PARASITOIDS (HYMENOPTERA: CHALCIDOIDEA; CERAPHRONOIDEA) REARED MAINLY FROM COCCOIDEA (HOMOPTERA) ATTACKING SANDALWOOD, SANTALUM ALBUM L.

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ABSTRACT. The hymenopteran parasitoids of pests associated with sandalwood in southern Indian State of Karnataka are dealt with. One new encyrtid genus (Neperpolia) and ten new species are described: 6 species in Encyrtidae (Anicetus inglisiae Hayat, Metaphycus bolangerae Hayat, Microterys agaeus Hayat, Neperpolia bangalorensis Hayat, Ooencyrtus kerriae Hayat, Philosindra inglisiae Hayat), one species in Signiphoridae (Signiphora woolleyi Hayat), and 3 species in Eulophidae (Aprostocetus bangaloricus Narendran, A. santalimus Narendran, Euplectrus nuperus Narendran). The following species are recorded: Aphelinidae: Coccophagus bivittatus, C. ceroplastae; C. cowperi; Encarsia citrina; Marietta leopordina; Encyrtidae: Bothriopryne pulvinariae; Cheiloneurus basiri; Encyrtus auranti; Thomsonisca pakistanensis; Pteromalidae: Cephaleta nirupama; Scutellista caerulea.

Key words: Taxonomy, sandalwood pests and parasitoids, new species of Encyrtidae, Signiphoridae and Eulophidae, India, Oriental Region.

Introduction

Sandal, Santalum album Linn. (Family Santalaceae), is a semi root parasite occurring in mixed forests and moderate rainfall areas at elevations up to 1050m. It is valued for the scented heartwood and the essential oil derived from it. The wood being amenable to carving, is used in making handicrafts and idols, while the fragrant oil is utilized in perfumery materials.

In India, sandal is distributed mainly in Karnataka and Tamil Nadu (accounting for 90% of total area) and the rest distributed in other States. The sandal population is gradually diminishing due to various biotic and abiotic factors.

All stages of development of sandal are affected by insect pests which impede the growth of the tree. More than 150 species of insects representing important orders associated with different parts have been recorded. Only a few of these are serious pests and of economic importance. In addition, the tree is attacked by Mycoplasma like organism causing the deadly 'spike disease' of sandal. Among the different insect pests including defoliators, stem borers and termites, the role of sap sucking insects belonging to the Coccoidea is very crucial since it causes dieback and lessening of fruit setting and even leads to mortality. The main coccoid pests are Saissertia spp., Inglisia bivalvata, Ceroplastes actiniformis and Kerria lacca (Remadevi et al., 1998). Earlier, Remadevi & Mutukrishnan (1998) dealt with biology and control of I. bivalvata, and recorded the follow-
ing parasitoids: Anagyrus mirzai Agarwal & Alam, Aprostocetus sp., Coccobius sp., Marietta sp. and Philosindia sp. Of these the record of A. mirzai from this host is undoubtedly based on misidentification of the host as it is a parasitoid of mealybugs.

Identification of the Aphelinidae, Encyrtidae and Signiphoridae was done by M. Hayat and that of Eulophidae, Pteromalidae and Ceraphronidae by T.C. Narendran.

The following abbreviations are used in the text:

DZCU – Department of Zoology, Calicut University, Calicut.
IWST – Institute of Wood Science and Technology, Bangalore.
ZDAMU – Department of Zoology, Aligarh Muslim University, Aligarh.
AOL – Minimum distance from a posterior ocellus to anterior ocellus.
OCL – Minimum distance from a posterior ocellus to occipital margin.
OOL – Minimum distance from a posterior ocellus to eye margin.
POL – Minimum distance between the posterior ocelli.
F1, 2, etc. – Funicle segments 1, 2, etc.

Family APHELINIDAE

The recent revision of the Indian Aphelinidae by Hayat (1998) may be consulted for detailed descriptions, hosts and distribution of the aphelinid species recorded here on coccoid pests of sandalwood. All the specimens are returned to IWST, Bangalore.

1. Coccophagus cowperi Girault


This is a very widely distributed species, recorded from the Afrotropical and Palearctic regions, and from several States in India. The host insect and the host plant are new for this species from India.

2. Coccophagus cerooplastae (Howard)


This is a cosmopolitan species, and known from several Indian States on a variety of coccid species, including C. actiniformis.

3. Coccophagus bivittatus Compere


This species is known from South Africa, Israel, Argentina and India (Haryana, Rajasthan, Tamil Nadu, Uttar Pradesh). This is a new record of this species on the host insect and the host plant from Karnataka.

4. Encarsia citrina (Craw)

Specimens examined: INDIA: Karnataka: Bangalore, 6 ♀, 5.xii.2000, ex indet. ‘coccids’ [probably diaspidids] on sandalwood.
This is a well-known, cosmopolitan species parasitizing various diaspidids.

5. *Marietta leopardina* Motschulsky


This is a very widely distributed, nearly cosmopolitan hyperparasitoid recorded from several coccoid and other homopterous hosts which are its secondary hosts. The secondary host, *Inglisia bivalvata*, is a new record for this species from India.

6. *Aphytis* sp.

*Specimens examined*: INDIA: Karnataka: Gottipura near Bangalore, 5 ♀, 2 ♂ (1♀, 1♂, on a slide), 3.iii.2001, ex *Aspidiotus* sp. on sandalwood.

Family ENCYRTIDAE

1. *Anictus inglisiae* Hayat, sp. nov. (Figs 12 - 14)

*Female*: Length, holotype, 1.55mm. Head pale orange yellow; malar space yellow; scrobes and inter-toral area orange yellow; thorax yellow-orange-brown; dorsum slightly shiny violet bronze; metanotum and propodeum same, the latter becoming reddish-brown mesally; gaster about the same as thoracic dorsum, but sides especially of TI, brownish and metallic violet-bronzy. Tips of mandibles dark. Antenna pale orange-brown, ventral margin of scape and last segment of clava brownish; concave dorsal margins of scape and pedicel dark brown, with violet-bronzy shine. Fore wing infuscation as in Fig. 13; hind wing hyaline. Legs, including coxae, brown yellow, concolorous with mesopleuron, rather indistinctly pale brownish on femora and tibiae.

Head with a distinct transverse frontal carina (a characteristic of the genus); frontovertex with regular, polygonal, raised reticulate sculpture, the cells small and with pale long setae; area below frontal carina with fine, squamous reticulate sculpture; malar space with longitudinally elongate reticulate sculpture; eyes sparsely setose, setae transparent and each about as long as a facet; ocellar triangle with apical angle acute; posterior ocellus very close to eye margin, and about half its diameter to occipital margin; anterior ocellus slightly more than its diameter to eye margins. Mandible with two teeth and a truncation. Antenna as in Fig. 12; note the distinctly concave dorsal edges of scape and pedicel; pedicel with upper edge strongly produced forwards so as to cover more than basal two funicle segments, and its ventral part thin with apex almost pointed; only F1 slightly shorter than other segments which are subequal in length; longitudinal sensilla begin from F4. Relative measurements (holotype): head dorsal width, 54; frontovertex width, 8; head dorsal length, 28; head frontal length, 32; eye length, 25; malar space length, 19; POL, 5.5; AOL, 6.75.

