

Taxonomic studies on some Chalcidoidea (Hymenoptera) associated with Xylophagous beetle *Demonax decorus* Gahan (Coleoptera: Cerambycidae) from Kerala (India) with descriptions of five new species.

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Abstract

Five new species viz. *Metapelma periyaricum* Narendran & Mohana, *M. kokkaricum* Narendran & Abhilash, *Calosota idukkiensis* Narendran & Bijoy, *Calosota iochroma* Narendran and *Tetrastichus demonaxi* Narendran are described and their differences from the closely resembling species are provided. Key to Oriental species of *Metapelma* and *Calosota* are provided. *Eurytoma xylophaga* Yang is redescribed. A male of indetermined *Solenura* is described.

Key words: New species, *Metapelma*, *Calosota*, *Tetrastichus*, *Eurytoma*, *Solenura*, Keys, redescription, Kerala, Western Ghats, India

Introduction

Xylophagous beetles are very destructive to forest trees in India. The Bourdillon's Laurel Tree (*Litsea bourdillonii* Gamble), locally known as "Mulaku naree" in the local language (Malayalam) of Kerala is an endemic sub canopy tree in the Western Ghats which is one of the world's hot spots of biodiversity. These trees are seen at an elevation of 750-1800 m. in South Sahyadri (a mountain range of West Peninsular India, parallel to Malabar coast of the Arabian Sea). A part of the tree is used for preparation of traditional medicine. From a dead wood of this tree several species of Chalcids belonging to Eupelmidae, Eurytomidae, Eulophidae and Pteromalidae emerged from bore holes (Fig. 26) made by the Cerambycid beetle *Demonax decorus* Gahan (Fig. 25). The collected material were identified and found to contain 5 new species and 2 known species. They are taxonomically treated here. The species *Eurytoma xylophaga* Yang is redescribed here since the original description is not sufficient for easy identification. In this paper for redescription of a known species we have used the term 'Plesiotype' as defined by Mayr et al. 1952 for a specimen on which subsequent description and figures are based.

Materials and Methods

The terminology used were of Boucek (1988) and Gibson (2003). The photographs were taken using Leica (S8 APO) microscope. The holotypes and paratypes of the new species are deposited in the Western Ghat Regional Centre of Zoological Survey of India, Kozhikode, Kerala, India.

Abbreviations used: AOL = Distance between front ocellus and hind ocellus; CC = Costal cell; F1 to F4 = Funicular segments 1 to 4; F11 to F18 = Flagellar segments 1-8 of Eupelmidae. L = Length; MV = Marginal vein; MS = Malar sulcus; OOL = Ocellular distance; OPS = Ovipositor sheath; PMV = Postmarginal vein; SMV = Submarginal vein; STV = Stigmal vein; T1 to T8 = Gasteral tergites 1 to 8.; W=Width.

Acronyms of depositories: NWCF = Northwestern College of Forestry, Yangling, Shaanxi, China. ZSIK = Western Ghat Regional Centre of Zoological Survey of India, Kozhikode, Kerala, India.

1. Family Eupelmidae.

Genus *Metapelma* Westwood

Metapelma Westwood, 1835:69. Type species: *Metapelma spectabile* Westwood. Monotypy.

Halidea Foerster, 1856:31. Type species:

Metapelma nobilis Foerster; subsequent designation by Boucek, (1988) [designation of *H. insignis* Foerster by Gahan & Fagan (1923) incorrect (Gibson, 1989)] Synonymy by Ashmead, 1896: 5. **Diagnosis:** Head lenticular in lateral view; vertex and gena smoothly curved to about level of posterior ocelli; scrobe with a short vertical depression above each torulus (Figs. 2, 6); acropleuron separated from mesopleuron by subdivided upper and lower mesepimeron; the separated lower part of mesepimeron appears as narrow vertical sclerite at posterior end of mesopleuron before the depressed and hairy mesopleuron (Figs. 1, 5); dorsellum V-like; axillae triangular in dorsal view with anteromedian angles contiguous; mesotibia with row of pegs along anteroapical edge; flagellum 8 segmented (anellus considered as F11); hind tibia and basitarsus foliaceous, widened; ovipositor sheath extended beyond apical tergite. In the females, the semi-membranous apex of epipygium is produced into a whitish filament.

Host: Xylophagous beetles (Coleoptera)

Distribution: Cosmopolitan.

Remarks: Monophyly of this genus is indicated by the percurrent paraspinal lines and compressed hind metatibia and hind metatarsus. The separated lower part of mesepimeron which appears as narrow vertical sclerite at posterior end of mesopleuron before the depressed and hairy mesopleuron also distinguishes this genus from other genera of Metapelmatinae (Gibson, 1989).

Annotated Key to Oriental species of

Metapelma

(Based on Females)

(The differential characters of known species used in the key are from published information or from collected specimens and not based on types. Additional characters given in square parentheses may not be differential characters but given here for helping identification easier).

1. Hind tibia with a dorsal forked expansion (Fig. 38E of Mani et al. 1973); (Sri Lanka) [hind leg brownish black except white base of tibia; F12 as long as F13; wings without infuscation; general body colour brownish black with metallic bluish green refringence] (Mani & Kaul, 1973; Mani, 1988)..... *M. strychnocola* Mani & Kaul, 1973.
= Hind tibia with dorsal expansion (lamella) not forked as above.....2.

2. Hind tibia 5.75x its width (including lamella) [Height of MS 0.5x length of scape; gaster hardly equal to mesosoma in length; length of ovipositor sheath 0.8x length of body] (Malaysia, India; Cameron, 1909, Islam & Hayat, 1986).....
..... *M. compressipes* Cameron, 1909.
= Hind tibia distinctly shorter, 5x its width.....3.
3. Head metallic green with spot on vertex and 2 oval spots, contiguous anteriorly, on the middle of frons cupreous; F12 about 5x as long as pedicel; hind tibia width 0.23-0.24x its length. (Philippines) (Enderlein, 1912; Gahan, 1925; Ferriere, 1938)..... *M. albisquamulata* Enderlein, 1912
= Head without spots as above; other characters partly or completely different.....4.
4. Hind femur black with apex white or pale.....5.
= Hind femur with different colour pattern.....6.
5. Lamella of hind tibia as broad as width of hind tibia (excluding lamella); length of ovipositor sheath equal to combined length of mesosoma and metasoma; 0.73x length of body (Philippines) (Gahan, 1925; Ferriere, 1938).....
M. tenuicrus Gahan, 1925.
= Lamella of hind tibia 3.3x as broad as width of hind tibia; ovipositor sheath shorter than half of metasoma, 0.22x length of body (India, Thailand) (Westwood, 1874; Islam, Hayat, 1986; Ferriere, 1938; Dalla Torre 1898)..... *M. obscuratum* Westwood, 1874
6. Apex and adjoining area of forewing infumated (Fig. 8 of Westwood, 1874); width of hind tibia including lamella 0.17x its length; proportional length of mesosoma: metasoma: Ovipositor sheath = 15:15:30; F11 and F12 equal in length; length of F13 3.5x length of F12 (Fig. 8a of Westwood, 1874; Dalla Torre, 1898.) (Philippines) (Westwood, 1874, Dalla Torre, 1898)..... *M. gloriosum* Westwood, 1874
= Forewing not with such infumation as above; proportion of body parts different from above.....7
7. Metasoma red with a cupreous tint at base; mesosoma black; tegula white; length of ovipositor sheath half of body length (2.5:5); forewing longer than body (6.5:5) (Sri Lanka) (Westwood, 1874).....
..... *M. taprobanae* Westwood, 1874.
= Metasoma not as above; other characters partly or completely different.....8.
8. F13 as long as F12; middle tibial spur as long as

metatarsus; hind tibial lamellar width equal to hind tibial width; pedicel about 1.5x as long as F11; metanotum with median triangular process extending posteriorly to the middle of propodeum; ovipositor sheath length 0.5x to 0.6x as long as length of body; tegula dark aeneous, nearly black; metasoma about as long as mesosoma. Sarawak (Malaysia) (Westwood, 1874; Gahan 1925 as *M. acroregularis*, synonymized by Ferriere, 1938; Dalla Torre, 1898).....***M. rufimanum*** Westwood, 1874.

= F13 shorter than F12; mid tibial spur shorter than mid metatarsus; width of hind tibial lamella more than width of hind tibia.....9.

9. Minimum distance between eyes 0.46x maximum distance between eyes in anterior view; F12 length 4.5x length of F11; F15 0.8x as long as F14; PMV 1.3x as long as MV; hind tibial width including lamella 0.3x length of hind tibia; gaster 0.7x length of body; ovipositor sheath length 1.44x length of gaster (Fig.1). India (Host: *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae)***M. periyaricum*** Narendran & Mohana *sp.nov.*

= Minimum distance between eyes shorter than 0.34x maximum distance between eyes; F12 length 2.7 to 3.1x length of F1; F15 as long as F14; PMV 1.1-1.2x as long as MV; hind tibial width including lamella 0.16-0.23x length of hind tibia; length of gaster 0.4 -0.5x length of body; length of ovipositor sheath as long as or shorter than gaster.....10.

10. MS 0.22x height of eye; gaster as long as half of body; POL 1.75x OOL; pedicel length 0.5x length of scape; ovipositor sheath 0.86x length of gaster; India. (Host: *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae) (Fig.5.).....***M. kokkaricum*** Narendran & Abhilash *sp.nov.*

= MS 0.33x height of eye; gaster length 0.4x length of body; POL as long as OOL; pedicel 0.34x -0.4x length of scape; ovipositor sheath as long as gaster (India: Andaman Islands, West Bengal (new record) (Mani et al, 1973; Mani, 1988)***M. mesandamna*** Mani & Kaul, 1974

1. *Metapelma periyaricum* Narendran & Mohana *sp. nov.* (Figs.1-4)

Female (Holotype): Length 8.5mm. Ovipositor sheath length 5.58mm.

