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TWO NEW SPECIES OF *MEGASTIGMUS* DALMAN (HYMENOPTERA : TORYMIDAE) FROM INDIA, WITH A REVISED KEY TO INDIAN SPECIES

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INTRODUCTION

The genus *Megastigmus* was described by Dalman in 1820 with *Pteromalus bipunctatus* Swederus as its type species. This genus belongs to the subfamily Megastigminae of the family Torymidae. This genus consists of 133 species worldwide of which 20 species were reported from the Oriental Region and 8 species from India (Noyes, 2003; Sureshan, 2009). Most species are phytophagous but some are parasitic in gall-forming insects (Narendran, 1994; Noyes, 2003). In this paper, two new species viz., *Megastigmus sonneratae* Narendran and Girish Kumar sp. nov. emerged from the leaf galls of the mangrove plant *Sonneratia apetala* Buch. Ham and *Megastigmus dharwadicus* Narendran and Vastrad sp. nov. emerged from the galls of *Eucalyptus*, are described. The new species *M. dharwadicus* is an important parasitoid of *Leptocybe invasa* Fisher and LaSalle which is a serious invasive pest (Narendran, 2007; Mendel *et al.*, 2004) of *Eucalyptus* in India and adjacent countries. A revised key to separate Indian species of *Megastigmus* is also provided.

The type specimens are deposited at the 'National Zoological Collections' of the Zoological Survey of India, Kolkata (NZSI).

MATERIALS AND METHODS

The leaf galls of the plant *Sonneratia apetala* and *Eucalyptus* were collected and reared in the laboratory from which the parasites emerged out. The specimens

were card mounted and studied under a stereozoom microscope (Wild Heerbrugg made in Switzerland) and drawings were made using the drawing tube of the microscope.

The following abbreviations are used in the text: F1-F2 = Funicular segments 1 and 2; MV = Marginal vein; NZSI = 'National Zoological Collections' of the Zoological Survey of India, Kolkata; OOL = Ocellular distance; PMV = Postmarginal vein; POL = Postocellar distance; SMV = Submarginal vein; STV = Stigmal vein; T1- T2 = Gastral tergites 1 and 2.

RESULTS

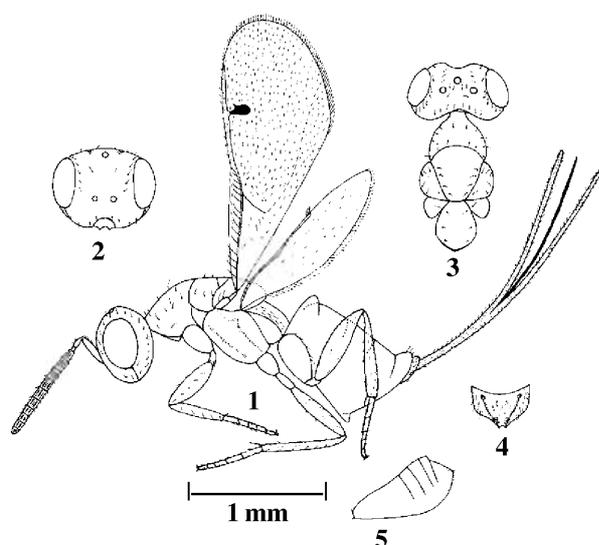
1. *Megastigmus sonneratae* Narendran and Girish Kumar sp. nov. (Figs. 1- 5)

Female : Holotype : Length 2.51 mm (excluding exerted ovipositor, 2.06 mm). General body colour yellow with gaster a little darker; antenna yellowish brown with scape and pedicel brownish yellow; eye brownish red; ocelli reflecting yellow; tegula concolorous with thorax; wings hyaline, veins pale brown; ovipositor sheath black. Pubescence in general pale brownish yellow with stouter setae on head, thorax and legs darker.

Head : Width in dorsal view (Fig. 3) 2.44x length, 1.76x as long as pronotal width; head width in anterior view (Fig. 2) 1.26x its median length; vertex convex, cross striate, with bristles black; POL 2.5x OOL; occiput moderately emarginate; vertex with six large brown setae

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Figs. 1-5 : *Megastigmus sonneratae* Narendran and Girish Kumar sp. nov.

Female : Fig. 1. Body profile. Fig. 2. Head front view. Fig. 3. Pronotum, mesoscutum and scutellum. Fig. 4. Propodeum.

Male : Fig. 5. Gaster.

on occipital margin submedially; an oblique line of strong setae on each parascrobal space (Fig. 2); clypeus demarcated with lower margin incised. Antenna inserted a little above level of ventral margin of eye; antennal formula 11173; scape not reaching front ocellus, pedicel as long as F1; ring segment shorter than half of pedicel; F1 shorter than F2; length of clava longer than preceding two segments.