Thorax very slightly convex; collar of pronotum with a line of dark brown setae; mesoscutum with fine, very shallow, largely transversely elongate reticulate sculpture, and with numerous dark brown setae; scutellum with irregular polygonal reticulations, slightly deeper than on mesoscutum, and with about 40 dark brown setae; propodeum (medially overlapped by apex of scutellum) on each side with some elongate lineolations, and with several, long, silvery white setae distal of each spiracle. Fore wing venation and setation as in Fig. 14. Relative measurements (holotype): thorax length, 56; mesoscutum
length (width), 22 (47); scutellum length (width), 28 (30). (From slide, paratype): fore wing length (width), 178 (79); marginal fringe length, 6; hind wing length (width), 140 (47); marginal fringe length, 7.5.

Gaster shorter than thorax (40:56); ovipositor exserted part nearly one-sixth of gaster length (7:40). Relative measurements (from slide, paratype): ovipositor length, 73; third valvula length, 24 [mid tibia length, 73; mid basitarsus length, 23; mid tibial spur length, 22; distance between propodeal spiracles, 72].

**Male:** Unknown.

**Holotype:** ♀, paratypes: 4 ♀ (2 ♀ paratypes on slides, EH.1053, EH.1054), INDIA: Karnataka: Bangalore, 5.vi.2000, ex *Inglisia bivalvata* on sandalwood. Holotype and one paratype (slide No. EH.1054) in Hayat collection (ZDAMU); 3 paratypes in IWST, Bangalore.

**Host:** *Inglisia bivalvata* (Homoptera: Coccidae) on sandalwood.

**Distribution:** India: Karnataka.

**Comments:** This new species comes closest to *aquilus* (Annecke, 1967), but differs by the following characters: pedicel with upper edge strongly produced forwards to cover more than basal two funicle segments, and its ventral part very thin with a pointed apex; only F1 somewhat shorter than F2, and longitudinal sensilla begin from F4; ovipositor equal in length to mid tibia and 3x as long as third valvula. [In *aquilus*: pedicel with upper edge covering basal two funicle segments and its ventral part thicker with apex broadly convex; F1 and F2 reduced in length compared to F3, and with longitudinal sensilla begin from F3; ovipositor clearly longer than mid tibia (170:106), and 3.7x as long as third valvula.]

**Etymology:** The specific name is derived from the generic name of the host insect.

2. **Bothriophyrene pulvinariae** Agarwal, Agarwal & Khan

**Specimens examined:** INDIA: Karnataka: Bangalore, 7 ♀, 5 ♂, (1 ♀, 1 ♂, on slides), 11.x.2000, ex *Ceroplastes actiniformis* on sandalwood. 2 ♀, 2 ♂, in Hayat Collection, ZDAMU; 5 ♀, 3 ♂, in IWST, Bangalore.

This species was earlier known from Rajasthan, Goa and Tamil Nadu respectively from a *Pulvinaria* sp., indet. soft scales and Anona scale (see Hayat, 1999; Hayat & Bash, 2001; Hayat et al. 2002). This is a new record of this species and its host from Karnataka.

3. **Cheiloneurus basiri** Hayat, Alam & Agarwal

**Specimens examined:** INDIA: Karnataka: Bangalore, 2 ♀ (1 ♀ with antennae missing and body partly distorted), 5.xii.2000, [with] *Ceroplastes actiniformis* on sandalwood. Specimens in IWST, Bangalore.

This species was known from Goa and Kerala reared from *Saissetia coffeae* and *C. actiniformis* (Hayat et al., 1975). This is the first record of *basiri* from Karnataka.
4. *Encyrtus aurantii* (Geoffroy)

*Specimens examined:* INDIA: Karnataka: Bangalore, 5 ♀ (1♀ on slide), 7.vi.2000, on sandalwood; 2 ♂, 7.ii.2001, ex *Ceroplastes actiniformis* on sandalwood. 1 ♀ in Hayat collection, ZDAMU; rest of the specimens in IWST, Bangalore.

This is a nearly cosmopolitan species, earlier known better under its junior synonym, *E. lecaniorum* (Mayr). It is widely distributed in India, recorded from several States from several species of soft scale insects. However, *C. actiniformis* on sandalwood is a new host record from Karnataka.

5. *Metaphycus bolangerae* Hayat, sp. nov. (Figs 26 – 32)

*Female:* Length, holotype, about 1.00mm. Body yellow to whitish; mouth margin and lower half of malar space brownish; occiput on sides and above foramen brown; apical half of mandible reddish brown; pronotum medially and a spot at each posterolateral corner, anterior margin of mesoscutum, dark brown; sides of metanotum, and propodeum especially on sides, brownish; gaster brownish except sides and ventre which are pale yellow. Antennal radicle, basal half or slightly more of pedicel, F1-3, and clava except apex, dark brown; F4 brownish; F5 and F6 white; scape with a brownish patch as in Fig. 28. Wings hyaline. Legs pallid to white; all tibiae with two brownish rings; tarsal segments 2-5 of fore leg, 5th of mid leg, and 4 and 5 of hind leg, brown.

Sculpture and setation as in other species, but the following may be noted:

Head about four times as broad as frontovertex width, and distinctly broader than long. Mandible as in Fig. 26. Maxillary palps 4-segmented, labial palps 3-segmented (Fig. 27). Antenna as in Fig. 28; scape flattened and expanded beneath, 2.75x as long as broad; F1-4 smaller, without sensilla; F5 and F6 larger, with sensilla; clava large, 1.5x as broad as F6, and as long as F2-6 combined. Relative measurements (slide, holotype): head frontal width, 49; head frontal length, 37; frontovertex width, 12.5; eye length, 29; malar space length, 16; scape length, 21.

Thorax: Venation of fore wing as in Fig. 29. Relative measurements (slide, holotype): thorax length, 54; mesoscutum length (width), 23.5 (37); scutellum length (width), 25.5 (25). Fore wing length (width), 110 (46); hind wing length (width), 72 (16); marginal fringe length, 4.5.

Gaster: Ovipositor as in Fig. 31. Relative measurements (slide, holotype): gaster length, 57; ovipositor length, 46; third valvula length, 6 [mid tibia length, 38; mid basitarsus length, 15; mid tibial spur length, 10; distance between propodeal spiracles, 39].

*Male:* Similar to female in colour and other details; antenna with the coloured segments somewhat paler than in female, clava pale brown basally. Antenna as in Fig. 32.

*Holotype:* ♀ (on slide under 4 coverslips, slide No. EH.1067), *paratype:* 1 ♂ (on slide under 3 coverslips, slide No. EH.1068), INDIA: Karnataka: Bangalore, 7.ii.2001, ex *Ceroplastes actiniformis* on sandalwood. Types in Hayat collection (ZDAMU).

*Host:* *Ceroplastes actiniformis* on sandalwood.

*Distribution:* India: Karnataka.

*Comments:* This new species belongs to *zebratus*-group of species characterized by 4-segmented maxillary palps and 3-segmented labial palps. It does not agree with any of the known Indian species of this group (Zeya & Hayat, 1993). It runs to *M. hageni* Daane
& Caltagirone (see Guerrieri & Noyes, 2000), a Palaeartic species, and agrees with that species in several characters including similar configuration of the antennal segments. The new species differs from hageni in having mouth margin and about lower half of malar space brownish; scape with infuscation more extensive, with a small white area in ventral half of basal third, and the infuscation reaching dorsal margin; head about 4x as broad as frontovertex width; third valvula slightly shorter than one-seventh of ovipositor length. [In hageni: head orange with face and malar space paler, without brown mouth margin and malar space; scape with infuscation resembling a letter ‘H’ and not reaching dorsal margin; head 4.6x as broad as frontovertex width; third valvula about one-sixth of ovipositor length.]

