3D). Scrobe very shallow. Antenna inserted close together on lower half of face, just below an imaginary line connecting lower margins of compound eyes. Distance from upper torular margin to median ocellus  $1.7 \times$  distance from torulus to lower clypeal margin; intertorular distance  $0.5 \times$  torular diameter; distance between torulus and inner eye margin  $4.5 \times$  intertorular distance. Antennal formula 11253, scape swollen at basal half,  $4.5 \times$  as long as wide,  $3 \times$  as long as pedicel, reaching median ocellus and touching imaginary line connecting upper margin of compound eyes; pedicel  $1.5 \times$  as long as its maximum width; funicular segments symmetrical, clearly separated, subequal in length, terminal segments becoming progressively narrower toward apex, with sensilla and setae arranged as in figure (Fig. 3F); F1  $1.3 \times$  as long as wide and  $0.9 \times$  as long as pedicel; clava three segmented  $2.7 \times$  as long as wide and  $2.4 \times$  longer than preceding funicular segment. Malar space  $0.5 \times$  length of compound eye, malar sulcus hardly visible. Compound eye  $1.2 \times$  as long as wide. Vertex flattened. Ocelli arranged in an obtuse triangle (Fig. 3E). POL  $6 \times$  OOL; POL  $6 \times$  median ocellus diameter. **Mesosoma.** Pronotum as in figure (Fig. 3G),  $0.3 \times$  longer than wide,  $0.4 \times$  as long as mesoscutum. Notauli indicated, incomplete (Fig. 3C). Scapula  $2.2 \times$  as wide as long. Axilla  $1.1 \times$  as long as wide,  $0.5 \times$  longer than scapula. Mesoscutellum rhomboidal, convex, broadly joined to trans-scutellar line (Fig. 3G),  $1.1 \times$  wider than long and  $1.2 \times$  as long as mesoscutum. Propodeum narrow (Fig. 3H),  $8 \times$  wider than long and  $0.2 \times$  as long as mesoscutellum; propodeal spiracles separated from each other by  $1.3 \times$  distance between spiracle and hind margin of propodeum. Forewing with very short but dense pilosity,  $2.4 \times$  longer than wide; SM, M, PM and ST approximately in a ratio of 63:43:53:25 (Fig. 3I). SM with 10 widely placed setae; submarginal area with 11 setae; M touching anterior wing border,  $1.7 \times$  longer than ST, with 7 setae. PM rather long with 8 setae; ST as in figure (Fig. 3J) with 4 sensilla and 3 setae. Hindwing  $4.5 \times$  as long as wide. Fore leg: coxa  $2.3 \times$  longer than wide; femur  $3.8 \times$  longer than wide and  $1.4 \times$  as long as coxa;



**Fig. 3.** *Sycosapter benjaminiae* sp. nov. Holotype ♀. **A.** lateral view (without tail); **B.** lateral view (with tail); **C.** head; **D.** lower clypeal margin; **E.** head, dorsal view; **F.** antenna; **G.** mesosoma, dorsal view; **H.** propodeum; **I.** forewing venation; **J.** stigmal vein (enlarged); **K.** gaster, dorsal view. Scale bar 0.1 mm.