Thorax : Pronotum 1.66x as broad as long, very finely transversely striated; mesoscutum with anterior one third smooth and shiny, remaining part striate reticulate, striae stronger than those of pronotum; scapulae transversely striated; mesoscutum with 5 pairs of setae, each scapulae with 7 setae on outer margin (arranged in two rows; 3 pairs outer; 4 pairs towards middle), 2 setae near inner margin. Scutellum as long as broad, transversely reticulate, with a median shallow sulcus extending upto middle; scutellum with 3 pairs of setae (one pair at the frenal area); frenal furrow indistinct, frenum longitudinally rugose. Dorsellum smooth. Propodeum (Fig. 4) 0.55x length of scutellum, with submedian grooves and few median shallow short grooves; surface of propodeum transversely and irregularly reticulate. Forewing (Fig. 1) length 2.54x its maximum width; costal cell narrow with pubescence in distal half, proximal half bare; basal cell with some

pubescence (about 8 setae in number), open basally; speculum very narrow, almost absent, closed below; MV a little shorter than half length of costal cell, subequal to PMV; 2.3x as long as STV; STV 1.64x as long as broad. Legs with minute pubescence with the following parts having thick setae: fore femur, fore tibia, mid tibia, hind coxa and hind tibia.

Gaster : As long as thorax; first tergite deeply emarginate on posterior margin; ovipositor sheath as long as combined length of thorax and gaster, 2x as long as thorax, 2x as long as gaster.

Male : Length 1.74-2.04 mm. Resembles female but differs in having: slightly dull in colour, propodeum and gaster darker; median sulcus of scutellum very shallow; clava flattened; gaster as in figure 5.

Host : Emerged from the leaf galls of *Sonneratia apetala* Buch. Ham (Family : Lithraceae), a mangrove plant commonly known as 'Mangrove Apple', which is one of the most common plants in Sunderbans mangrove forests.

Biology : Unknown.

Distribution : India : West Bengal; Sunderbans Biosphere Reserve.

Etymology : The species name is derived from the generic name of the host plant, *Sonneratia*.

Material examined : Holotype. Female, India : West Bengal, S- 24 Parganas dist., Sunderbans Biosphere Reserve, Netidhopani, 31.iii.2008, Coll. Girish Kumar, P. (NZSI Reg. No. 11813/H3). Paratypes. 1 Female and 2 Males, same collection data of the holotype. (NZSI Reg. Nos. 11814/H3 to 11816/H3).

Discussion : This new species comes close to *Megastigmus karnatakensis* Narendran, 2002 but distinctly differs from it in having: (1). Scapulae with 2 setae near inner margin (in *M. karnatakensis* scapulae with 3 or 4 setae near inner margin); (2). Ovipositor sheath 2x as long as thorax (in *M. karnatakensis* ovipositor sheath 2.7x as long as thorax); (3). Basal cell of forewing with some pubescence (about 8 setae in number) (in *M. karnatakensis* basal cell bare); (4). Speculum of forewing absent, setose (in *M. karnatakensis* speculum present); (5). Forewing length 2.54x its maximum width (in *M. karnatakensis* forewing length 3.17x its maximum width); (6). Gaster as long as thorax (in *M. karnatakensis* gaster distinctly longer (1.22x) than thorax).

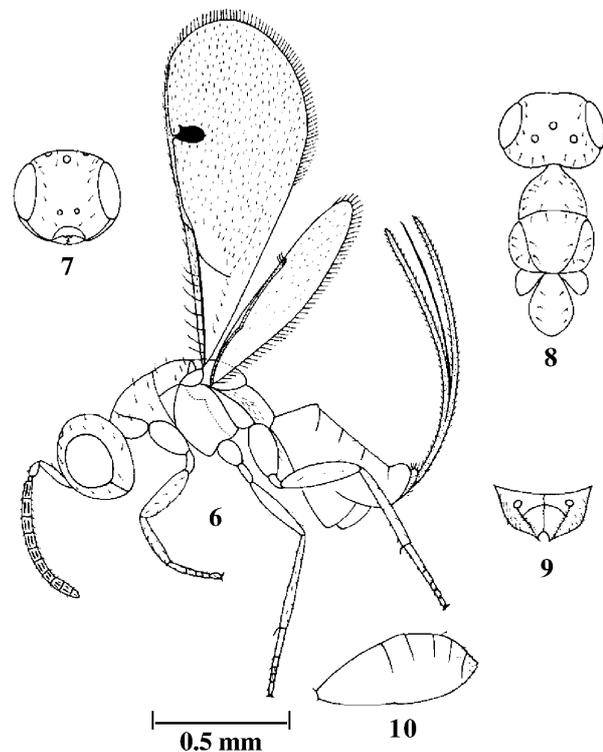
This new species also comes close to *Megastigmus viggianii* Narendran and Sureshan, 1988 but distinctly differs from it in having: (1). Frenum longitudinally rugose (in *M. viggianii* frenum nearly smooth); (2). Lower clypeal margin incised in the middle (in *M. viggianii* lower clypeal margin not distinctly bilobed or incised in the middle); (3). F1 shorter than F2 (in *M. viggianii* F1 longer than F2); (4). POL 2.5x OOL (in *M. viggianii* POL nearly twice OOL).