**Etymology:** The specific name is an ‘anagram’ of Bangalore.

6. *Microtères aegaus* Hayat, sp. nov. (Figs 15 - 17)

**Female:** Length, holotype, 1.90mm. Head pale brownish yellow to yellow; thorax brownish yellow; sides of mesoscutum yellowish; metanotum on sides and propodeum in middle (mesad of spiracles) brownish; tegulae yellowish-white; prepectus pale yellow; mesopleuron yellow to pale orange yellow; gaster yellowish brown; TI mainly dark metallic with violet lustre especially on sides. Antennal scape brown-yellow; pedicel, F1-3 yellow brown, in upper half dark brown; F4-6 white; clava black. Fore wing very lightly infuscate from base, the infuscation becoming paler towards apex, and with a single, curved, hyaline band just distad of venation (Fig. 16); hind wing hyaline. Legs, including coxae, pale brownish yellow, with tibiae yellowish.

Head: Eyes appear bare; ocellar triangle with apical angle strongly acute; posterior ocelli nearly touching eye margins; frontovertex with irregular, raised, polygonal sculpture; scrobal area with cells somewhat transversely drawn-out; malar space with elongate-reticulate to almost lineolate sculpture; setae on frontovertex and inter-torular space whitish, on malar space dark brown. Mandible with two teeth and a truncation. Antenna as in Fig. 15; F1 longer than pedicel; setae on scape and dark brownish areas of pedicel and F1-3 dark brown, otherwise pale. Relative measurements (holotype): head dorsal width, 56; head dorsal length, 27; frontovertex width, 8; head frontal length, 53; eye length, 38; malar space length, 20; POL, 3.25; OOL, about 0.5; OCL, 7; AOL, 10.

Thorax slightly convex; scutellum convex in middle with declivous sides and apical third; mesoscutum with fine, irregular polygonal cells; scutellum with somewhat raised reticulate sculpture, cells polygonal, but sides with elongate cells; scutellum with about 40 dark brown setae; propodeum (overlapped in middle by apex of scutellum) with fine longitudinal lines on sides, and with numerous white setae on each side distad of spiracles. Fore wing venation and setation as in Figs 16 and 17. Relative measurements (holotype): thorax length, 71; mesoscutum length (width), 35 (52); scutellum length (width), 30 (31); fore wing length (width), 136 (55); hind wing length (width), 93 (28).

Gaster shorter than thorax (56:71); ovipositor long, appear to arise from between hind coxae, and exerted part one-fifth of gaster length (11:56); TI-VII with setae as follows: TI with about 2 lines, narrowly interrupted in middle; TII-IV each with one broadly interrupted line; TV and TVI each with one complete line; TVII with several setae. Relative measurements (from slide, paratype): ovipositor length, 152; third valvula length, 45 [mid tibia length, 102; mid basitarsus length, 30; mid tibial spur length, 37; distance between propodeal spiracles, 78].
Male: Unknown.

Holotype: ♀, paratypes: 4 ♀ (1 ♀ on slide, No. EH.1055), INDIA: Karnataka: Bangalore, 9.xii.2000, ex Inglisia bivalvata on sandalwood. Holotype and 1 paratype (on slide) in Hayat collection (ZDAMU); 3 paratypes in IWST, Bangalore.

Host: Inglisia bivalvata on sandalwood.

Distribution: India: Karnataka.

Comments: Among the species of Microterys characterized by the presence of a single hyaline band just distad of venation, at least slightly flattened antennal scape, and F1 longer than pedicel, the new species comes very close to the Australian species M. garibalida (Girault, 1933) (see Prinsloo, 1976, for a redescription and illustrations), but differs by the uniformly coloured brownish-yellow scutellum; gaster brownish-yellow with TI darker; frontovertex width at least one-seventh of head width; scape a little more than 3x as long as broad; F5 and F6 subequal in length, each shorter than F4; clava with apex transversely truncate; F3-6 and clava with numerous sensilla; mandible with the truncate part broader than the denticulate part; mesoscutum densely setose, upwards of 90 setae; scutellum with about 40 setae; and mid tibial spur clearly longer than basitarsus and about seven-ninths of third valvula length. [In garibalida: distal third or so of scutellum blackish with green lustre; gaster black; frontovertex width about one-sixth of head width; scape slightly expanded in distal two-thirds, 4x as long as broad; F4 and F5 subequal in length, each clearly longer than F6; clava with apex rounded; F3-6 and claval segments with relatively fewer sensilla; mandible with truncate part smaller than denticulate part; mesoscutum with about 45 setae; scutellum sparsely setose; mid tibial spur shorter than basitarsus, and about two-thirds of third valvula length.]

Etymology: The name of the species is derived from the Greek: agaios = neat, admirable.

*Neperpolia* Hayat, gen. nov. (Figs 6 – 11)

Type species: *Neperpolia bangalorensis* Hayat, sp. nov.

Female: Head dorsally slightly convex; frontovertex broad, half of head width; mouth fossa about three-fourths as wide as frontovertex; scrobes not deep, convergent above, with rounded margins; malar sulcus present, fine; occipital margin sharp; eyes small, just reaching occiput behind, separated from occiput by about diameter of a facet; cheeks about three-fourths of eye length; ocellar triangle with apical angle a right angle; toruli with their upper margins slightly above lower eye margins, and removed from mouth margin by more than their own lengths; inter-torular distance equal to torulush-mouth margin distance. Vertex with irregular, fine reticulations; frons and face with cells obliquely elongate, but irregular; malar space behind sulcus with fine, lineolate-reticulate sculpture. Mandible with three pointed teeth. Maxillary palps 4-segmented, labial palps 3-segmented. Antenna, 1,1,6,3; scape unexpanded, more or less cylindrical, clearly shorter than width of frontovertex; pedicel not longer, and hardly broader than F1; funicle segments each slightly longer than broad; clava slightly broader than F6; flagellar segments with numerous longitudinal sensilla.

Thorax slightly convex; mesoscutum with notaular lines absent, with elongate-reticulate to lineolate-reticulate sculpture, and with dark brown setae; axillae narrowly meeting; scutellum with apex rounded, and with longitudinally elongate-reticulate sculp-
ture in about anterior three-fifths to two-thirds, smooth and shiny on sides and apex, and with 24-26 dark brown setae; propodeum very short in middle, about one-tenth of scutellum length, without any apparent sculpture, and with about 10 setae on each side including one seta near proximal margin of each spiracle; metapleuron and propodeum in contact with hind coxa so that the mesopleuron is clearly separated from base of gaster. Fore wing hyaline; parastigma clearly separated from marginal vein by a hyaline break; marginal vein longer than postmarginal or stigmal veins; postmarginal vein as long as stigmal vein, the latter with apex broad and with 4 circular sensilla; basal triangle sparsely setose, and with a distinct asetose area; linea calva broadened posteriorly, neither interrupted nor closed; costal cell with two lines of setae on ventral surface. Legs normal, with 5-segmented tarsi; mid tibial spur as long as basitarsus.

Gaster subequal in length to thorax; TI on each side with a distinct reticulate area (apparently glandular area); hypopygium not reaching to apex of gaster; cercal plates situated in basal half of gaster; ovipositor with third valvula just visible at apex of gaster.

Body, including tegulae, dark brown to black.

*Male:* Unknown.