Colour: Head metallic green with violet patches anterior on region anterior to antennal toruli, on interantennal projection and on vertex; occipital region dark violet in median part with cupreous refringence; temples violet mixed with green; ocelli pale yellow with middle portion dark brown; eyes black; distal part of clypeus dark with a pale yellow labral lobe; mandibles black with a dark brown patch at base. Antenna black with slight metallic refringence, with a dull brownish yellow on anterior ventral half of scape. Mesosoma: Pronotum black with violet and green refringence, extreme anterior part (cervix) pale brownish yellow dorsomedially; mesoscutum dark violet on sides with metallic green violet refringence medially and yellowish and cupreous refringence on notaular region; axillae metallic green and violet refringence; scutellum black with violet refringence; propodeum metallic green on sides with yellowish tinge and black with violet refringence medially (Fig.4); tegulae dark brown with basal half white (Fig.1); prepectus black; acropleuron metallic green with violet refringence on anterior corner, on posterior part and on metapleuron. Anterior and middle coxae metallic green; hind coxa metallic green with dark violet refringence on dorsal side; all trochanters pale brownish yellow; fore-femur pale brownish yellow with anterior ventral margin brownish black; fore-tibia pale brownish yellow with dorsal margin dark brownish yellow; fore- tibial spur pale brownish yellow; first four tarsal segments brownish yellow, fifth tarsals black; mid- femur pale brownish yellow; mid- tibia pale brownish yellow with apex darker; mid- tibial spur brownish yellow; mid- metatarsus pale brownish yellow with apical one fourth dark brown; remaining segments dark brown becoming black apically. Hind femur with basal half pale brownish yellow and apical half black with extreme apex white; hind tibia jet black with base white; hind metatarsus jet black with apex white; second, third and fourth hind tarsi white; fifth tarsus black. Metasoma black with metallic violet refringence dorsally and metallic green refringence on patches at sides. Wings hyaline with brownish infuscations adjoining PMV.

Head: Reticulate with scattered setigerous pits; width in anterior view 1.13x its height; width in dorsal view 2.1x its length; minimum distance between eyes in anterior view 0.46x anterior width of head; maximum distance between eyes in anterior view 0.68x anterior width of head. POL 2x OOL;

AOL 0.86x OOL; hind ocellar diameter 1.43x OOL. MS 0.30x height of eye; eye length 0.7x eye height. Antenna inserted a little below (0.35x diameter of a torulus) level of lower ocular line; toruli separated from each other by a distance slightly more than diameter of a torulus (21:20). The distance between a torulus and eye margin= the distance between the two toruli. Antenna with relative L:W of segments: Scape= 74:19; Pedicel= 28:13; FL1= 22:12; FL2= 98:12; FL3= 74:12; FL4= 37:13; FL5= 30:14; FL6= 27:14; FL7= 21:15; FL8= 15:15; Clava 32:15.

Mesosoma: Aciculoreticulate on dorsal side of pronotum, mesoscutum and scutellum; reticulations a little stronger on scutellum than that of mesoscutum. Pronotum length 0.7x its width; mesoscutum length 1.10x its width; scutellum length 1.55x its width. Propodeum length 0.3x length of scutellum, 0.24 times its own width. Metanotum projecting posteriorly upto middle of propodeum; propodeum distinctly reticulate; acropleuron finely and coriaceously aciculate; prepectus reticuloaciculate, its length 0.85x length of tegula; acropleuron 2.31x as long as length of tegula. Forewing length 3.30x its width; disc fully pilose. Relative L of: CC= 229; SMV= 213; MV= 131; PMV= 165; STV= 34. Legs: Hind coxa aciculoreticulate, 1.32x as long as its width; femur length 7.4x its width; width of hind tibia 0.3x its length including lamella; hind metatarsus length 0.39x length of hind tibia. Relative L of hind tarsal segments: 1st tarsus (metatarsus) = 96; 2nd =34; 3rd =27; 4th =21; 5th =22.

Metasoma: Gaster length (excluding ovipositor sheath) 1.13x length of mesosoma; ovipositor sheath length 1.44x length of gaster; hypopygium ending after the middle of gaster.

Male: Unknown.

Host: *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae)

Material examined: Holotype female, INDIA: Kerala, Idukki District, Thekkady, Kokkare, 06.iv.2013, Coll. K.Rajmohana (ZSIK). Paratypes 3 females of same data of holotype.

Etymology: The species name is after the locality of the species: Periyar Wildlife Sanctuary.

Remarks: There are 9 species of *Metapelma* so far known from Oriental Region. *M. periyaricum* differs from them as follows:

Metapelma periyaricum Narendran & Mohana

sp.nov. differs from the Indian species *M. mesandamana* Mani & Kaul (1973) in having: 1) In anterior view maximum distance between eyes 1.56x minimum distance between eyes (in *M. mesandamana* maximum distance between eyes in anterior view 2.67x minimum distance between eyes); 2) width of hind tibia (including lamella) 0.29x its length (in *M. mesandamana* width of hind tibia 0.22 – 0.23x its length); 3) length of FL7 0.57x length of FL4. (in *M. mesandamana* length of FL7. 0.83x length of F4.); 4) in *M. mesandamana* tegula white at basal half or more (in *M. mesandamana* tegula black or dark brown without a white patch); 5) POL 1.4x OOL (in *M. mesandamana* POL equal to OOL); 6) PMV 1.26x as long as MV (in *M. mesandamana* PMV 1.1x as long as MV); 7) FL7 longer than F18 (21:15) (in *M. mesandamana* F17 almost equal to F18 (20:19.5) and 8) hind tibia jet black with base white (in *M. mesandamana* hind tibia chocolate brown with base pale yellow).

This new species differs from the Oriental *M. rufimanum* Westwood (1874) in having: 1) FL2 1.32x as long as FL3. (in *M. rufimanum* FL2 equal to FL3); 2) scape length 0.76x length of FL2 (in *M. rufimanum* scape equal to FL2); 3) mid tibial spur 0.9x length of first mid tarsal segment (mid tibial spur as long as first mid tarsal segment); 4) ovipositor sheath 0.66x length of remaining part of body (in *M. rufimanum* ovipositor sheath 0.50 to 0.55x length of remaining part of body.); 5) basal half of tegula white (in *M. rufimanum* tegula mostly black without white basal half); 6) pedicel 1.27x as long as F1 (in *M. rufimanum* pedicel 1.5x as long as F1); 7) width of hind tibial lamella 1.67x width of tibia (in *M. rufimanum* width of hind tibia as broad as tibia); and 8) gaster longer than mesosoma (3.99:3.52) (in *M. rufimanum* gaster as long as mesosoma).

M. periyaricum differs from *M. compressipes* (Cameron, 1909) (known from India (Karnataka) and Malaysia) in having: 1) length of hind tibia 3.44x its width (including lamella (in *M. compressipes* length of hind tibia 5.75x its width (including lamella); 2) length of ovipositor sheath 0.6.5-7x length of body (in *M. compressipes* length of ovipositor sheath 0.75-0.8x length of body); 3) height of MS 0.37x as long as scape (in *M. compressipes* height of MS 0.5x length of scape); 4) gaster longer than mesosoma (in *M. compressipes* gaster hardly equal to mesosoma in length); 5) length of pronotum 0.7x its width (in *M. compressipes*

length of pronotum as long as its width);and 6) basal two segments of flagellum not equal in length (in *M. compressipes* basal two segments of flagellum are equal in length).

M. periyaricum differs from the Sri Lankan *M. albisquamulata* Enderlein (1912) in having: 1) F12 3.5x as long as pedicel (in *M. albisquamulata* F12 about 5x as long as pedicel); 2) hind tibia width 0.29x its length (in *M. albisquamulata* width of hind tibia 0.23-0.24x its length); 3) vertex and frons metallic green with violet patches (in *M. albisquamulata* spot on vertex and two oval spots contiguous anteriorly and on middle of frons cupreous); 4) scape black (in *M. albisquamulata* scape blackish above and fulvous below); 5) tegulae white on basal half and dark brown on apical half (in *M. albisquamulata* tegula completely yellowish white) and 6) Ovipositor sheath shorter 90.77x than combined length of mesosoma and gaster (in *M. albisquamulata* ovipositor sheath equal to combined length of mesosoma and gaster).

M. periyaricum differs from the Philippine species *M. tenuicrus* Gahan (1925) in having :1) F1.2 1.24x as long as F13 (in *M. tenuicornis* F12 nearly equal to F13); 2) scape length 0.76x length of F12.(in *M. tenuicrus* scape as long as F12); 3) hind tibial lamella broader than tibial width (5:3) (in *M. tenuicrus* hind tibial lamella as broad as tibia) 4) ovipositor sheath 0.65x length of body (in *M. tenuicrus* ovipositor sheath 0.92x length of body); 5) propodeum mostly metallic green (in *M. tenuicrus* propodeum coppery); 6) hind femur black on distal half and pale yellow on proximal half (in *M. tenuicrus* hind femur black with a very narrow white band at apex); and 7) median process of metanotum extending to middle of propodeum (in *M. tenuicrus* median process of metanotum not extending to middle of propodeum).

M. periyaricum differs from *M. gloriosum* Westwood (1874) from Philippines in having:1) Gaster length 1.13x length of mesosoma (in *M. gloriosum* gaster as long as mesosoma); 2) ovipositor sheath 0.65x length of body (in *M. gloriosum* ovipositor sheath 0.90x length of body) 3) hind tibia width including lamella 0.3x its length (in *M. gloriosum* hind tibia width 0.17x its length); 4) forewing with apex strongly infuscated (as in figure 8a of Westwood,1874) and F2 4.5x as long as F1 (in *M. gloriosum* F2 subequal to F1).

M. periyaricum differs from the Indian *M. obscuratum* Westwood (1874) in having: 1) hind

metatarsus distinctly shorter than following 4 segments combined (90:104) (in *M. obscuratum* hind metatarsus length subequal to following 4 segments combined); 2) ovipositor sheath length 1.7x length of gaster (in *M. obscuratum* ovipositor sheath as long as gaster); 3) hind femur with basal half pale brownish yellow and apical half black with extreme apex white (in *M. obscuratum* hind femur black with tip white); 4) hind tibia jet black with base white (in *M. obscuratum* hind tibia white); 5) hind metatarsus jet black with apex white (in *M. obscuratum* hind metatarsus white); 5)F11 1.8x as long as wide (in *M. obscuratum* F11 3x as long as wide); 6) F12 4.45x as long as F11(in *M. obscuratum* F12 2x as long as F11) and 6) Gaster longer than mesosoma (in *M. obscuratum* gaster shorter than mesosoma).

M. periyaricum differs from *M. taprobanae* Westwood in having: 1) forewing shorter than body length (excluding ovipositor sheath (5.8:8.5) (in *M. taprobanae* forewing longer than body length (14.3:10.8); 2) Ovipositor sheath 0.65x length of body (in *M. taprobanae* ovipositor sheath half length of body) and 3) metasoma black with metallic violet refringence dorsally and metallic green refringence on patches at sides (In *M. taprobanae* metasoma piceous with base with cupreous tint).