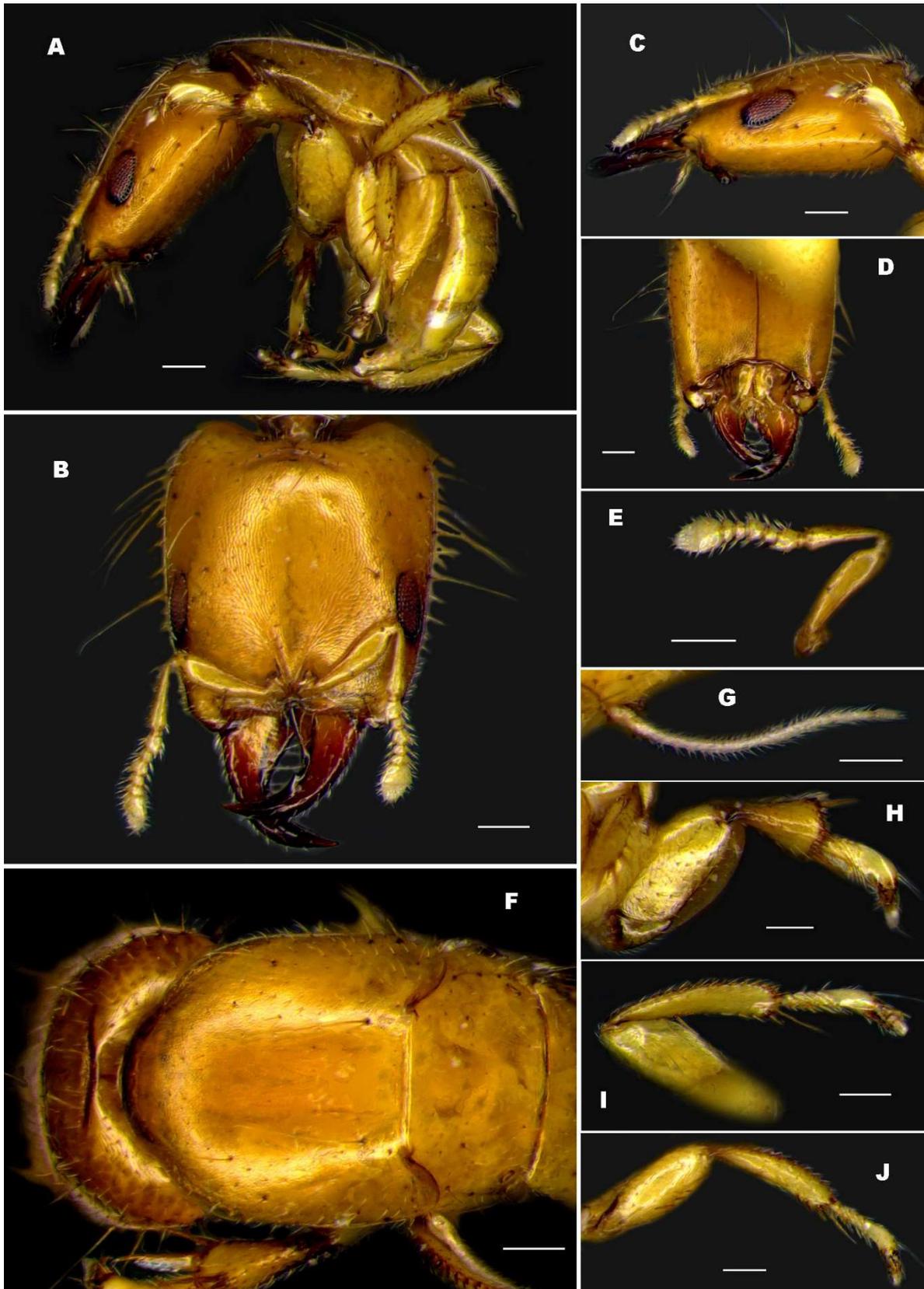


Fig. 4. *Sycoscapter benjaminiae* sp. nov. Paratype ♂. A. lateral view; B. head, frontal view; C. head, lateral view; D. head, ventral view; E. antenna; F. mesosoma, dorsal view; G. forewing remnant; H. fore leg; I. mid leg; J. hind leg. Scale bar 0.1 mm.