*Comments:* The new genus does not run well to any of the known encyrtid genera (Prinsloo & Annecke, 1979, Afrotropical genera; Noyes, 1980, Neotropical genera; Noyes & Hayat, 1984, Indo-Pacific genera; Trjapitzin, 1989, Palaeartic genera; Noyes, Woolley & Zolnerowich, 1997, Nearctic genera). However, the genus may be related to *Gahaniella* Timberlake, and more so to *Perpolia* Noyes & Woolley (see Noyes & Hayat, 1984; Noyes & Woolley, 1994) in having a broad frontovertex which is broader than the length of the antennal scape; relatively highly placed toruli, with their upper margins above level of lower eye margins; more or less similar antennae having pedicel not or not much longer and broader than F1; and flagellar segments all with numerous longitudinal sensilla. In *Gahaniella:* marginal vein of fore wing as long as or shorter than stigmal vein; linea calva interrupted by 2-3 setae; mandible with one or two teeth and a truncation; eyes apparently bare, with setae, pale and shorter than a facet; scutellum uniformly sculptured to apex; and sculpture of the mesoscutum and scutellum which is not elongate to lineolate reticulate.

The new genus runs to *Perpolia* in the key to the Nearctic genera (Noyes *et al.*, 1997) if the funicle segments are regarded as not all longer than broad. From the description of *Perpolia* given by Noyes & Woolley (1994), the new genus appears closely related to that genus, as it agrees with it in a majority of characters, but differs mainly in the following characters: frontovertex with irregular reticulate sculpture; mesoscutum and anterior 3/5 – 2/3 of scutellum with elongate reticulate to lineolate reticulate sculpture; mandible narrowed towards apex; stigmal vein shorter than marginal vein and with an expanded stigma; all funicle segments longer than broad; and clypeal margin slightly concave or truncate, not convex. [In *Perpolia:* frontovertex with raised reticulate sculpture, the cells fairly regular; mesoscutum and scutellum with fairly regular, moderately deep, raised, almost hexagonal sculpture covered with numerous short setae; mandible apically broad; stigmal vein slightly longer than marginal vein and elongate, and stigma slightly expanded; distal funicle segments quadratic to broader than long (in the type species, *P. trebia* Noyes & Woolley); and clypeal margin slightly produced, and convex medially.]
Etymology: The genus name is coined by adding the Greek prefix *ne* = not to the generic name *Peropolia*.

7. *Neperopolia bangalorensis* Hayat, sp. nov. (Figs 6 – 11)

**Female:** Length, 0.80mm. Body completely dark brown to black; frontovertebra dark, dull violet-purple; area between toruli and mouth margin somewhat bluish-green; pronotum and largely mesoscutum dull black, with faint violet blue-green shine; posterior third or so of mesoscutum bronze violet; scutellum with sculptured part dark, dull violet, otherwise intense bluish-green; tegulae dark; metanotum and propodeum black, indistinctly shiny; gaster violet with bronzy; TI largely dark violet. Scape brownish, with yellowish ventral margin; pedicel dark brown; flagellum brownish. Wings hyaline. Legs: fore and hind coxae, and fore and mid femora whitish; all tibiae very pale yellow; mid coxa at least basal two-thirds black as mesopleuron, apical third or less pale yellow; hind femur pale yellow to white, with apical third dark brown; fore tarsal segments 2-5 infuscate brown to brown; mid tarsus with 5th segment pale brown; hind tarsal segments 2-4 yellow brown, 5th brownish. (All tarsi appear pale yellow in cleared, slide-mounted specimen).

Head, in front view, as in Fig. 6. Antenna as in Fig. 7. Relative measurements (holotype): head dorsal width, 24; head dorsal length, 10; frontovertebra width, 12; POL, 5; OOL, 3; eye length, 14.5; malar space length, 10. (From slide, paratype): frontovertebra width, 21.5; scape length, 16.5.

Thorax: Pronotum, mesoscutum, axillae and scutellum with brown setae; scutellum with 24-26 setae; sculpture of mesoscutum as in Fig. 10; sculpture of scutellum as in Fig. 11. Fore wing venation and setation as in Fig. 8. Relative measurements (from slide, paratype): thorax length, 50; mesoscutum length (width), 21 (36); scutellum length (width), 24 (24); propodeum length, 2.25. Fore wing length (width), 103 (47); venation length, 51.5; hind wing length (width), 78 (18) venation length, 49; marginal fringe length, 3.

Gaster, in dried specimens, somewhat shorter than thorax; TI on each side with a glandular (?) structure (Fig. 9); TI-VII with setae as follows: TI with a narrowly separated line; TII and TIII each with a broadly separated line; TIV and TV each with a narrowly separated line; TVI with a complete, curved line; TVII with several setae; setae dark brown, long. Relative measurements (from slide, paratype): gaster length, somewhat stretched, 55; ovipositor length, 47; third valvula length, 13.5. [mid tibia length, 38; mid basitarsus length, 10; mid tibial spur length, 10; distance between propodeal spiracles, 30.5].

**Male:** Unknown.

**Holotype:** ♀, *paratypes:* 9 ♀ (1 ♀ on slide, No. EH.1066), INDIA: Karnataka: Bangalore, 5.x.1999, on sandalwood. Holotype and 1 ♀ paratype in Hayat collection (ZAMU); 8 ♀ paratypes in IWST, Bangalore.

**Hosts:** Unknown; collected with an aspirator on sandalwood trees.

**Distribution:** India: Karnataka.

**Etymology:** The specific name is derived from the name of the type locality, Bangalore.
8. *Ooencyrtus kerriae* Hayat, sp. nov. (Figs 18 – 25)

**Female:** Length, holotype, 1.30mm. Body completely dark, metallic; frontovertex and inter-torular area bronzy-violet; face, malar space and temples more bluish-green; pronotal collar bronzy, rest of pronotum and mesoscutum bluish-green; scutellum with the central sculptured area with bronzy shine, sides and apex bluish-green; axillae bluish-green; tegulae yellow in basal half or so, brown distally; posterior margin of prepectus yellowish; metanotum and propodeum violet; gaster mainly bronzy violet, TI mainly bluish-green. Scape yellowish or yellow-brown, dorsally brown; basal two-thirds of pedicel dark brown, apical third yellow-brown; funicle yellow-brown; clava brown to dark brown. Wings hyaline. Legs, including coxae, yellow; tibiae with indistinct pale brown suffusions or darker yellow; fore tarsi brownish; mid tarsi yellow-brown, 5th segment brown; hind tarsal segments 3-5 or 4-5 yellow-brown to brown.

Head: Ocellar triangle with apical angle slightly acute; posterior ocelli very close to eye margins; eyes just reaching occiput behind; eyes setose, setae translucent and each seta shorter than a facet; vertex with somewhat raised reticulate sculpture, but frons with shallow, regular, polygonal sculpture, the cells small, and with minute setigerous punctures in and around ocellar area, setae pale; sides of scrobes and malar space with elongate reticulations; between sides of scrobes and malar space upto sulcus with a few distinct setigerous punctures; malar sulcus indistinct to faint to clearly visible; scrobes distinct, short, not meeting above, and with outer margins in lower half carinate (Fig. 20). Mandible three-dentate, dorsal tooth prominent and clearly separated from middle tooth by a concavity (Fig. 20). Antenna as in Figs 22 and 23; either with funicle segments all longer than broad or F6 or F5 and F6 quadrate to broader than long. Relative measurements (holotype): head dorsal width, 40; head dorsal length, 19; frontovertex width, 9; POL, 5; OOL, 0.5; OCL, 5.5; AOL, 4.5.