M. periyaricum differs from the Indian species *M. strychnocola* Mani & Kaul (1973) in having: 1) Hind tibia without a dorsal forked expansion (in *M. strychnocola* hind tibia with a dorsal forked expansion (Fig.38E of Mani,1988); 2) foreleg brownish yellow with coxa dark metallic green (in *M. strychnocola* fore leg brownish black); 3) pedicel 0.34x as long as scape (in *M. strychnocola* pedicel 0.40x as long as scape; 4) F1 length 0.79x pedicel (in *M. strychnocola* F1 length 0.70x length of pedicel); 4) Clava shorter than preceding 2 segments combined (in *M. strychnocola* clava shorter than preceding 3 segments combined) and 5) ovipositor sheath 1.44x length of gaster (in *M. strychnocola* ovipositor sheath 0.70x length of gaster).

This new species does not fit in to the key of Ferriere (1938).

2. *Metapelma kokkaricum* Narendran & Abhilash *sp. nov.* (Figs.5-7)

Female (Holotype): Length 4.89mm. Ovipositor sheath 1.89mm.

Colour: Head anteriorly bright metallic green with

violet-blue in middle and a little dark patch below anterior ocellus (Fig.6.). Eyes pale gray with brown patches; mandibles black; vertex metallic green with slight golden tinge, area behind posterior ocelli with bronzy refringence; temple greenish blue. Antenna black with golden refringence on scape. Pronotum black with slight metallic refringence dorsally; lateral panel bluish green with golden and bronzy refringence on dorsal margin; prepectus violet blue; mesoscutum with gold and green refringence medially and dark bronze refringence on lateral parts; scutellum dark with violet refringence; axillae bluish green; dorsellum black; propodeum black medially and metallic green on sides; tegula pale brownish yellow; acropleuron and metanotum bluish green. Legs: Fore and mid coxae pale brownish yellow with tarsi yellowish brown. Hind leg with coxa metallic violet blue with apex pale brown; trochanters pale yellowish brown; hind femur pale brownish yellow with black colour on two-third of femur on dorsal marginal area and at apex (Fig.5); apical extremity of femur white; hind tibia black with base white; hind metatarsus black, remaining tarsal segments white except apical extremity dark brown. Gaster with metallic greenish blue refringence at basal part, remaining tergite with violet and bronze refringence; ovipositor sheath black. Wings hyaline with dark infuscation behind level of basal part of STV to apex (Fig. 5.) and another cross infuscation behind parastigma extending to posterior margin of wing.

Head: Cross reticulate with scattered setigerous pits; width in anterior view 1.16x its height (113:97); width in dorsal view 1.86x its length (108:58); minimum distance between eyes in anterior view 0.31x anterior width of head; maximum distance between eye in anterior view 0.66x width of head. POL 1.75x OOL. AOL 1.75x OOL; hind ocellar diameter 2x OOL; MS 0.22x eye height; eye length 0.67x eye height. Antenna inserted at level of lower ocular line; toruli separated from each other by a distance of 1.3x diameter of a torulus, or by the same distance between a torulus and eye margin. Relative L: W of antennal segments: Scape = 35:9; pedicel = 16:5; Fl 1 = 11:5; Fl2 = 30:6; Fl3 = 22:6; Fl4 = 12:6; Fl5 = 12:7; Fl6 = 9:7; Fl7 = 9:8; Fl8 = 8:8; Clava = 15:8.

Mesosoma: Aciculate reticulate, reticulation not raised; length 1.9x its width; scutellum length 1.6x its width; metanotum not projecting over propodeum; propodeum length 0.2x length of

scutellum, 0.11x its width; propodeum reticulate (not raised reticulation); prepectus reticulate, its length 1.2x length of tegula; acropleuron length 3.3x length of tegula, strongly striato reticulate. Forewing length 3.2x its width, disc fully pilose. Relative L of CC = 137; SMV = 136; MV = 90; PMV = 110; STV = 26. Legs: Length of mid tibial spur 0.64x length of mid metatarsus; hind coxa reticulate, its length 1.7x its width; hind femur length 5.4x its width; hind tibia width including lamella 0.16x its length; hind metatarsus length 0.46x length of hind tibia. Relative L of: Hind metatarsus = 90; second tarsus = 38; third tarsus = 9; fourth tarsus = 7; fifth = 5.5.

Metasoma: Length (excluding ovipositor sheath) equal to mesosoma; ovipositor sheath length 0.86x length of gaster; hypopygium exceeding middle of gaster, about 0.8x length of gaster.

Host: Emerged from holes made by *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae)

Material examined: Holotype Female, INDIA: Kerala, Idukki Dist. Thekkady, Kokkare, 06.iv.2013, Coll. K.Rajmohana (ZSIK). Paratypes: 2 males of same data of holotype.

Etymology: Named after the locality Kokkare from where the species is collected.

Remarks: *M. kokkaricum* differs from *M. periyaricum* in having: 1) minimum distance between eyes in anterior view 0.31x maximum distance between eyes (in *M. periyaricum* minimum distance between eyes in anterior view 0.46x maximum distance between eyes); 2) MS 0.22x height of eye (in *M. periyaricum* MS 0.30x height of eye); 3) antennal toruli do not exceed lower ocular line (in *M. periyaricum* antennal toruli exceed lower ocular line); 4) Width of hind tibia including lamella 0.16x its length (in *M. periyaricum* hind tibia width including lamella 0.3x its length); 5) AOL 1.76x OOL (in *M. periyaricum* AOL 0.86x OOL); 6) Diameter of posterior ocellus 2x OOL (in *M. periyaricum* diameter of posterior ocellus 0.43x OOL); 7) length of prepectus 1.2x length of tegula (in *M. periyaricum* length of prepectus 0.85x length of tegula); 8) Length of acropleuron 3.3x length of tegula (in *M. periyaricum* length of acropleuron 2.31x as long as tegula); 9) gaster as long as mesosoma (in *M. periyaricum* gaster 1.13x length of mesosoma); and 10) Length of ovipositor sheath 0.86x length of gaster (in *M. periyaricum* length of ovipositor sheath 1.44x length of gaster).

M. kokkaricum differs from *M. rufimanum* in having: 1) F12 longer (92:74) than F13 (in *M. rufimanum* F12 equal to F13); 2) scape longer (35:30) than F12 (in *M. rufimanum* scape as long as F12); 3) mid tibial spur 0.64x length of mid metatarsus (in *M. rufimanum* mid tibial spur as long as mid metatarsus); 4) width of hind tibial lamella longer (17:11) than width of hind tibia (5:3) (in *M. rufimanum* width of hind tibial lamella equal to hind tibial width); and 5) ovipositor sheath length 0.39x length of body (in *M. rufimanum* ovipositor sheath 0.50-0.55x length of body).

This new species does not fit to the key of Ferriere (1938)

***Calosota* Curtis**

Calosota Curtis, 1836: folio 596. Type species: *Calosota vernalis* Curtis. Original designation.

Calosoter Walker, 1837:358. Type species: *Calosoter vernalis* Walker. Subsequent designation by Westwood, 1839:72 [*Pteromalus eneubulus* Walker incorrectly designated by Ashmead, 1904:288]. Synonymy by Gahan & Fagan, 1923:26.

Metacalosoter Masi, 1917:167.

Type species: *M. frequens* Masi. Monotypy.

Gibson, 1989:60. synonymised.

Calosota (Paracalosota) Masi, 1922:142. Type species *C.(P.) viridis* Masi (MSNG). Monotypy. Boucek, 1988:544. synonymised.

Calosota (Hylephila) Masi, 1926:330. Preoccupied by *Hylephila* Billberg, 1820:81, and by *Hylephila* Rondani, 1877:233. Type species: *C.(H.) stenogastra* Masi. Monotypy. Synonymy by Boucek, 1988:544. *Hylephilisca* Ghesquire, 1946:368. New name for *Hylephila* Masi 1927.

Diagnosis: Prepectus extends to tegula; mesoscutum uniformly black or dull metallic refringence and finely sculptured; mesoscutum quadrangular or almost so; linear traces of notauli almost parallel, not quite meeting; axillae reduced to narrow sclerites on sides of the broad base of the scutellum; scutoscuteellar sutures carinated extended to near apex of scutellum. STV relatively long; mid tarsus with two distinct rows of stout small pegs on under side.

Host: Coleoptera; Chalcidoidea, Diptera, Lepidoptera, Sphecoidea, Vespoidea, Apoidea and Hemiptera (Pentatomidae) (Gibson, 1989).

Distribution: Cosmopolitan

Remarks: *Calosota* comes very close to *Balcha* Walker in having parallel, carinate lateral margin of scutellum; enlarged acropleuron and a convex

mesepimeron on the same plane as the acropleuron. The only reliable character that separate *Calosota* from *Balcha* is its prepectus extending to tegula (in *Balcha* prepectus not extending to tegula). We do not find any other reliable character to separate these two genera and only further studies with more material may reveal if intermediate forms exist or not.

Annotated Key to Oriental species of *Calosota* Curtis

(Based on Females. Modified from Narendran et al. 2007)

(The differential characters of *C. stenogastra* Masi, *C. sinensis* Ferriere and *C. splendida* Girault are based on published information and not based on types).

1. Parascrobal area with transverse depression or fascia (Fig. 9)..... 2.
- = Parascrobal area without transverse depression of fascia..... 4.
2. Length of apical tergite of gaster 3x its width; pairs of mid tarsal pegs as follows: 12:7:6:3:0; width of dorsellum 0.2x width of scutellum; mesosoma length 0.4x length of metasoma; length of MV 3.9x length of STV; PMV 1.9x STV; flagellum length 2.5x height of eye; length of scape 0.23x length of flagellum. (Fig. 12); India (Host: *Demonax decorus* Gahan (Coleoptera: Cerambycidae).....
- ***C. iochroma*** Narendran *sp. nov.*
- = Length of apical tergite 1.25 – 1.4x its width; pattern of mid tarsal segment differs from above; width of dorsellum 0.5x width of scutellum; mesosoma length 0.33 – 0.5x metasoma; length of MV 3 or 5.6x length of STV; PMV 1.5 or 2.1x as long as STV; flagellum length and scape length different from above..... 3.
3. Length of apical tergite 1.25x its width; F13 longer than F14 (5:4); eyes pubescent; pairs of pegs of mid tarsi as follows: 11:6:5:3:0; dorsellum width 0.3x width of scutellum; MV about 3x length of STV; PMV 1.5x as long as STV; flagellum about 2x height of head; eye height 1.54x its length; head width 1.23x its height; length of scape 0.3x flagellum. Taiwan (Masi, 1926; Narendran et al. 2007).....
- ***C. stenogastra*** Masi, 1926
- = Length of apical tergite 1.4x its width in dorsal view; F13 as long as F14; eyes bare; pairs of pegs in tarsi of mid leg starting from metatarsus to fifth tarsus = 10:7:5:3:0; dorsellum width 0.4x width of scutellum; length of MV 5.6x length of STV; PMV 2.1x as long as STV.; flagellum length 1.5x height

of head; height of eye 1.28x its length; Head width in anterior view 1.3x its height; length of scape 0.4x length of flagellum.(Fig.8); India (Host: *Demonax decorus* Gahan (Coleoptera: Cerambycidae)

.....*C. idukkiensis* Narendran & Bijoy *sp. nov.*

4. Dorsum of mesosoma nonmetallic; scutellum with a median punctate furrow; clava 2 segmented and not swollen; each eye with a broad fovea below; India(Narendran & Anitha, 2004; Narendran et al 2007).....*C. kottiyoorica* Narendran & Anitha, 2004.