tibia  $0.9 \times$  as long as femur, tibial armature with 1 bifid subapical ventral spur and 1 spines between spur and apex; five tarsal segments in a ratio of 5:4:3:2:7. Mid leg: tarsal segments in a ratio of 13:5:4:3:8. Hind leg: coxa  $3.5 \times$  longer than wide; femur  $3.2 \times$  longer than wide and  $0.9 \times$  as long as coxa; tibia  $6 \times$  longer than wide and  $1.3 \times$  as long as femur, tibia with 2 subapical ventral spurs in a ratio of 7:3, and 5 spines between spur and apex along with 6 odontoid spines on posterior margin; tarsal segments in a ratio of 11:6:4:3:6, basitarsus  $0.2 \times$  tibia. **Metasoma.** Eighth and ninth tergite extremely long forming tail-like part protecting ovipositor (Fig. 3B). Length of metasoma without tail  $2 \times$  as long as broad. Third tergite  $0.2 \times$  as long as metasoma without tail. Tail-like part of metasoma  $4.6 \times$  as long as remaining metasoma. Hypopygium wide and very short,  $0.9 \times$  as long as hind tibia.

**Male (Fig. 4A-J). Measurements.** Length: Body 1.2 mm, head 0.6 mm, mesosoma 0.7 mm, metasoma 0.5 mm. **Colour, sculpture and pilosity.** Body fundamentally testaceous except eyes red, mandible reddish brown (Fig. 4A). Body well sclerotized. Head and mandible sparsely setose with long setae of variable length; head with fine longitudinal carination. **Head.** Head rectangular,  $0.9 \times$  wider than long; posterior and lateral margin of head with long setae (Fig. 4B). Mandible dagger-shaped, strongly built,  $1.9 \times$  longer than basal width, curved inwards, unidentate with very sharp tip (Fig. 4B). Lower clypeal margin with shallow median emargination (Fig. 4B). Antenna inserted close together near lower clypeal margin. Each torulus on inner side slightly overroofed by a fold, as if base of antenna was pushed towards median line. Antennal formula 11153, scape distally widened,  $4.6 \times$  as long as wide,  $1.5 \times$  as long as pedicel; pedicel  $4.2 \times$  as long as its maximum width; anellus distinct; funicular segments asymmetrical, clearly separated, wider than long, with sensilla and setae as in figure (Fig. 4E); F1 larger than the second, as long as wide and  $0.2 \times$  as long as pedicel; clava  $1.8 \times$  as long as wide and  $4.7 \times$  as long as preceding funicular segment. Malar space  $1.3 \times$  length of compound eye. Compound eye  $1.5 \times$  as long as wide. **Mesosoma.** Pronotum (Fig. 4F)  $0.9 \times$  longer than wide. Mesonotum, metanotum and propodeum combined  $1.5 \times$  as wide as long (Fig. 4F). Wings vestigial, forewing remnant  $1.7 \times$  as long as mesonotum, metanotum and propodeum combined, slender with numerous fine macrochaetae (Fig. 4G). Fore leg (Fig. 4H): coxa  $1.7 \times$  longer than wide; femur  $2.2 \times$  longer than wide and  $0.8 \times$  as long as coxa; tibia  $0.7 \times$  as long as femur, tibial armature with 17 spines; five tarsal segments in a ratio of 4:2:2:3:18. Mid leg (Fig. 4I): tarsal segments in a ratio of 3:3:3:3:16. Hind leg (Fig. 4J): coxa  $2.4 \times$  longer than wide; femur  $2.6 \times$  longer than wide and  $0.9 \times$  as long as coxa; tibia  $4.3 \times$  longer than wide and as long as femur, tibia with 29 spines; tarsal segments in a ratio of

5:4:4:4:17, basitarsus  $0.1 \times$  tibia. **Metasoma.** Metasoma weakly sclerotized, dorsoventrally flattened (Fig. 4A),  $1.3 \times$  longer than broad.