2. *Megastigmus dharwadicus* Narendran and Vastrad sp. nov. (Figs. 6-10)

Female : Holotype : Length 1.67 mm (excluding exerted ovipositor, 1.15 mm). General body colour yellowish brown with small brownish black patches scattered on head and thorax; gaster mostly black with pale yellow on sides of T1 and T2, tegula concolorous with thorax; ovipositor sheath brownish black. Antenna brown with scape and pedicel yellowish beneath. Eye pale reddish brown; ocelli reflecting yellow. Wings hyaline with veins and pubescence brown, stigma dark brown, uncus transparent. Legs concolorous with the body.

Head : In dorsal view, head (Fig. 8) width 1.44x length, about 1.62x as long as pronotal width, moderately long and sparse bristles on vertex and face; vertex, frons and face below antenna finely striate reticulate; occipital carina distinct; POL 2.5x OOL. In front view, head (Fig. 7) 1.19x as broad as high; gena smooth and shiny; malar space 0.32x as long as eye; malar groove distinct; eye moderately protruded, length 1.16x width; scrobe deep and shiny, not reaching front ocellus. Antenna inserted above level of ventral margin of eye; antennal formula 11173; scape not reaching front ocellus, pedicellus plus flagellum 3.8x as long as scape, F1 shorter than pedicel and ring segment combined; ring segment distinctly shorter than half of pedicel; anellus elongated, terminal funicular segments a little shorter, others are of equal length, with a single row of long sensillae, clava 2.6x as long as preceding segment, 3x or a little more than 3x as long as wide.

Thorax : With rather weak cross striations except on pronotal collar and midlobe of mesoscutum a little coarser, with brown bristles. Pronotal collar 1.5x as broad as its median length and distinctly shorter than midlobe of mesoscutum. Mesoscutum 1.13x as broad as long,



Figs. 6-10 : *Megastigmus dharwadicus* Narendran and Vastrad sp. nov.

Female : Fig. 6. Body profile. Fig. 7. Head front view. Fig. 8. Pronotum, mesoscutum and scutellum. Fig. 9. Propodeum.

Male : Fig. 10. Gaster.

notauli complete. Scutellum as long as mesoscutum medially, 1.25x as long as broad, frenal furrow vaguely indicated. Dorsellum smooth. Propodeum (Fig. 9) medially 0.6x as long as scutellum; median area irregularly and finely reticulate; median carina present; cross carina present as in figure 9; callus with dense white hairs, base of each hair with reddish brown spot; spiracle oval, separated by its own diameter from hind margin of metanotum; postspiracular sulcus distinct. Prepectus broad, triangular, finely reticulate. Mesopleuron and metapleuron finely striate reticulate. Forewing (Fig. 6) 2.41x as long as broad; basal vein distinct, running obliquely to SMV, almost half as long as MV; MV 0.54x as long as costal cell; basal cell partly closed; cubital hair line complete; costal cell hairy in distal area; speculum present, closed below; stigma conspicuous with uncus distinct, stigmal lobe oval shaped, stigma 1.9x as long as broad (excluding uncus). Relative lengths of veins: SMV 17.5, MV 9.5, STV 3.8, PMV 8.5. SMV 1.92x as long as MV; STV 0.44x as long