= Dorsum of mesosoma with metallic refringence atleast partly, scutellum without median furrow; clava 3 segmented; subocular fovea absent.....5.

5. Antennal scape mostly black with metallic green refringence (base slightly yellow); head and body strongly metallic; all femora and tibiae metallic green except base and apex yellow or pale yellow; clava 1.8x as long as preceding segment; India (Narendran et al, 2004).....

..... *C. stoma* Narendran, 2007.

= Characters not as in above combination; partly or completely different..... 6.

6. Eyes densely covered with white hairs; SMV 2x as long as MV; PMV about 2x as long as STV; clava 2.5x as long as preceding segment ;pedicel shorter than F1[general body colour dark brown or black with slight metallic green or blue refringence], China (Ferriere, 1935; Narendran et al, 2007)

.....*C. sinensis* Ferriere, 1935.

= Eyes bare; SMV shorter than 1.5x MV; PMV equal to STV; pedicel longer than F1; PMV subequal to STV; clava subequal to Funicle 5(=F1 6) to Funicle 7 (=F1 8) combined. India (Narendran, 1996; Narendran et al., 2007)...*C. shyma* Narendran, 1996.

1. *Calosota idukkiensis* Narendran & Bijoy *sp. nov.*
(Figs.8-11)

Female (Holotype): Length 4.7mm. Colour: Head, mesosoma and metasoma black with metallic green and violet refringence; eyes gray; ocelli dark brown; scape pale yellow with apex brown; remaining segments black; lobe anterior to clypeus pale yellow; mandibles black; all pretarsi dark brown; fore coxa concolorous with mesosoma; fore femur concolorous with fore coxa except pale apex; fore tibia black with slight metallic green refringence except pale base and apex; fore tarsi pale yellow. Mid coxa dark

brown at basal half, remaining part and rest of mid leg pale brownish yellow; hind coxa concolorous with mesosoma; hind femur pale brownish yellow; hind tibia pale yellowish white; hind metatarsus yellowish white, remaining tarsi pale yellow. Wings hyaline, veins pale brown.

Head: Width anteriorly 1.3x its height; width in dorsal view 1.75x its length; eyes separated in anterior view by a minimum distance of 0.47x the maximum distance between eyes; distance between a torulus and eye margin 1.2x distance between toruli., POL 1.8x OOL; AOL 1.4x OOL; diameter of anterior ocellus 2x OOL; diameter of posterior ocellus equal to anterior ocellus. MS 0.5x eye height in profile; eye height 1.3x eye length. Relative L: W of antennal segments: Scape = 47:10; pedicel = 12:8; F11 = 5:6; F12 = 13:9; F13 = 12:9; F14 = 12:9; F15 = 12:10; F16 = 9:10; F17 = 9:10; F18 = 8:11; clava = 40:14.

Mesosoma: Length 1.35x its width; width of mesoscutum 1.9x its length, distinctly and closely punctate (Fig.11); scutellum 0.8x length of mesoscutum, subequal to its width (42:43), with raised reticulation. Dorsellum length 0.14x length of scutellum, its width 2.7x its length. Propodeum median length 2.5x length of dorsellum; diameter of propodeal spiracle shorter than distance between spiracle and posterior margin of metanotum (5:6); prepectus slightly longer than its width (27:26); acropleuron 1.6x as long its width; length of mid tibial spur 0.7x length of mid tarsus; pegs distributed on ventral side of mid tarsal segments as follows: in pairs: First tarsal segment = 10; second = 7; third = 5; fourth = 3; fifth = 0. Forewing length 2.5x its width, speculum partly closed behind, not extending to MV. CC length 7.3x its width. Relative L of CC = 124; SMV = 86; Parastigma = 29; MV = 83; PMV = 32; STV = 15.

Metasoma: 2.1x as long as mesosoma, 3.3x its width; length of apical tergite 1.4x its width; ovipositor sheath 0.3x length of apical tergite.

Male: Unknown

Host: Emerged from holes made by *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae).

Material examined: Holotype Female, INDIA: Kerala, Idukki Dist.Thekkady, Kokkare, 06.iv.2013, Coll. K.Rajmohana (ZSIK).

Etymology: Named after Idukki District from where the species is collected.

Remarks: This new species can be compared with

the Oriental species *Calosota stenogastra* Masi (from Taiwan) since it resembles *C. stenogastra* in general colour. However it differs from *C. stenogastra* in having :1) Length of apical tergite 1.4x its width in dorsal view (in *C. stenogastra* length of apical tergite 1.25x its width; 2) F13 as long as F14 (in *C. stenogastra* F13 longer than F14 (5:4); 3) eyes bare (eyes pubescent in *C. stenogastra*); 4) pairs of pegs in tarsi of mid leg starting from metatarsus to fifth tarsus = 10:7:5:3:0 (in *C. stenogastra* pairs of pegs as follows: 11:6:5:3:0); 5) dorsellum width 0.4x width of scutellum (in *C. stenogastra* dorsellum width 0.3x width of scutellum); 6) length of MV 5.6x length of STV (in *C. stenogastra* MV about 3x length of STV); 7) PMV 2.1x as long as STV (in *C. stenogastra* PMV 1.5x as long as STV); 8) flagellum length 1.5x height of head (in *C. stenogastra* flagellum about 2x height of head); 9) height of eye 1.28x its length (in *C. stenogastra* eye height 1.54x its length); 10.) Head width in anterior view 1.3x its height (in *C. stenogastra* head width 1.23x its height); and 11) length of scape 0.4x length of flagellum (in *C. stenogastra* length of scape 0.3x flagellum).

2. *Calosota iochroma* Narendran *sp. nov.*

(Figs.12-15)

Female (Holotype): Length: 7.66 mm. Colour: Black with violet refringence in most places, green and coppery refringence in some other regions (Figs.12, 15). Fore leg: Coxa dark violet; trochanters dark violet with apex yellow; femur black with slight violet refringence and base yellow; tibia black with violet refringence and base and apex yellow; tibial spur and tarsi yellowish brown. Mid leg: coxa dark violet; trochanters yellow; femur pale yellowish brown with apex yellow; tibia pale yellow with subbasal part and outer apical part yellowish brown; tarsi pale brown with metatarsus a little paler. Hind leg: Coxa dark violet; trochanters pale yellow; femur brown with base and apex pale yellow; tibia pale yellow with basal half yellowish brown; tarsi pale brown; ovipositor sheath pale brownish yellow at apical half. Pubescence on body silvery. Forewing: hyaline with slight yellowish tinge on anterior median part behind MV; veins brown. Hind wing hyaline.

Head: Wider than mesosoma; width in anterior view 1.25x its height; width in dorsal view 2x its length; POL 1.6x OOL; 2x AOL; diameter of posterior

ocellus as long as AOL; eye height in profile 1.3x its length, 2.3x height of MS; eyes bare; distance between eyes on vertex 3.5x POL. Antenna: scape not reaching anterior ocellus; its length 4.2x its width; flagellum 1.7x length of head. Relative L: W of antennal segments: scape = 59:14; pedicel = 17:11; F11 = 9:9; F12 = 22:12; F13 = 22:12; F14 = 22:12; F15 = 18:12; F16 = 14:12; F17 = 14:14; F18 = 13:18; clava = 51:16.

Mesosoma: Width 0.81x its length; pronotum width 5x its length, cross reticulate; mesoscutum width 2x its length, its length 4.2x length of pronotum, strongly punctuate (Fig. 15); scutellum length 0.9x length of mesoscutum, subequal to its width (61:60); dorsellum width 0.2x width of scutellum, with raised reticulation; propodeum with foramen broad and incurved to apex (Fig.1), submedian region smooth and shiny; propodeal width 2.9x its length; spiracle separated from metanotum by a distance shorter than diameter of spiracle (4:5); callus densely pubescent; lateral panel of pronotum obliquely striato-reticulate, depressed; prepectus closely punctuate and pubescent, as long as wide; acropleuron punctuate anteriorly, aciculate on remaining part; prosternum and hind coxa densely pubescent. Forewing length 2.64x its width, fully pilose with a hyaline cross streak; relative L of CC = 124; Parastigma = 42; SMV = 86; MV = 109; PMV = 52; STV = 28; STV = 28. CC length 7.3x its width. Mid tibial spur length 0.5x length of mid metatarsus. Tarsal pegs in pairs as follows: First mid tarsus (= metatarsus) = 12; second = 7; third = 6; fourth = 3; fifth = 0. Hind tibia with two apical spurs, shorter spur 0.6x length of longer spur.

Metasoma: Length 2.5x length of mesosoma; 5.3x its own width; width of metasoma 0.6x width of mesosoma. T1 smooth, its posterior margin medially incised. T2 and T3 medially sinuate; apical segment triangular in dorsal view, its length 3x its width; 0.31x length of gaster; visible part of ovipositor sheath from dorsal view 0.3x length of apical tergite; each cercus with 3 long hairs (length of a hair sub equal to visible part of ovipositor sheath from above).

Male: Unknown.

Host: Emerged from holes made by *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae).

Material examined: Holotype Female, INDIA: Kerala, Idukki District. Thekkady, Kokkare, 06.iv.2013, Coll. K. Rajmohana (ZSIK). Paratypes:

2 females of same data of holotype.

Etymology: The species name is from the Greek words “ion” meaning violet, and 'chroma' meaning colour.