**Host plant.** *Ficus benjamina*.

**Distribution.** Arunachal Pradesh, India.

**Etymology.** This species is named after its fig host.

## DISCUSSION

At subfamily level Sycoryctini males are quite similar to wingless males of *Philotrypesis* Förster. However, males of Sycoryctini can be differentiated out from wingless Philotrypesini males on the basis of hypopygial margin not distinctly emarginate in middle (*vs* hypopygial margin distinctly emarginate in middle), each torulus on its inner side slightly overroofed by a fold, as if the base of antenna pushed towards the median line (*vs* inner torular margin separated in the middle by a low keel) and 2<sup>nd</sup> flagellar segment longer than third (*vs* flagellar segments regular). Within tribe Sycoryctini differentiating the females and males at genus level is quite challenging. However, both sexes of six genera can be separated following the key provided in the supplementary material (S1). From the generic key it is evident that both sexes of *Sycoscapter* Saunders are more similar to *Arachonia* Joseph than other genera of the tribe and careful observation of only few selected characters determine generic placement.

The level of complexity involved in the process of reliable identification at species level is evident from the species level identification keys for genus *Sycoscapter*. Perusal of the key reveals that species separation is based upon a few set of characters *viz.*, POL: OOL, number and arrangement of alar setae, marginal vein length: stigmal vein length and ovipositor length: metasoma length. Nevertheless, all the 11 Indian species including the new ones described in the present study can be separated based on the proposed key.

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## Supplementary

### Key to genera of tribe *Sycoryctini*

(After Priyadarsanan, 2000; couplet 5 and 6 modified, couplet 9 added)

- 1a. Female ..... 2
- 1b. Male ..... 7
- 2a. Body yellow; fore femur swollen; antenna with only single anellus ..... ♀ *Adiyodiella*
- 2b. Body dark coloured with metallic tinge; fore femur not swollen; antenna with 1-3 anelli (*Sycoscapter* generic group) ..... 3
- 3a. Stigmal knob unusually produced downwards; forewing with some long robust hairs below the marginal vein, but otherwise pilosity reduced ..... 4
- 3b. Stigmal knob small, not produced downward; forewing without long robust hairs below the marginal vein; wing pilosity moderately dense ..... 5

- 4a. Proximal funicular segments asymmetric, distinctly dilated on ventral side ..... ♀ *Arachonia*
- 4b. Proximal funicular segments symmetric, not dilated on ventral side ..... ♀ *Sycoscapter*
- 5a. Ovipositor never more than 4 × as long as gaster; eye never more than 2 × as long as malar space ..... ♀ *Sycoscapteridea*
- 5b. Ovipositor usually more than 5 × as long as gaster, even up to 9 × gaster (with only exception of *Sycoryctes religiosae*, where ovipositor slightly over 3 × gaster); eye usually at least 2.5 × as long as malar space ..... 6
- 6a. Compound eye only 2.5 × as long as malar space; PM longer than 2 × as long as ST ..... ♀ *Sycorycteridea*
- 6b. Compound eye usually more than 3 × as long as malar space, if not so then PM not longer than 2 × ST ..... ♀ *Sycoryctes*
- 7a. Antennae placed wide apart, more towards the middle of the head ..... ♂ *Adiyodiella*
- 7b. Antenna placed in a common depression anterior the ocular line; toruli separated only by a narrow inter-antennal ridge ..... 8
- 8a. Hind basitarsus small ..... 9
- 8b. Hind basitarsus (sometimes 2 basal segments) enlarged, compressed and bears long setae on their dorsal side ..... 10
- 9a. Antenna without anellus; mesonotum completely separated from metanoto-propodeum; hind tibia often with very long setae ..... ♂ *Arachonia*
- 9b. Antenna with anellus; mesonotum fused to metanoto-propodeum; hind tibia never with very long setae ..... ♂ *Sycoscapter*
- 10a. Thorax with 2 apparent terga *viz.* pronotum and metanoto-propodeum ..... ♂ *Sycoryctes*
- 10b. Thorax with more than 2 apparent terga ..... 11
- 11a. Thorax with 3 separate dorsal segments ..... ♂ *Sycorycteridea*
- 11b. Usually two smaller thoracic terga visible in between pronotum and propodeum ..... ♂ *Sycoscapteridea*