- F1 shorter than (or at the most equal to) combined length of pedicel and ring segment 4
 - 3. Length of ovipositor 1.25x combined length of thorax and gaster; body yellow. Philippines (extralimital) .
..... *M. immaculatus* Ashmead*
 - Length of ovipositor 1.09x combined length of thorax and gaster; body yellow with dark tinge or patches on some parts of thorax and gaster. Host: fruits of *Dalbergia sericea*. Indonesia : Java (extralimital) ..
..... *M. leeuweni* Ferriere*
 - 4. Thorax dorsally metallic green; F1 equal to pedicel and ring segment combined. Host: parasitic on Cynipidae on *Quercus*. Europe; India: Uttar Pradesh
..... *M. dorsalis* (Fabricius)
 - Thorax dorsally yellowish brown; F1 shorter than pedicel and ring segment combined 5
 - 5. Ovipositor one fifth of metasoma; scutellum with a median groove; F1 equal to pedicel; general colour orange with base of propodeum black medially and with four black cross stripes on gaster; in habits on twigs of swellings on wild lemon Australia; India...
..... *M. brevivalvus* (Girault)*
 - Characters not as above, partly or completely different 6
 - 6. Ring segment of antenna about half as long as pedicel; forewing with stigmal lobe narrow and elongate, basal vein weakly distinct. Host: seeds of *Cupressus torulosa*. India: Himachal Pradesh, Punjab
..... *M. cupressi* Mathur*
 - Ring segment distinctly shorter than half of pedicel; forewing with stigmal lobe not as above, mostly oval or semicircular; basal vein clearly distinct ... 7
 - 7. Ovipositor 2x or more than 2x as long as gaster 8
 - Ovipositor less than 2x as long as gaster 10
 - 8. Frenum nearly smooth; lower clypeal margin not distinctly bilobed or incised in the middle; F1 longer than F2; POL nearly twice OOL. Host: bud galls of *Calycopterys floribunda*. India: Kerala.....
..... *M. viggianii* Narendran and Sureshan
 - Frenum longitudinally rugose; lower clypeal margin incised in the middle; F1 as long as or shorter than F2; POL 2.3- 2.5x OOL 9
 - 9. Scapulae with 2 setae near inner margin; ovipositor sheath 2x as long as thorax; basal cell of forewing with some pubescence (about 8 setae in number); speculum of forewing absent, setose; forewing length 2.54x its maximum width; gaster as long as thorax. Host: leaf galls of *Sonneratia apetala*. India: West Bengal *M. sonneratiae* Narendran and Girish Kumar sp. nov.
 - Scapulae with 3 or 4 setae near inner margin; ovipositor sheath 2.7x as long as thorax; basal cell bare; speculum present; forewing length 3.17x its maximum width; gaster distinctly longer (1.22x) than thorax. Hosts: Psychid (*Pteroma* sp.) from *Rhizopora mucronata* and parasitic on borers of *Sonneratia* seeds. India: Karnataka
..... *M. karnatakensis* Narendran
 - 10. POL as long as OOL; SMV about 7x as long as MV; STV about as long as MV; antennal club about 1.7x as long as preceding segment; scape 3.75x as long as pedicel. Host: pods of *Albizzia*. India: Delhi, Tamil Nadu *M. albizziae* Mukerji
 - POL 2.3- 2.5x OOL; SMV 1.92- 2.33x as long as MV; STV 0.44-0.52x as long as MV; club 2.3- 2.6x as long as preceding segment; scape 2.17- 2.6x as long as pedicel 11
 - 11. Propodeum (Fig. 9) with cross carina; scape not reaching front ocellus; propodeal spiracle separated by its own diameter from hind margin of metanotum; malar space 0.32x as long as eye; mesoscutum 1.13x as long as broad; forewing with cubital hairline complete, speculum present; ovipositor sheath 1.78x as long as gaster, 3.23x as long as hind tibia. Host: tender leaf and stem galls of *Eucalyptus*. India: Karnataka *M. dharwadicus* Narendran and Vastrad sp. nov.
 - Propodeum without such a cross carina; scape exceeds level of vertex; spiracle separated by 1.5x its own diameter from hind margin of metanotum; malar space half as long as eye; mesoscutum 1.5x as long as broad; cubital hairline incomplete, speculum very narrow, almost absent; ovipositor sheath 1.5x as long as gaster, 2.3x as long as hind tibia. Host: Associated with wild rose *Rosa webbiana*. India: Jammu & Kashmir
..... *M. kashmiricus* Sureshan
- * Names with an asterisks indicate no material of the species was examined and the differential features

provided are from the previous descriptions and publications.

SUMMARY

Two new species of *Megastigmus* Dalman viz., *M. sonneratae* Narendran and Girish Kumar sp. nov. and *M. dharwadicus* Narendran and Vastrad sp. nov. are described from India and their affinities to the closest relatives are discussed. A revised key to the Indian species of *Megastigmus* is also provided.

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eucalypti Girault in spite of the poor condition of these types. He also thanks Dr. Zerova M.D. and Dr. Victor Fursov of Shmalhausen Institute of Zoology, Ukraine for supplying and translating the key to *Megastigmus* of Palaearctic Region. Second author (P. G. K.) is grateful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata, Dr. T. K. Pal, Additional Director & Officer-in-Charge of Entomology Division (A), Zoological Survey of India, Kolkata and Dr. S. I. Kazmi, Officer-in-Charge of Hymenoptera Section, Zoological Survey of India, Kolkata for giving an opportunity to participate in the Sunderbans expedition and providing necessary facilities and encouragements. Third author (A. S. V.) is grateful to the authorities of the University of Agricultural Sciences, Dharwad, Karnataka, for providing necessary research facilities.

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