Remarks: This new species resembles *C. stenogastra* and *C. idukkiensis* in having transverse fascia on parascrobal space and in general colour pattern. However it differs from *C. stenogastra* in having: 1) length of apical tergite of gaster 3x its width (in *C. stenogastra* apical tergite 1.25x as long as its width); 2) pattern of mid tarsal pairs :12:7:6:3:0) (in *C. stenogastra* pgs : 11:6:5:3:0); 3) width of dorsellum 0.2x width of scutellum (in *C. stenogastra* width of dorsellum 0.4x width of scutellum); 4) mesosoma length 0.33x length of gaster (in *C. stenogastra* mesosoma length half length of metasoma); 5) length of MV 3.9x length of STV (in *C. stenogastra* length of MV about 3x length of STV); 6) PMV length 1.9x length of STV (in *C. stenogastra* PMV length 1.5x length of STV); 6) height of eye 1.3x its length (in *C. stenogastra* height of eye 1.54x its length); and 7) length of scape 0.23x length of flagellum (in *C. stenogastra* length of scape 0.3x length of flagellum) .

C. iochroma differs from *C. idukkiensis* in having: 1) apical tergite of metasoma 3x its width (in *C. idukkiensis* apical tergite of metasoma 1.4x its width); 2) width of dorsellum 0.2x width of scutellum (in *C. idukkiensis* width of dorsellum 0.4x width of scutellum); 3) length of mesosoma 0.4x length of metasoma (in *C. idukkiensis* length of mesosoma 0.5x length of metasoma); 4) length of MV 3.9x length of STV (in *C. idukkiensis* length of MV 5.6x length of STV); (5) length of PMV 1.9x length of STV (in *C. idukkiensis* length of PMV 2.1x length of STV) and 6) scape length 0.32 x length of flagellum (in *C. idukkiensis* scape length 0.4x length of flagellum).

2. Family Eurytomidae

Genus *Eurytoma* Illiger

Eurytoma Illiger, 1807:192. Type species: *Chalcis abrotani* Panzer, by subsequent designation of Westwood, J.O. (1839).

Decatoma Spinola, 1811:151. Type species: *Chrysis adonidum* Rossi, by subsequent designation by Ashmead (1904:265). Synonymy by Hincks (1944:37).

Bephratella Girault, 1913:95. Type species *Bephratella nymphe* Girault, original designation (Synonymy by Girault 1915[242]:238).

Eurytomidia Masi, 1917:137. Type species *Eurytomidia dubia* Masi by monotypy (Synonymy by Lotfaizadeh et al., 2007:508.).

Ipideurytoma Boucek & Novicky, 1954:267. Type species *Ipideurytoma spessivtsevi* Boucek & Novicky, original designation and monotypy. (Synonymy by Zerova, 1978:332).

Diagnosis: Head without raised preorbital carina; genotemporal margin carinate and carina stronger on ventral half of genotemporal margin; posterior side of head with postgenal groove descending obliquely to near genal carina; gena with posterior margin slightly angulate above oral fossa.

Host: Both entomophagous and phytophagous species exist in this genus. Both primary and secondary parasitoids are present. Some are gall makers. Some are both parasitic and phytophagous (Narendran, 1984,) 2001, 2007).

Distribution: Cosmopolitan

Remarks: The generic limits of the genus is difficult to define since members of this genus exhibit extreme plasticity in morphological features. For the same reason several workers interpreted the genus in different ways.

Eurytoma xylophaga Yang

(Figs. 16, 17)

Eurytoma xylophaga Yang, 1996: 59, 305, China (Shaanxi) (NWCF)

Redescription

Female (Plesiotype): Length 2.76mm. Black with following exceptions: scape, pedicel, basal part of F1, pale brownish yellow. Fore leg: trochanters, base and apex of femur, pale brownish yellow; fore tibia pale brownish yellow with apex pale yellow; fore tarsi pale brownish yellow; pretarsi brown. Mid leg: trochanter, femur (except pale apex of femur) and three-fourth of tibia from base to apex pale brownish yellow, remaining apical one-third of tibia pale yellow; tarsi pale yellow; pretarsi brown. Hind leg: trochanters yellowish brown; extreme base and apex of femur brown; tibia yellowish brown with apex pale yellow; tibial spur and tarsi pale yellow; pretarsi brown. Hypopygium pale brownish yellow; ovipositor pale yellow (sheath black). Wings hyaline with MV, PMV and STV pale hyaline brown.

Head: Width in anterior view 1.35x its height; width in dorsal view 1.8x its length; POL 2.88x OOL; AOL equal to OOL; OD 0.6x OOL. MS 0.65x eye height; eyes bare; eye length 0.84x eye height; frons

and vertex with close pits and interstices carinate; scrobe reticulate. Antenna inserted at level of lower ocular line; distance between toruli 0.27x distance between a torulus and eye margin; scape reaching anterior ocellus, with distinct reticulate sculpture (Fig.17). Relative L: W of antennal segments: scape = 28:4; pedicel = 7:6; anellus = 1:4; F1 = 17:7; F2 = 7:8; F3 = 10:8; F4 = 9:8; F5 = 10:9; clava = 20:8. Metasoma: Width 1.7x its length; pronotum closely pitted with interstices humped in median part; pronotum width 1.29x its length; mesoscutum and scutellum closely punctate with interstices carinate; apex of scutellum rounded; mesoscutum length 0.6x length of pronotum, 0.45x its own width; scutellum slightly longer than its width (42:40). Fore coxa with an oblique carina, not distinctly forming a tooth anteriorly; episternum sulcate with close minute pits (Fig.14); hind coxa closely pitted and pubescent, 0.64x as long as hind femur; hind tibia 1.18x length of hind femur; hind tibial spur 0.4x length of hind metatarsus. Fore wing length 2.3x its width; speculum reaching area behind MV; CC 9x as long as its width; relative length of CC = 83; SMV = 62; Parastigma = 21; MV = 19; STV = 10. Metasoma: Laterally compressed slightly (Fig.12); length 1.15x its height, shorter than mesosoma (123:127); petiole shorter than hind coxa (12:15); anterior dorsal rim of petiole raised so that it appears as spine in side view (Fig.12); relative length of tergites in dorsal margin: petiole = 12; T1 = 23; T2 = 23; T3 = 26; T4 = 25; T5 = 17; T6 hidden under T5 (hence could be measured). Exserted visible part of ovipositor sheath in side view 1.2x as long as T5; tilted upwards.

Host: Emerged from holes made by *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae). Yang (1996) reported this species from unidentified bark beetles on *Quercus* sp.

Distribution : India (New Record); Peoples Republic of China (Shaanxi) (Yang, 1996).

Material examined: Plesiotype Female: INDIA: Kerala, Idukki District: Thekkady, Kokkare, 06.iv. 2013, Coll. K.Rajmohana (ZSIK). Additional material examined: 1 Female of same data of Plesiotype.

Remarks: This species resembles *Eurytoma chinnarensis* Narendran & Sureshan (2013) in having: 1) F1 relatively long (2) in facial and pronotal sculpture (3) in having scape with reticulation. However it differs from *Eurytoma chinnarensis* in having: 1) Gaster compressed slightly from sides

(In *E. chinnarensis* gaster not at all compressed from sides); 2) POL 3 to 3.4x OOL (in *E. chinnarensis* POL 4x OOL); 3) Ovipositor sheath protruding and in most individuals tilted upwards (in *E. chinnarensis* ovipositor sheath not protruded); 4) Body black without reddish brown patches (in *E. chinnarensis* body black with reddish brown patches); 5) AOL equal to OOL (in *E. chinnarensis* AOL 1.7x OOL); F2 shorter than F3 (in *E. chinnarensis* F2 length equal to F3); 6) mesosoma width 1.7x its length (in *E. chinnarensis* mesosomal width 1.14x its length); 7) antennae inserted at level of lower ocular line (in *E. chinnarensis* antennae inserted distinctly a little above lower ocular line); and 8) metasoma shorter than mesosoma (in *E. chinnarensis* metasoma longer than mesosoma). This species does not come near any species treated by Narendran (1994).

3. Family Eulophidae

Genus *Tetrastichus* Haliday

Tetrastichus Haliday, 1844:297. Type species *Cirrospilus attalus* Walker, by original designation. *Ennetoma* Dahlbom, 1857:292. Type species: *Eulophua hylotomarum* Bouche, by designation of Graham, 1990; synonymy by Graham, 1990.

Solenoderus Motschulsky, 1863:71. Type species: *Solenoderus cyaniventris* Motschulsky, by monotypy. Synonymy by Bouček, 1965.

Lygellus Giard, 1896:839. Type species: *Lygellus epilachnae* Giard, by monotypy. Synonymy by Dominichni, 1966.

Neotetrastichus Perkins, 1912:14. Type species: *Neotetrastichus minus* Perkins, by monotypy. Synonymy by Burks, 1943.

Ceratoneuromyia Girault, 1913:252. Type species: *Ceratoneuromyia arnoldi* Girault. Synonymy by Bouček, 1988.

Neparaprostocetus Mani, 1939:90. Type species: *Neparaprostocetus asphondyliae* Mani, by monotypy. Synonymy by Hussain and Khan (1986). Narendran, 2007 indicated this may be *Aprostocetus* Weswood.

Pseudomphaloides Girault, 1915[230]:258. Type species: *Pseudomphaloides aenella* Girault, original designation and monotypy. Synonymy by Bouček (1988).

Redinia Girault, 1936:1-3. Type species: *Redinia hispidivertex* Girault, by monotypy. Synonymy by Bouček (1988)

Diagnosis: SMV with one dorsal seta (rarely with

2-4 dorsal setae). Propodeum with a characteristic paraspiracular carina in the form of an inverted “Y”; scutellum with submedian and sublateral sulci; gaster usually sessile; body usually black to dark or bright metallic refringence, generally without light colouration.

Remarks: *Tetrastichus* resembles several genera of the subfamily Tetrastichinae but can be easily separated from all of them with the following characters: Paraspiracular carina in the form of inverted “Y”; gaster sessile; SMV with one dorsal seta usually and body generally with metallic refringence.

Hosts: Species of this genus attack a wide variety of hosts such as Lepidoptera, Diptera, Coleoptera and Hymenoptera. Odonata and Orthoptera are recorded from New World.

Distribution: Cosmopolitan

Tetrastichus demonaxi Narendran *sp. nov.*

(Figs.18-21)

Female (Holotype): Female 1.6mm. Length: 1.6mm. Black with weak metallic green refringence; eyes grayish brown; ocelli black; radícula pale brown; scape yellow; pedicel and anelli pale brown; funicle and clava blackish brown; tegula dark brown; all coxae and trochanters concolorous with mesosoma; all femora concolorous with mesosoma except yellow bases and apices; all tibiae and tarsi yellow; pretarsi dark brown. Wings hyaline, veins pale brown.