Thorax: Mesoscutum finely reticulate, cells irregular and somewhat transversely drawn-out, with numerous fine setigerous punctures, the setae dark brown; axillae with transversely drawn-out cells; scutellum in about middle half or so in a triangular area with slightly raised reticulate sculpture, the cells irregular, polygonal, and somewhat deeper than those on mesoscutum; sides and apical third or more smooth (very fine reticulations visible at higher magnification); scutellum with 20-22 dark brown setae, including one pair in apical third and one subapical pair of longer setae; propodeum with some fine reticulations on sides, and 6-7 long, white setae on each side distad of spiracles. Fore wing venation and setation as in Fig. 24; note the long and thin stigmal vein and the uninterrupted and open linea calva. Relative measurements (holotype): thorax length, 46; pronotum length (width), 3 (33); mesoscutum length (width), 22 (35); scutellum length (width), 20 (21). (From slide, paratype): fore wing length (width), 153 (67); hind wing length (width), 100 (25); marginal fringe length, 5.5.

Gaster shorter than thorax (35:46); terga with setae as follows: TI–IV each with a broadly interrupted line of setae; TV with a narrowly interrupted line; TVI with a complete line; TVII with several setae; TI on each side with an apparently reticulate area (glandular?). Relative measurements (from slide, paratype): ovipositor length, 64; third valvula length, 14.5 [mid tibia length, 58; mid basitarsus length, 21; mid tibial spur length, 15; distance between propodeal spiracles, 46].

**Male:** Length, 0.75 – 0.95mm. Similar to female in colour and sculpture, except for the head (Fig. 18); antennal structure (Fig. 19). Head dorsum more than 2.66x as broad as
long (32:12); frontovertex 0.5x of head width (16:32); ocellar triangle with apical angle obtuse; posterior ocelli about equidistant from both eye and occipital margins, not less than one diameter of an ocellus; POL, 7.5; OOL, 3; OCL, 2.5; antennal toruli with their lower margins in line with lower eye margins and removed from mouth margin by a distance equal to twice inter-torular distance. Gaster shorter than thorax (25:42); genitalia with phallobase with short parameres, and short digit; each digitus with one denticle. Relative measurements (from slide): head frontal width, 46; head frontal length, 39.5; frontovertex width, 21.5 (scape length, 14); eye length, 26.5; malar space length, 16; fore wing length (width), 123 (59); hind wing length (width), 82 (23); phallobase length, 13; mid basitarsus length, 14; mid tibial spur length, 12.5.

Variation: Some of the female paratypes have the frontovertex broader (head width:frontovertex width – 41:12, 37:11; 35:11); malar space with sulcus either distinct, or only basally distinct or indistinct, but this character appears not to be related to the width of the frontovertex; and F6 or F5 and F6 may be quadrate. Otherwise, all other characters are same in specimens with a narrow and a broader frontovertex.

Holotype: ♀, paratypes: 9 ♀ (2♀ on slides, EH.1061, EH.1062), INDIA: Karnataka: Gottipura near Bangalore, 3 iii.2001, ex lac insect on sandalwood. 1 ♂ paratype (on slide, EH.1058), with same data except coll. 5 ii.2001. Holotype, 3 ♀, 1 ♂ paratypes in Hayat collection (ZDAMU); 6 ♀ paratypes in IWST, Bangalore.

Non-type specimens: 9 ♂ (some with antennae missing, some with wings damaged), with same data as for the male paratype. 1♂ in Hayat collection (ZDAMU), 8 ♂ in IWST, Bangalore.

Host: Lac insect [Kerria lacca] on sandalwood.

Distribution: India: Karnataka.

Comments: This species is placed in Ooencyrtus with considerable hesitation, because of the type of mandibular teeth, the long and thin stigmal vein, and the type of antennal scrobes. But other characters, such as the axillae medially overlapped by the mesoscutum, and posteriorly enlarged mesopleuron, point out its relationship with that genus.

Ooencyrtus kerriae does not agree with any of the Indo-Pacific, Palaearctic or Afro-tropical species (Huang & Noyes, 1994; Trjapitzin, 1989; Prinsloo, 1987).

Etymology: The specific name is derived from the generic name of the lac insect.

9. Philosindia inglisiae Hayat, sp. nov. (Figs 1 – 5)

Female: Length, 1.07-1.70mm (holotype, 1.70mm). Body testaceous yellow; clypeus brown; occiput above foramen with a broad transverse brownish patch; pronotum largely dark brown, with collar and sides yellow; mesothorax brownish yellow; gaster yellowish brown; T1 brownish; sides of gaster up to cercal plates brownish yellow. Antennal scape dark brown in about basal half; pedicel slightly brownish in upper half, and clava with at least distal two segments brownish; rest of antenna yellow to testaceous yellow. Wings hyaline. Legs, including coxae, yellowish; pretarsi dark.

Head, in front view, as in Fig. 1: ocelli large; ocellar triangle with apical angle a right angle; anterior ocellus slightly more than its diameter from eye margin; toruli with their lower margins in line with lower eye margins or slightly above level of lower eye mar-
gins; each torulus separated from mouth margin by 1.5x inter-torular distance; occipital margin sharp; eyes over-reaching occiput behind; eyes bare; frontovertex with raised reticulate sculpture, irregularly polygonal, with fine setiferous punctures; punctures distinct on vertex; setae fine and pale; malar space and face with transverse to obliquely drawn-out cells. Mandible with two small pointed teeth and a broad truncation. Antenna as in Fig. 2; note the elongate funicle segments; scape shorter than width of frontovertex (13:14). Relative measurements (holotype): head dorsal width, 47; head dorsal length, 17; frontovertex width, 18; head frontal length, 39; eye length, 26; malar space length, 12; POL, 8; OOL, 2; OCL, 2.5; AOL, 4.5.

Thorax: Axillae narrowly separated being overlapped mesally by the slightly convex posterior margin of mesoscutum; mesopleuron clearly separated from base of gaster so that the hind coxae and metapleuron are in contact; mesoscutum with irregular, polygonal reticulations, not deeper than on vertex, and with numerous brown setae; scutellum triangular, with apex pointed, and with a very thin apical flange; scutellum with irregular polygonal reticulations, deeper than on mesoscutum, and with brown setae; sides of propodeum densely setose, setae white. Fore wing distal veins as in Fig. 3. Relative measurements (holotype): thorax length, 68; pronotum length, 5; mesoscutum length (width), 30 (42); scutellum length (width), 31 (26); propodeum length, 3; fore wing length (width), 128 (57).

Gaster distinctly shorter than thorax (50:68). Relative measurements (from slide, paratype): ovipositor length, 95; third valvula length, 21.5 [mid tibia length, 80; mid basitarsus length, 22; mid tibial spur length, 24].

**Male**: Length, approx. 1.00mm. Different from the female in body colour, antennal structure and dimensions of various body parts. Head largely except an area below toruli to mouth margin, pronotum except sides, mesoscutum except postero-lateral sides, scutellum completely, and gaster (except TI in slide-mounted gaster) dark brown and metallic; the excepted parts/areas yellow; frontovertex intense bluish-green; mesoscutum dark area brony, bluish-green; scutellum bronze violet in middle, bluish-green on sides and at apex; metanotum and propodeum yellow, with brownish suffusions; thoracic pleura and sterna yellowish; gaster violet to bluish-green. Antennal scape in about basal half pale brown; pedicel dorsally in proximal two-thirds brown; rest scape and pedicel yellow; flagellum brownish (F1) to brownish yellow.