Head: Width anteriorly 1.2x its height; width dorsally 2x its length; POL 1.7x OOL; AOL 0.7x OOL; Height of MS 0.6x eye height; eye height 1.2x eye length; malar sulcus curved anteriorly (Fig.19); distance between eyes in dorsal view 4.6x POL; eyes with scattered minute pubescence (Fig.19); distal margin of clypeus with two teeth; frons and vertex reticulate punctate; antennae inserted at level of lower ocular line; antennal formula 11233; scape not reaching anterior ocellus; relative L:W of antennal segments : scape = 23:6; pedicel = 10:5; F1 = 11:7; F2 = 10:8; F3 = 9:8; clava = 16:9; length of antenna 1.5x width of head in dorsal view, 1.4x width of mesosoma (excluding tegulae).

Mesosoma: Length 1.5x its width; pronotum width 2.3x its length, reticulate with scattered setigerous pits on posterior half; mesoscutum with a median longitudinal sulcus, sulcus weak near anterior

margin of mesoscutum; median lobe with two rows of adnotaular setae on each side, outer row with 5-6 setae and inner row with 2-3 setae anteriorly; mesoscutum and scutellum distinctly reticulate; scutellum 0.8x length of mesoscutum, 0.9x its own width; submedian grooves slightly diverging posteriorly; width of space between submedian grooves 2x length of scutellum; dorsellum width 4x its length; dorsellum length 0.3x median length of propodeum. Propodeum with a median carina, inverted “Y” shaped paraspiracular carina on either side present; surface of propodeum reticulate. Hind tibial spur 0.6x length of metatarsus (Fig.21); second tarsus 0.8x length of metatarsus; third tarsus 0.8x length of second tarsus; fourth tarsus 0.8x length of third. Forewing length 2x its width; speculum closed behind by cubital line of setae. Relative L of CC = 29; SMV = 25; Parastigma = 11; MV = 40; STV = 12. PMV = 0.

This new species resembles *Tetrastichus cupressi* Yang [a parasitoid associated with bark beetles in China (Yang, 1996)] in having MS curved anteriorly and submedian grooves slightly diverging posteriorly. However this new species differs from *T. cupressi* in having: 1) scape shorter than eye height (23:26) (in *T. cupressi* scape as long as height of eye); 2) length of dorsellum 0.3x length of propodeum (in *T. cupressi* length of dorsellum 0.6x length of propodeum); 3) width of space between submedian grooves of scutellum 2x length of scutellum (in *T. cupressi* width of space between submedian grooves of scutellum 2.8x length of scutellum); 4) speculum not extending as a narrow strip below MV (in *T. cupressi* speculum extending as a narrow strip below MV) and 5) gaster shorter than mesosoma (in *T. cupressi* gaster longer than mesosoma).

Domenichini (1960) described *Tetrastichus xyloborum* Domenichini parasitic on *Xyloborus* beetles (Scolytidae) from Java and this species differs from *T. demonaxi* in having: 1) length of scape 3.8x length of pedicel (in *T. demonaxi* length of scape 2.3x length of pedicel); 2) F1 shorter than F2 (19:20) (in *T. demonaxi* F1 longer than F2(11:10)); 3) MV 4.5x as long as STV (in *T. demonaxi* MV 3.3x as long as STV) and 4) metasoma longer than mesosoma (120:55) (in *T. demonaxi* metasoma shorter than mesosoma (73:80)).

Host: Emerged from holes made by *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae).

Etymology: Named after its beetle host genus *Demonax*.

Material examined: Holotype Female: INDIA: Kerala, Idukki Dist., Thekkady, Kokkare, 06.iv.2013, Coll. K. Rajmohana (ZSIK).

Remarks: *T. demonaxi* does not fit in the key to species of *Tetrastichus* by Narendran (2007).

4. Family : Pteromalidae

Genus *Solenura* Westwood

Solenura Westwood, 1868:xxxvi. Type species: *Solenura telescopica* Westwood, by monotypy

Ormyrodes Brues, 1907:46. Type species: *Ormyrodes carinatus* Brues, by monotypy. Synonymy by Gahan (1951).

Toaga Cameron, 1909:210-211. Type species: *Toaga rufipes* Cameron, by monotypy. Synonymy by Hedqvist (1961).

Thecasoma Matsumura, 1918:158. Type species: *Thecasoma longicauda* Matsumura, by monotypy. Synonymy by Boucek (1958).

Thaumasurelloides Girault, 1927:554. Type species: *Thaumasurelloides silvae* Girault, by monotypy. Synonymy by Baltazar (1961).

Diagnosis: Gaster with at least T3 to T5 punctate; female with syntergum and abruptly narrowed T5 and T6 form a tail and with at least T5 and T6 carinate mediolongitudinally; male with T1 having 'V' like or parallel basal fovea; Eyes densely pilose; pedicel and clava of equal length; funicle 8 segmented; scutellum without reflexed marginal rim, evenly curved down to dorsellum. (Gibson, 2003).

Hosts: Parasitoids of wood boring beetle larvae.

Distribution: Oriental, Afrotropical, and Palearctic regions.

Remarks: This genus comes very close to *Grooca* Sureshan & Narendran in having ventral mesepimeron usually pubescent along posterior margin and in having clava usually three segmented. However *Solenura* differs from *Grooca* in having: 1) T3-T5 distinctly pitted (in *Grooca* T3 – T5 only reticulate); 2) Female with a tail like prolongation posteriorly formed by syntergum and narrow T5 and T6. (in *Grooca* gaster lanceolate without distinct tail like prolongation).

Solenura sp.

(Figs. 22-24)

Male: Length 3.3 mm. Head dark metallic blue; pronotum, mesoscutum and scutellum metallic bluish green with golden and brownish refringent patches (Fig. 22); propodeum metallic blue with slight golden refringence (Fig. 23); gaster T1 bright metallic blue; remaining tergites dark metallic blue (Fig. 24). Legs yellowish brown. Wings hyaline with veins brown.

Head: Width 1.36x its height in anterior view; width in dorsal view 2x its length; POL 2.1x OOL; AOL a little longer than OOL (8:7); diameter of posterior ocellus 1.4x OOL; eyes pilose; Height of MS 0.29x eye height; eye height 1.2x eye length; space between antennal toruli 1.6x diameter of a torulus; distance between a torulus and eye equal to diameter of a torulus. Relative L: W of antennal segments: Scape = 40:8; pedicel = 14:7; F11 (= anellus):8:8; F12 = 13:9; F13 = 12:14; F14 = 13:10; F15 = 11:11; F16 = 12:11; F17 = 11:11; F18 = 11:11; clava = 21:11.

Mesosoma: With close pits and interstices carinate (Fig. 23); mesoscutum width 1.43x its length; scutellum width 0.83x its length; scutellum a little shorter than mesoscutum (52:61). Dorsellum pubescent. Propodeum closely pitted, with median carina present; Forewing 2.6x as long as its width; MV 0.94x as long as PMV, 3.8x length of STV. Metacoxa without carinate dorsal margin.

Metasoma: length 1.1x length of mesosoma, 1.7x its own width; length of median basal fovea of T1 2.3x its width; Relative L: W of tergites: T1 = 33:51; T2 (visible part) = 6:45 (T2 mostly concealed under T3); T3 = 25:47; T4 = 36:54; T5 = 32:45; T6 = 16:34; T7 = 8:20; T8 = 5:13.

Host: Emerged from holes made by *Demonax decorus* Gahan (Coleoptera: Cerambycidae) on *Litsea bourdillonii* Gamble (Lauraceae). Yang (1996) reported this species from unidentified bark beetles on *Quercus* sp.

Material examined: 1 Male: INDIA: Kerala, Idukki District. Thekkady, Kokkare, 06.iv.2013, Coll. K.Rajmohana (ZSIK).

Remarks: This comes to *Solenura ania* (Walker, 1846) in the key to species by Gibson (2003) but to be sure the female specimens also needed to confirm the species identity. Hence it is kept unnamed here.

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References

- Ashmead, W.H. 1896. On the genera of the Eupelminae. Proceedings of the Entomological Society of Washington 4: 4-20
- Ashmead, W.H. 1904. Classification of the chalcid flies of the superfamily Chalcidoidea, with descriptions of new species in the Carnegie Museum, collected in South America by Herbert H. Smith. Memoirs of the Carnegie Museum 1(4) pp. i-xi, 225-551
- Baltazar, C.R. 1961. New generic synonyms in parasitic Hymenoptera. Philippine Journal of Science 90(3) pp. 391-395
- Bilberg, G.J. 1820. Enumeratio Insectorum in Museo Gust. Joh. Bilberg, Stockholm. 138pp.
- Boucek, Z. 1958. Eine Cleonyminen-Studie; Bestimmungstabelle der Gattungen mit Beschreibungen und Notizen, eingeschlossen einige Eupelmidae (Hym. Chalcidoidea). Sborník Entomologického Oddělení Národního Muzea v Praze 32 pp. 353-386
- Boucek, Z. 1988. Australasian Chalcidoidea, a biosystematic revision of genera of fourteen families, with a reclassification of species. 832pp. CAB Internatl., Wallingford
- Boucek, Z. and Novicky, S. 1954. *Ipideurytoma spessivtsevi* n.g., n.sp., ein neuer Borlenkäferparasit. Entomologisk Tidskrift 75: 266-271
- Brues, C.T. 1907. New chalcid-flies from Cape Colony. Bulletin of the Wisconsin Natural History Society 5(1): 46-53
- Cameron, P. 1909 (01 Mar 1909). Descriptions of three undescribed species of Chalcididae from Borneo. Deutsche Entomologische Zeitschrift, Berlin 1909: 205-207.
- Cameron, P. 1909. On two new genera (one representing a new tribe) from Borneo. Entomologist 42:209-211. Curtis, J. 1836, British Entomology 13:578-624 London
- Dalla Torre, K.W. von 1898. Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus. V. Chalcididae et Proctotrupidae. pp. 598pp Leipzig
- Enderlein, G. 1912. Zur Kenntnis der Chalcididen Ceylons (Hym.). Entomologische Mitteilungen, Berlin 1: 144-148
- Ferrière, C. 1935. Notes on some bred exotic Eupelmidae (Hym. Chalc.). Stylops IV:152
- Ferrière, C. 1938 (10 Apr 1938). *Eupelmides exotiques* (Hymenopt. Chalcididae). Annales de la Société Entomologique de France 107:25-72
- Förster, A. 1856. Hymenopterologische Studien. 2. Chalcidiae und Proctotrupii. pp.31 Aachen
- Gahan, A.B. 1925. A second lot of parasitic Hymenoptera from the Philippines. Philippine Journal of Science 27:83-109,
- Gahan, A.B. 1951. Some synonymy and new combinations in Chalcidoidea (Hymenoptera). Canadian Entomologist 83(7) pp. 170-176
- Gahan, A.B., Fagan, M.M. 1923. The type species of the genera of Chalcidoidea or chalcid-flies. Bulletin of the United States National Museum, Washington 124 pp. 173pp
- Ghesquière, J. 1946. Contribution à l'étude de microhyménoptères du Congo Belge. X. Nouvelles dénominations pour quelques genres de Chalcidoidea et Mymaroida. XI. Encore les gn. Chalcis, Smiera, et Brachymeria (Hym. Chalcidoidea). Revue de Zoologie et de Botanique Africaines 39: 367-373
- Gibson, G.A.P. 1989. Phylogeny and classification of Eupelmidae, with a revision of the world genera of Calosotinae and Metapelmatinae (Hymenoptera: Chalcidoidea). Memoirs of the Entomological Society of Canada 149: 1-121.
- Gibson, G.A.P. 2003. Phylogenetics and classification of *Cleonyminae* (Hymenoptera: Chalcidoidea: Pteromalidae). Memoirs on Entomology, International 16:v+339pp
- Girault, A.A. 1913. Diagnoses of new chalcidoid Hymenoptera from Queensland, Australia.

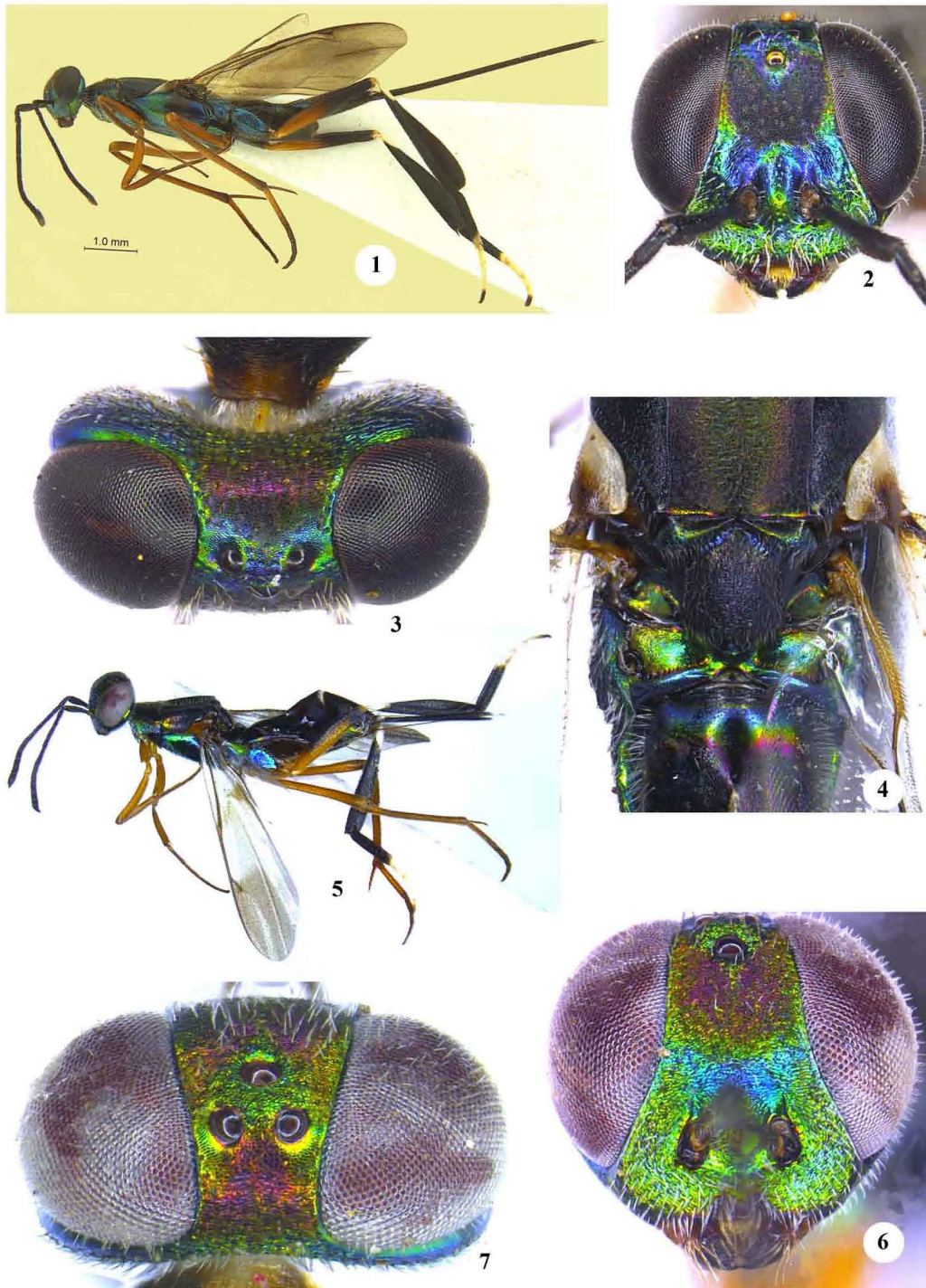


PLATE: I.

Figs. 1-4. *Metapelma periyaricum* Narendran & Mohana, *sp. nov.* Female: 1. Body profile; 2. Head anterior view; 3. Head dorsal view; 4. scutellum and propodeum.

Figs. 5-7. *Metapelma kokkaricum* Narendran & Abhilash Peter *sp. nov.* Female: 5. Body profile; 6. Head anterior view; 7. Head dorsal view.

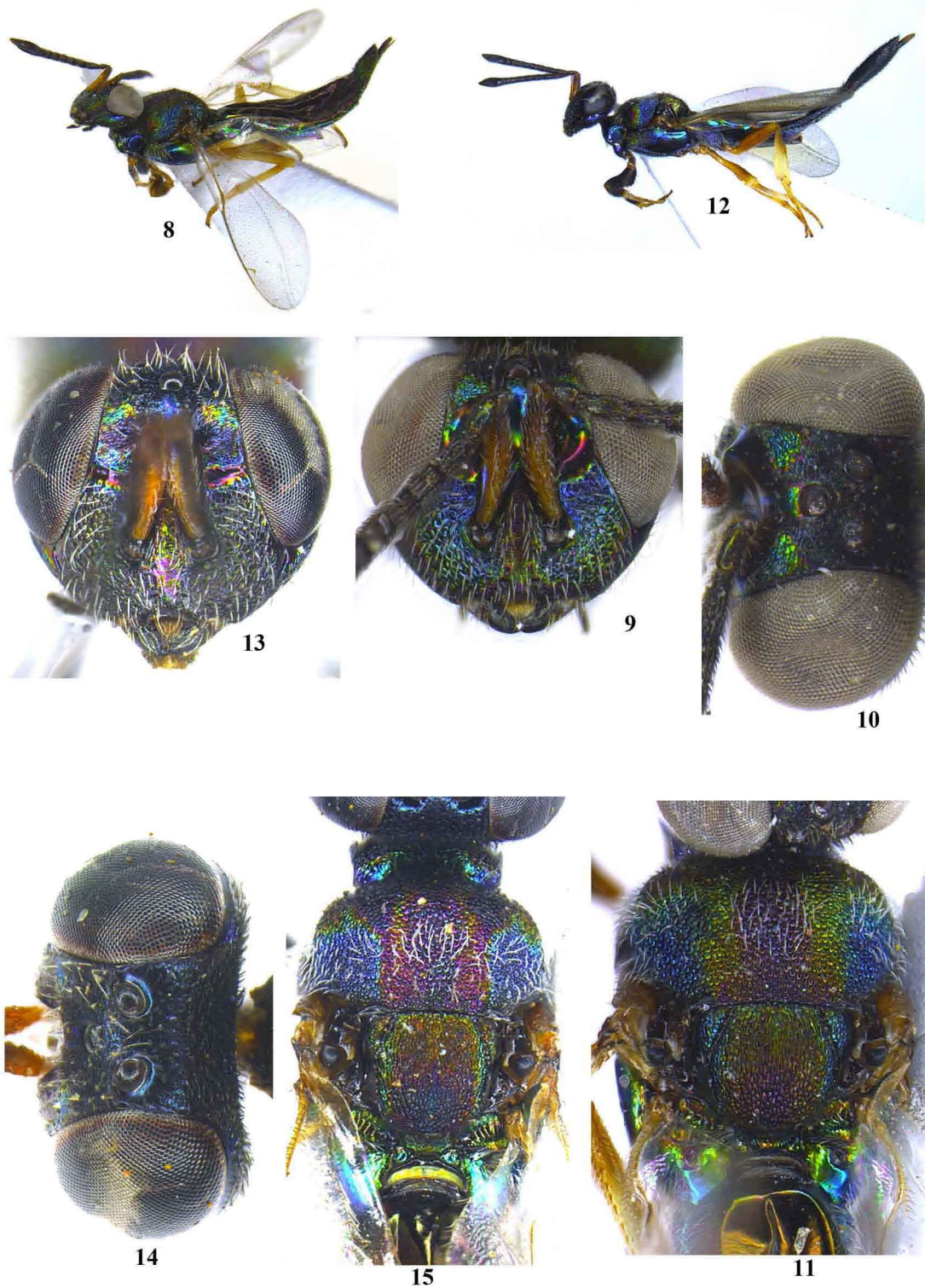


PLATE : II.

Figs. 8-11. *Calosota idukkiensis* Narendran & Bijoy *sp. nov.* Female: 8. Body profile; 9. Head anterior view; 10. Head dorsal view; 11. Mesosoma dorsal view. Figs.12-15. *Calosota iochroma* Narendran *sp. nov.* 12. Body profile; 13. Head anterior view; 14. Head dorsal view; 15. Mesosoma dorsal view.