Head with frontovertex broad, at least half of head width; ocellar triangle with apical angle obtuse, posterior ocelli less than one diameter to both eye and occipital margins. Antenna as in Fig. 4. Distal veins of fore wing as in Fig. 5. Genitalia with digitii short, and each digitus with a denticle; phallobase with short parameres. Other details as in the following measurements. Relative measurements (from slide): head frontal width, 56; head frontal length, 44; frontovertex width, 29 (scape length, 17.5); eye length, 27.5; malar space length, 17; mouth fossa width, 23.5; torulus length, 9; inter-torular distance, 8; torulus-mouth margin distance, 15. Thorax length, 79; mesoscutum length (width), 35 (54); scutellum length (width), 38.5 (34). Fore wing length (width), 145 (67); hind wing length (width), 98 (30). Gaster length, 56; phallobase length, excluding the short parameres, 24. Mid tibia length, 56; mid basitarsus length, 15; mid tibial spur length, 17.

**Holotype**: ♀, **paratypes**: 10 ♀ (2♀ on slide, slide NO. EH.1056), INDIA: Karnataka: Bangalore, 11.xi.2000, ex *Inglisia bivalvata* on sandalwood. Holotype and 2 ♀ paratypes in Hayat collection, ZDAMU; 8 ♀ paratypes in IWST, Bangalore.
The following males, although apparently belong to the same species, are not included in the type series:

*Non-type specimens:* 7 ♂ (1 ♀ on slide, No. EH.1057), INDIA: Karnataka: Bangalore, 6.xii.1999, ex *Saisssetia coffeae* on sandalwood. 2 ♂ in ZDAMU; 5 ♂ in IWST, Bangalore.

*Hosts:* *Inglistia bivalvata,* *Saisssetia coffeae.*

*Distribution:* INDIA: Karnataka.

*Comments:* The genus *Philosindia* Noyes & Hayat (1984) contains so far only the type species, *longicornis* Noyes & Hayat, described from Hong Kong. Noyes & Hayat (1984) reported that there are a further 8 species (undescribed) from India, Philippines, Papua New Guinea and the Solomon Island. The genus, and in particular the species described here, is apparently very close to the Indian species of *Neastymachus* Girault and may be confused for it; but *Philosindia* differs from *Neastymachus* by the higher placement of the antennal toruli, with their lower margins at least in line with lower eye margins; generally very elongate flagellum with long funicule segments, either with a compact 3-segmented clava or the clava with segments separated and very similar to funicule segments; antennal scape shorter than width of the frontovertebra; and the postmarginal vein of fore wing longer than stigmal vein.

The Indian species described here differs from *longicornis* in several characters, notably the presence of a compact, 3-segmented clava; postmarginal vein slightly longer than stigmal vein; scape dark brown in basal half; and the flagellum not quite twice as long as head width. [In *longicornis:* clava not differentiated from funicule; postmarginal vein 1.5x as long as stigmal vein; scape with only dorsal margin brownish; and flagellum clearly longer than twice of head width.]

*Etymology:* The specific name is derived from the generic name of the host insect.

10. *Thomsonisca pakistanensis* (Ahmad)

*Specimens examined:* INDIA: Karnataka: Goppipura near Bangalore, 5 ♀, 3 ♂ (3 ♀, 1♂, on two slides), 10.xii.2000, ex *Aspidiotus* sp. on sandalwood. 3 ♀, 1 ♂, in Hayat collection, ZDAMU; 2 ♀, 2 ♂, in IWST, Bangalore.

This species was earlier known from India (Rajasthan and Uttar Pradesh) and Pakistan (see Subba Rao, 1979, for synonymy and other details). It is here recorded from Karnataka for first time from an *Aspidiotus* sp. on sandalwood.

**Family SIGNIPHORIDAE**

1. *Signiphora woolleyi* Hayat, sp. nov. (Figs 33-39)

*Female:* Length, 0.51mm. Body golden yellow; a transverse spot just below toruli dark brown; occiput on each side with a curved brownish band; pronotum and anterior fourth or so of mesoscutum brownish; gaster pale brownish-yellow to golden yellow. Tips of mandibles dark brown. Antenna pale yellow, with pedicel and most of clava pale brown to brownish-yellow, distal fourth of clava dark brown. Fore wing infuscate as in Fig. 38; hind wing hyaline. Legs pale yellow, femora and tibiae somewhat darker yellow.

Frontovertebra with finely, transversely lineolate-reticulate sculpture; malar space with longitudinally lineolate-reticulate sculpture; sides of scrobes with obliquely elongate re-
ticulate sculpture; pronotum, mesoscutum and the triangular part of propodeum with transversely elongate-reticulate to lineolate-reticulate sculpture; gasteral terga II to VI with intricate, largely finely but irregularly cellulate-reticulate sculpture, the cells somewhat transversely drawn-out in middle third and oblique on sides. Setation as in Figs 33 and 37. Relative measurements (from slide, holotype): ovipositor length, 25.5; third valvula length, 5 [mid tibia length, 15; mid basitarsus length, 10; mid tibial spur length, 8.5].

Structural details as in Figs 33-39.

**Male:** Unknown.

**Holotype:** ♀ (on slide under 3 coverslips), INDIA: Karnataka: Bangalore, 7.ii.2001, [with] Ceroplastes actiniformis on sandalwood. **Paratype:** 1 ♀ (on slide; antennae beyond scape missing), with same data as the holotype. Holotype **in** Hayat collection (ZDAMU), and paratype in IWST, Bangalore. **Holotype in NAC., ICRF.**

**Non-type specimens:** INDIA: Karnataka: Bangalore, 32 ♀ (28♀ on a slide), 29. vi. 1994, [with] Hemiberlesia lataniae on vine. Specimens received from Dr M. Mani of the Indian Institute of Horticultural Research, Bangalore (IIHR No. 1002). The above non-type specimens assigned to this species have the clava somewhat shorter and broader, and the fore wing infuscation fainter, but this may be due to preservation in alcohol prior to mounting them on card and slide.

**Hosts:** Bred from Ceroplastes actiniformis on sandalwood and Hemiberlesia lataniae on vine. These hosts might be its secondary hosts. The primary host being one of the encyrtid species bred from these hosts.

**Distribution:** India: Karnataka.

**Comments:** This new species belongs to the flavopalliata species group of *Signiphora* Ashmead (see Woolley, 1988). The following characters place the new species near flavopalliata Ashmead, *fax* Girault, and *insularis* (Dozier): submarginal vein with a single seta; fore wing disc with a long seta (=bristle); marginal fringe at least as long as width of the fore wing; hind wing parallel-sided beyond venation and with very long marginal fringe; marginal vein with two setae. From all these three species, the new species differs in its body colour which is mainly golden yellow to pale yellow, with some brownish to pale brownish on occiput, pronotum, anterior margin of mesoscutum and the generally pale brownish gaster. The third valvulae are one-third the length of mid tibia. [In *S. flavopalliata*: head and gaster mainly blue-black, with posterior tergites of gaster suffused with yellowish on sides; thorax, except pronotum, bright yellow; ovipositor sheaths (=third valvulae) long, about three-fifths the length of mid tibia. In *S. fax* Girault: body sooty brown or brown; thorax, except pronotum and anterior two-thirds of mesoscutum, lemon yellow; gaster all dark or distally lighter brown; ovipositor sheaths two-fifths the length of mid tibia. In *S. insularis*: general colour dark brown, head lighter; lower (=posterior?) half of mesoscutum lemon yellow; clava 4x as long as broad; marginal fringe of fore wing as long as width of wing; discal bristle pale. See Dozier, 1933; Girault, 1913; Quezada et al., 1973.]