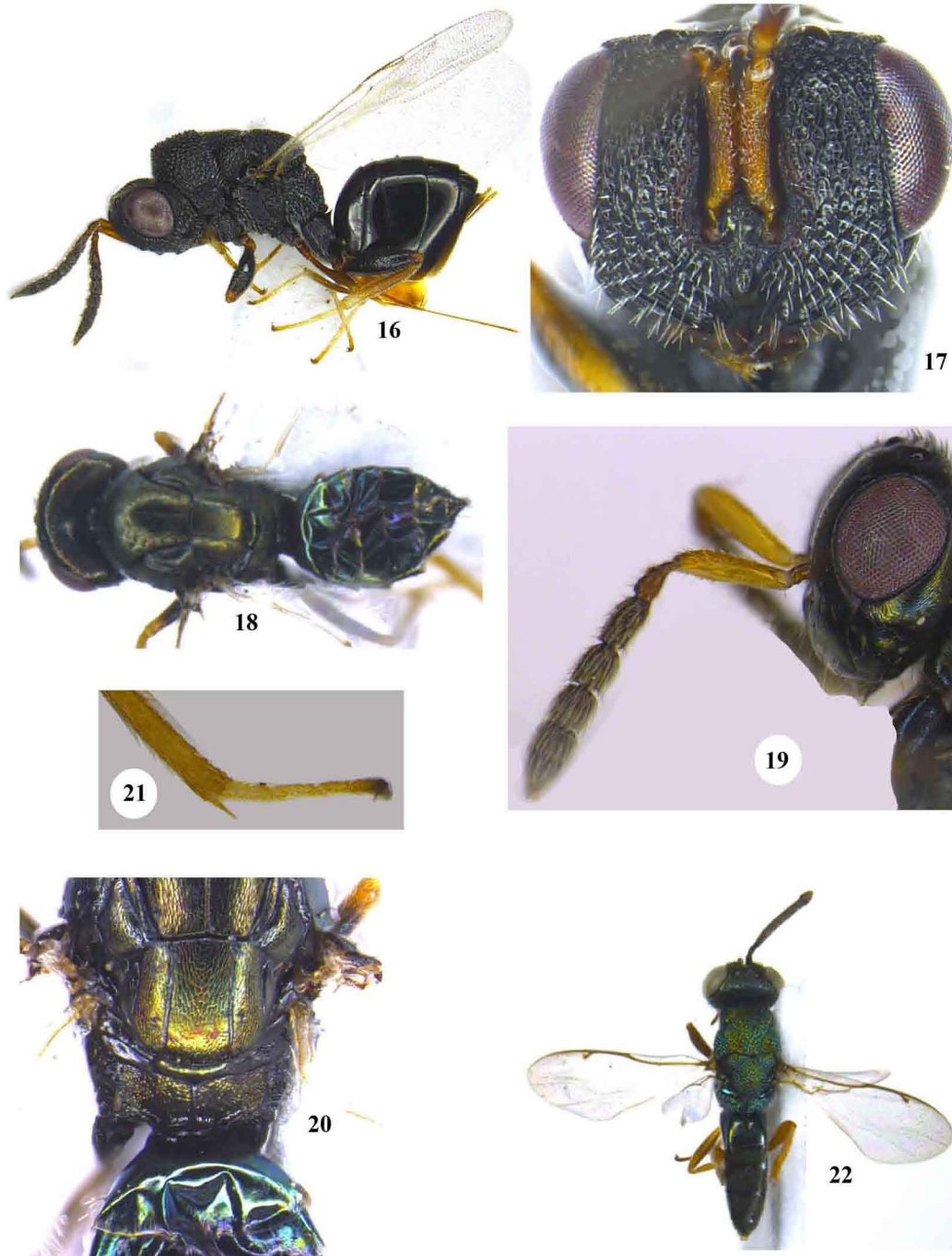


PLATE: III.

Figs.16-17. *Eurytoma xylophaga* Yang, Female: 16. Body profile; 17. Head anterior view. Figs.:18-21: *Tetrastichus demonaxi* Narendran *sp. nov.* 18. Body dorsal view; 19. Head and antenna side view; 20. Posterior part of mesosoma, dorsal view.view; 21. Apical half of hind tibia and tarsi. Fig.22. *Solenura* *sp.* Male: dorsal view.



PLATE: IV.

Figs. 23-24. *Solenura* sp. Male: 23. Head, mesosoma and T1 dorsal view; 24. Gaster dorsal view. Fig. 25. *Demonax decorus* Gahan Female: dorsal view. Fig. 26. Bore hole made by *D. decorus* on *Litsea bourdillonii* Gamble.

- Archiv für Naturgeschichte (A) 79(6):90-107
- Girault, A.A. 1915 [230], Australian Hymenoptera Chalcidoidea IV. Supplement. Memoirs of the Queensland Museum 3:180-299.
- Girault, A.A. 1915. [242], Australian Hymenoptera Chalcidoidea, XI. The family Eurytomidae with descriptions of new genera and species. Memoirs of the Queensland Museum 4 pp. 238-274
- Girault, A.A. 1927. Four new Chalcid flies from the Philippines. Philippine Journal of Science 32: 553-555.
- Girault, A.A. 1936. Terror-errors; and novitates of Pterygota (or Earth realities not state bound) pp.3 Sydney, private publications
- Hedqvist, K.J. 1961. Notes on Cleonymidae (Hym. Chalcidoidea). I. Entomologisk Tidskrift 82 (1-2) pp. 91-110
- Hincks, W.D. 1944. Notes on the nomenclature of some British parasitic Hymenoptera. Proceedings of the Royal Entomological Society of London (B) 13 pp. 30-39
- Husain, T. and Khan, M.Y. 1986. Family Eulophidae. (In: Subba Rao, B.R.; Hayat, M. (Eds) - The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries.) Oriental Insects 20 pp. 211-245
- Illiger, K. 1807. Vergleichung der Gattungen der Hautflügler Piezota Fabr. Hymenoptera Linn. Jur. Magazin für Insektenkunde, 6:189-999
- Islam, S.S. and Hayat, M. 1986. Family Eupelmidae. (In: Subba Rao, B.R.; Hayat, M. (Eds) - The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries.) Oriental Insects 20:57-65
- Lotfalizadeh, H., Delvare, G. and Rasplus, J.-Y. 2007. Phylogenetic analysis of Eurytominae (Chalcidoidea:Eurytomidae) based on morphological characters. Zoological Journal of the Linnean Society 151 pp. 441-510.
- Mani, M.S. 1939. Descriptions of new and new records of some known chalcidoid and other hymenopterous parasites from India. Indian Journal of Entomology 1: 69-99.
- Mani, M.S. 1989. The fauna of India and adjacent countries, Chalcidoidea (Hymenoptera. Part I). Agaontidae, Torymidae, Leucospidae, Chalcididae, Eurytomidae, Perilampidae, Eucharitidae, Cleonymidae, Miscogasteridae, Pteromalidae, Eupelmidae and Encyrtidae: xlv+1067pp Zoological Survey of India, Calcutta
- Mani, M.S., Dubey, O.P., Kaul, B.K. and Saraswat, G.G. 1973. On some Chalcidoidea from India. Memoirs of the School of Entomology, St. John's College, Agra No 2:1-128
- Masi, L. 1917. Chalcididae of the Seychelles islands. (With an appendix by J.J.Kieffer.) Novitates Zoologicae 24:121-230
- Masi, L. 1922. Materiali per una fauna dell'Arcipelago Toscano. XII. Calcididi del Giglio. Terza serie: Eupelminae (Seguito), Pteromalinae (partim). Annali del Museo Civico di Storia Naturale Giacomo Doria. Genova. 50:140-174
- Masi, L. 1926. H. Sauter's Formosa - Ausbeute. Chalcididae (Hym.). Konowia 5(3):264-279
- Masi, L. 1927 (28 Jan 1927). H. Sauter's Formosa - Ausbeute. Chalcididae (Hym.). (cont.) Konowia 5(4):325-381
- Matsumura, S. 1918, Thousand insects of Japan Supplement 4:1508-167. Tokyo
- Mayr, E., Linsley, E.G. and Usinger, R.L. 1953. Methods and principles of Systematic Zoology. 335 pp. McGraw-Hill Book Company, Inc.
- Narendran, T.C. 1994 (31 Jan 1994). Torymidae and Eurytomidae of Indian subcontinent (Hymenoptera: Chalcidoidea): 500pp Zoological Monograph, Department of Zoology, University of Calicut, Kerala, India
- Narendran, T.C., Anitha, P.V., Girish Kumar, P. and Santhosh, S. 2004. A new species of Calosota Curtis (Hymenoptera: Eupelmidae) from India. Bulletin of Pure and Applied Sciences (A) 23(1):7-10.
- Narendran, T.C., Santhosh, S., Peter, A., Sheeba, M. and Jilcy, M.C. 2007. A review of Calosota Curtis (Hymenoptera: Eupelmidae) of Oriental region. Hexapoda 14(2):83-88.
- Narendran, T.C. 1996. Alpha systematic of some Eupelmidae (Hymenoptera: Chalcidoidea) from India. Entomon 21:77-87.
- Spinola, M. 1811. Essai d'une nouvelle classification générale des Diplolépaires. Annales du Muséum National d'Histoire Naturelle. Paris. 17:138-152.
- Sureshan, P.M., Narendran, T.C. and Nikhil, K. 2013. Parasitoids (Hymenoptera) of

- xylophagous beetles (Coleoptera) attacking dead wood in southern Western Ghats, Kerala, India, with descriptions of two new species. *Journal of Threatened Taxa* 5(9): 4385–4391.
- Walker, F. 1837 (31 Oct 1837), *Monographia Chalciditum*. (Continued.) *Entomological Magazine* 5(1): 35-55.
- Walker, F. 1846. List of the specimens of Hymenopterous insects in the collection of the British Museum. Part 1 Chalcidites pp.93 London
- Westwood, J.O. 1835., Various hymenopterous insects, partly from the collection of the Rev. F.W. Hope. *Proceedings of the Zoological Society of London* III: 68-72.
- Westwood, J.O. 1839. Synopsis of the genera of British insects. Order VI. Trichoptera Kirby. Order VII. Hymenoptera Linn. (Piezata Fab.). Introduction to the modern classification of insects founded on the natural habits and corresponding 2(XIII) (appendix):49-80
- Westwood, J.O. 1868. Descriptions of new genera and species of Chalcididae. *Proceedings of the Entomological Society of London* 1868:xxxvi
- Westwood, J.O. 1874. *Thesaurus entomologicus Oxoniensis*; or, illustrations of new, rare, and interesting insects, for the most part contained in the collection presented to the University of Oxford by the Rev. F.W. Hope. pp.150 Oxford
- Yang, Z.Q. 1996. Parasitic wasps on bark beetles in China (Hymenoptera): iv+363pp Science Press, Beijing
- Zerova, M.D. 1978. *Hymenoptera Parasitica. Chalcidoidea - Eurytomidae*. *Fauna Ukraini* 11(9) pp. 1-465 Institute of Zoology, Ukrainian.