**Etymology:** This species is named for Dr J. B. Woolley (Department of Entomology, Texas A&M University, College Station, Texas) for his contribution to the systematization of the Signiphoridae.
Family EULOPHTIDAE

1. *Aprostocetus bangaloricus* Narendran, sp. nov. (Figs. 43-44)

**Female:** Length, 1.22-1.25 mm. Mainly black with slight metallic refingence on head and mesosoma; flagellum brown; scape, pedicel, femora, trochanters, tibiae, tarsi and tegulae pale brownish yellow; coxa dark brown; first metasomal tergite and sides of second tergite pale yellowish brown; wings hyaline, veins pale whitish yellow.

Head as long as broad in anterior view, subequal in width to mesosoma in dorsal view; dorsally (if not collapsed) 2.76x its maximum length, nearly smooth; lateral ocellus slightly nearer to median ocellus than to eye; POL:OOL = 10:6; eye subcircular, asetose; gena not very convex; malar sulcus simple, not arcuate; toruli at level of ventral margin of eye; clypeal margin bilobate; antennal flagellum plus pedicel subequal to width of head; scape slender, slightly shorter than eye, and not exceeding vertex, on dorsomesal surface vaguely reticulate; pedicel 2x as long as wide, subequal to first funicular segment, slightly shorter than second segment; clava 2.4x length of third funicular segment; flagellum slightly thickening towards apex, 2.5x as long as scape, with two anelli, first very small; clava apparently 2-segmented and with a pointed apex; specula not very distinct.

Mesosoma 1.5x as long as broad, dorsally with silky gloss due to microscopic and superficial longitudinal reticulations; median lobe of mesoscutum with complete median groove with 4 short adnotaular setae on each side; scutellum 1.5x as broad as long, convex, with two pairs of bristles, anterior ones long and erect, slightly behind middle, posterior ones moved laterad; submedian grooves hardly diverging forward; median area 1.5x as long as broad; lateral grooves slightly converging forward, not carinate on outside, well visible dorsally; dorsellum fully 4x as broad as long. Propodeum medially distinctly longer than dorsellum and with a broad median carina; submedian areas reticulate; plical carina indistinct or absent; spiracle round, separated by its diameter from metanotum, spiracular rim wholly exposed, with one bristle on either side near spiracle. Hind coxa on dorso-lateral surface shiny. Fore wing with relative lengths of costal cell, 27; marginal vein, 41; stigmal vein, 13. Postmarginal vein indistinct. Submarginal vein with 4 dorsal bristles.

**Male:** Length, 0.9-1.0 mm. Darkish colour more extensive including base of gaster, than in female; antenna longer than that of female; scape with rather short ventral carina situated in distal half; all four funicular segments and clava with long, sparse hairs; first funicular segment subequal (or a trifle shorter) to pedicel; claval apex with a narrow, short spicula.

**Holotype:** ♀, paratypes: 2 ♀, 2 ♂, INDIA: Karnataka: Bangalore, 2.i.2001, ex lac insect on sandalwood. Material in DZCU.

**Host:** Lac insect on sandalwood.

**Distribution:** India: Karnataka.

**Comments:** The genus *Aprostocetus* Westwood contains 43 valid species in India many of which were erroneously described in the genus *Tetrastriction* [Unpublished finding based on research by T.C. N. and his students.] The new species comes near *A. versicolor* (Ranaweera, 1947), comb. nov., in general appearance, but differs from it in having: lateral ocellus nearer to front ocellus than to eye margin; propodeum without lateral carinæ; gaster with a yellowish area at base; and in proportions of antennal segments. [In
versicolor: lateral ocellus nearer to eye margin than to front ocellus; propodeum with lateral carinate; gaster not with yellowish area at base.] This new species also comes near A. sankarani Boucek (1986), but differs in having: submarginal vein with 4 setae; mesoscutum with 4 adnotaular setae; malar groove not arcuate; scape slightly shorter than eye; and in several other features. [In sankarani: submarginal vein with one seta; mesoscutum with 2 adnotaular setae; malar groove arcuate; scape slightly longer than eye.]

**Etymology:** The specific name is derived from the type locality, Bangalore.

2. *Aprostocetus santalinus* Narendran, sp. nov. (Figs. 45-46)

**Female:** Length, 0.94-1.10mm. Black, with metallic green refringence; flagellum dark brown; scape, pedicel, base and apex of femur, trochanter, tibia, tarsus pale yellow; tegula pale brownish yellow; coxa dark brown; gaster black with slight metallic refringence; first and second tergites without paler colours; wings hyaline, veins pale whitish yellow.

Head as long as broad in anterior view; subequal in width to mesosoma in dorsal view; dorsally (if not collapsed) 2.7x its maximum length, nearly smooth; lateral ocellus slightly nearer to median ocellus than to eye; POL:OOL = 13:8; eye subcircular, asetose; gena not very convex; malar groove deep, not arcuate; toruli at level of ventral margin of eye; clypeal margin bilobate. Antennal flagellum plus pedicel subequal to width of head; scape slender, slightly shorter than eye, not exceeding vertex, dorsomesal surface faintly reticulate; pedicel a little less than 2x as long as its width, slightly longer than first funicular segment but shorter than second funicular segment which is subequal in length to third funicular segment; clava a little less than 2.4x length of third funicular segment; flagellum slightly thickening towards apex, about 2.6x as long as scape, with one anellus; clava apparently 3-segmented and with short spicula at apex.

Mesosoma 1.3x as long as broad, dorsally with silky gloss due to microscopic and superficial longitudinal reticulations; mid lobe of mesoscutum with complete median groove with four short adnotaular setae on each side; scutellum 1.4x as broad as long, convex, with 2 pairs of bristles; anterior scutellar bristles erect, slightly behind middle, posterior ones moved laterad; submedian grooves hardly diverging forward; median area 1.72x as long as broad; lateral grooves slightly converging forward, not carinate on outside, well visible dorsally. Propodeum medially distinctly longer than dorsellum, with a median carina, submedian areas subreticulate, plical carina indistinct or absent; spiracle subcircular, separated by its own diameter from metanotum; spiracular rim wholly exposed, with one bristle on either side near spiracle. Hind coxa on dorsolateral side vaguely and finely reticulate. Fore wing with relative lengths: costal cell, 31; marginal vein, 37; stigmal, 12; postmarginal indistinct; submarginal vein with four bristles.

Metasoma: Petiole indistinct; gaster oval in shape, narrower than mesosoma, about 1.7x as long as its width; basal fovea on first tergite as in Fig. 46, with sides partly carinate; cercus with one long hair and two short hairs.

**Male:** Length, 0.75-0.83mm. Antenna slightly longer than that of female; scape with a short ventral carina situated on dorsal half; all four funicular segments and clava with long, sparse hairs; first funicular segment a trifle shorter than pedicel; claval apex with a narrow, long spicula.

**Holotype:** ♀, paratypes: 4 ♀, 2 ♂, INDIA: Karnataka: Bangalore, 7.ii.2001, ex *Ceroplastes actiniformis* on sandalwood. Holotype in DZCU.
Host: Ceroplastes actiniformis on sandalwood.

Distribution: India: Karnataka.

Comments: This species comes close to A. bangaloricus Narendran, sp. nov (see above), but differs from that species in having: malar sulcus deep and strong; propodeum with a concave, narrow part near metanotum on either side; marginal vein 1.2x as long as submarginal; fovea of first tergite distinct with sides carinate; and in having gaster completely black. [In bangaloricus: malar sulcus weaker and simple; propodeum not as in santalinus; marginal vein 1.51x as long as submarginal; fovea of first tergite not very distinct; and first and part of second tergites yellowish brown.]

This species also comes close to A. nowsherensis Kurian (1952), but differs from it in having: scape 2.3x as long as pedicel; first funicular segment shorter than half of scape; second funicular segment not shorter than first; antenna inserted at level of ventral margin of eye; body without brilliant metallic blue reflections. [In nowsherensis: scape 3x as long as pedicel; first funicular segment as long as half of scape; second funicular segment shorter than first; antenna inserted slightly above ventral margin of eye; body with brilliant metallic blue reflections.]

Etymology: The specific name is derived from the generic name of sandalwood.

3. Euplectrus nuperus Narendran, sp. nov. (Figs. 40-42)

Female: Length, 1.27 – 1.28mm. Head, except a patch below antennal toruli, mesosoma and petiole black; antenna yellow, gradually darkening towards clava; area below antennal toruli, legs, ventral side and a large area on middle of dorsum of metasoma yellow; base, sides and subapical part of metasoma dark brown.

Head width 1.3x its height, 2.3x its maximum dorsal length; inter-ocular distance 2.5x eye width in anterior view; malar sulcus absent; malar space 0.4x eye height in side view; scape not reaching front ocellus; pedicel shorter than F1. Relative lengths of antennal segments: scape, 35; pedicel, 11; F1, 11.9; F2-3, 14; F4, 11; clava, 24. Frons partly coriaceous; vertex smooth; distance from eye margin to lateral ocellus subequal to distance from front ocellus to lateral ocellus; vertex margined behind; posterior margin of vertex concave (Fig. 40); POL about 2x OOL.

Mesosoma: Mesoscutum coriaceous with incomplete median carina posteriorly; axillae and scutellum rugulose when viewed under high magnification; dorsellum and propodeum almost smooth. Legs: longer spur of hind tibia shorter than first two tarsal segments together. Fore wing 2.2x as long as broad; six setae on costal cell margin; ratio of submarginal, marginal, stigmal and postmarginal = 22:33:7.3:11.

Male: Unknown.


Host: Lepidopteran caterpillar on sandalwood.

Distribution: India: Karnataka.

Comments: Boucek (1988) estimated that about 100 species are known in the genus Euplectrus. There are 12 species in Australia and in north America, while 16 species are recorded from India (Mani, 1989) and 11 species from Sri Lanka (Wijesekara & Schaufl,
1994). The preceding description of new species of *Euplectrus* was possible because it possesses distinctly different characters from previously described species from the Indian subcontinent and elsewhere.

This new species comes close to *E. maternus* Bhatnagar (1952), but differs from it in having: vertex smooth; antenna inserted slightly below lower level of eye margin; postmarginal vein 1.5x as long as stigmal vein; costal cell margin with 6 setae; metasomal petiole 0.36x as long as hind coxa; body length, 1.27-1.28mm. [In *maternus*: vertex closely punctate; antenna inserted above lower level of eye margin; postmarginal vein 2x as long as stigmal; costal cell margin with 3 setae; metasomal petiole 0.25x as long as hind coxa; body length, 2mm]. This new species comes near *E. pectchansiis* Wijesekara & Schauff (1994) in the key to species given by these authors, but differs from that species in having: petiole 1.3x as long as broad; postmarginal vein 1.5x as long as stigmal; marginal vein 3x as long as postmarginal; funicular segments not subequal, and in several other characters. [In *pectchansiis*: petiole 2x as long as broad; postmarginal vein 2x as long as stigmal; marginal vein 2x as long as postmarginal; funicular segments subequal in length.]

**Etymology:** The species name is taken from Latin meaning ‘New’.

**Family PTEROMALIDAE**

1. *Cephaleta nirupama* Narendran & Mini


   This species was described by Narendran & Mini (1999) from Mangara (Tamil Nadu) from coccids on *Acacia nilotica*. The host and the host plant reported in this paper are new for the species from India.

2. *Scutellista caerulea* (Fonscolombe)


   This is a cosmopolitan species known from several Indian States on a variety of coccid species including the genus *Ceroplastes*.

**Family CERAPHRONIDAE**

1. *Aphanognus* sp.

   *Specimens examined:* INDIA: Karnataka: Bangalore, 6 ♀, 10.x.2000, ex *Inglisia bivalvata* on sandalwood.

   Since the taxonomy of the Indian *Aphanognus* needs a thorough revision, the specimens at hand could be identified only up to genus level.
References


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Figs. 1-11. (1-5) *Philosindia inquisiae* Hayat, sp. nov.: (1-3) paratype ♀: 1, head frontal view; 2, antenna; 3, distal veins of fore wing. (4, 5) ♂: 4, antenna; 5, distal veins of fore wing. (6-11) *Neperpolia bangalorensis* Hayat, gen. et sp. nov., paratype ♀: 6, head frontal view, with one mandible enlarged; 7, antenna; 8, fore wing basal half, with distal veins enlarged; 9, side of TI of gaster showing the peculiar glandular (?) structures; 10, sculpture of mesoscutum; 11, sculpture of scutellum.
Figs. 12-19. (12-14) *Anicetus inglisiiae* Hayat, sp. nov., paratype ♀: 12, antenna; 13, fore wing showing infuscation; 14, basal half of fore wing showing venation and setation. (15-17) *Microterys aegaeus* Hayat, sp. nov., paratype ♀: 15, antenna; 16, fore wing; 17, distal veins of fore wing. (18, 19) *Ooencyrtus kerriae* Hayat, sp. nov., ♂: 18, head frontal view; 19, antenna.
Figs. 20-32. (20-25) *Ooencyrtus kerriae* Hayat, sp. nov., paratype ♀: 20, 21, head, frontal view, variants, with mandible enlarged; 22, 23, antenna, variants; 24, basal half of fore wing showing venation and setation, with distal veins enlarged; 25, distal veins of fore wing. (26-32) *Metaphycus bolangerae* Hayat, sp. nov. (26-31) holotype ♀: 26, mandible; 27, maxillary and labial palps; 28, antenna; 29, distal veins of fore wing; 30, mid tibia and basitarsus; 31, genitalia, right half, drawn to same scale as Fig. 30. (32) antenna ♂.
Figs. 33-39. Signiphora woolleyi Hayat, sp. nov., holotype ♀: 33, head frontal, with mandible and maxillay palp enlarged; 34, antenna; 35, part of fore leg showing combed calcar; 36, part of mid leg; 37, thorax and gaster, dorsal, with apical two terga of gaster shown separately; 38, fore wing with distal veins enlarged; 39, hind wing with marginal vein enlarged.
Figs. 40-42. *Euplectrus nuperus* Narendran, sp. nov., ♀: 40, body, dorsal; 41, antenna; 42, head, front view.
Figs. 43-44. Aprostocetus bangaloricus Narendran, sp. nov., ♀: 43, body, dorsal; 44, antenna.

Figs. 45-46. Aprostocetus santalimus Narendran, sp. nov., ♀: 45, body dorsal; 46, antenna.