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## **Contribution to the Mesochorinae (Hymenoptera, Ichneumonidae) of Nepal**

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**A b s t r a c t :** Four new species of the subfamily Mesochorinae (Hymenoptera, Ichneumonidae) are described from Nepal: *Astiphromma flavitarsis* nov.sp., *Astiphromma himalayaensis* nov.sp., *Mesochorus rufoscutellaris* nov.sp. and *Mesochorus weigeli* nov.sp.

For all new taxa detailed descriptions, illustrations and differential diagnoses to the known Nepalese Mesochorinae are given.

**K e y w o r d s :** Ichneumonidae, Mesochorinae, *Astiphromma*, *Mesochorus*, Nepal, new species.

### **Introduction**

The subfamily Mesochorinae is a moderately large group of Ichneumonidae containing almost 900 described taxa worldwide, about 90% of them belonging to the cosmopolitan genus *Mesochorus* GRAVENHORST. The species of Mesochorinae are probably obligate hyperparasitoids, though some authors mentioned a few (questionable) cases of primary parasitism (BROAD et al. 2018).

In contrast to several larger revisions dealing with the Mesochorinae from the West Palaearctic, Nearctic and Neotropical regions, the Oriental Mesochorine fauna is incompletely known yet. 63 species of this subfamily have been reported from the entire Oriental region and 15 Mesochorinae taxa from Nepal so far (YU et al. 2016). Due to the abundance and diversity of Mesochorinae in other regions, one can expect a manifold higher number of undescribed species in the Oriental area.

I had the opportunity to study some Mesochorinae collected in Nepal which were deposited in the Naturkundemuseum Erfurt/Germany (Erfurt) and kindly sent for determination. Here, I give a first account of my findings.

### **Material and Methods**

For the descriptions below, I used the following measurements and indices: Length of flagellomeres was measured in lateral view (length of 1<sup>st</sup> flagellomere without anellus) and width of flagellomeres in the distal 0.8 of length. Length of temple and width of eye were measured from dorsal; facial width and combined length of face and clypeus from frontal, and length and width of hind femur, hind metatarsus and ovipositor sheath in lateral view.

A correct measurement of the pterostigma is often disturbed by a more or less developed fold of the frontal wing margin, so the relations could not always estimate correctly. The pectination of claws is often difficult to see (especially in basal parts of the claws) and would usually require preparation and further analysis with a compound microscope (see VIKBERG & VARDAL 2017). Here, I noted the visible pectination of the hind claws (usually the outer ones) of types seen in a stereo microscope with 70x magnification.

For the description of the punctuation of body parts the following relations were used: scattered punctures - distances larger than diameter of punctures; moderately dense punctures - diameter of punctures approximately as their distance; dense punctures - punctures larger than their distances.

For the measurements below I used an Olympus SZX 7 stereo microscope with dividing eyepiece. The figures were taken with an Olympus SC 30 CCD-camera using the AnalySIS getIT and Helicon Focus Pro softwares and processed with the Microsoft Office Picture manager.

### List of species

#### *Astiphromma flavitarsis* nov.sp. (figs 1-6)

**H o l o t y p e :** (♂) Central Nepal, N. Kathmandu env., Nagarkot, N27°4'08'' E85°31'19'', 13.V.2013, 2000 m, leg. A. Klimenko (coll. RIEDEL).

**P a r a t y p e s :** (3♂♂) Nepal: Mahakali, D: Darchula, Bachtal S Taisain, 18.VI.2017, LFH 17-08, leg. A. Weigel, 2910 m, mountain mixed forest, 3<sup>rd</sup> tent place, N29°51'52'' E80°40'17'' (Erfurt).

**D e s c r i p t i o n :** ♀: Body length 13-14 mm. Flagellum with 50-53 flagellomeres; 1<sup>st</sup> flagellomere length 4.9x width and 0.60x eye length; 2<sup>nd</sup> flagellomere length 3.0x width; preapical flagellomeres 2x longer than wide. Temple short, strongly and roundly narrowed behind eye, dorsally c. 0.33x as long as eye. Ocelli very large, lateral ocellus almost touching eye, distance of lateral ocellus to eye 0.1x ocellar diameter. Occipital carina complete and straight medially. Frons fine granulate. Face and clypeus densely but superficially punctate and finely granulate, ± matte. Facial width 0.95x length of face+clypeus and 0.73x eye length; inner eye margins parallel. Malar space 0.3x as long as width of mandibular base. Mandible stout, with two equal teeth. Genal carina reaching hypostomal carina away from mandibular base, both carinae low.

Mesoscutum covered with dense pale hairs, finely granulate, but ± shining. Mesopleuron with very fine rather dense setiferous punctures, speculum smooth. Metapleuron granulate, with very fine superficial punctures. Scutellum without lateral carina and apical tubercle, rounded in profile. Propodeum completely carinate. Area basalis trapezoid, slightly wider than long. Area superomedia 1.9-2.2x longer than wide and 1.4-1.7x longer than area petiolaris; costula reaching area superomedia in its frontal 0.35. Area petiolaris 0.95x as long as wide. Hind femur slender, 6.4-6.6x longer than wide; hind metatarsus 0.50-0.55x as long as hind tibia; distal fore tarsomere 2.4x longer than wide; hind claws with c. 7 long teeth.

Areolet slightly wider than long, pointed or shortly stalked; 2<sup>nd</sup> recurrent vein in its middle. Nervulus postfurcal (by 2-3x its width). Nervellus of hind wing slightly reclivous, intercepted at 0.75 of its length; discoidella distinctly developed.

1<sup>st</sup> tergite 2.9-3.1x longer than wide, with deep glymma, without ridges in front of

glymma; dorsal carina weak, in height of tergal spiracle. Postpetiolus with weak central rim, finely granulate, matte. 2<sup>nd</sup> tergite 1.10-1.15x longer than wide; thyridium large, roundish. Ovipositor sheath completely pilose, 6.5-8.0x longer than wide and 0.85-0.9x as long as hind metatarsus, moderately narrowed in apical 0.4.

Colour: Head including antenna red; mandibular base, malar space, clypeus, face, gena and orbits yellowish; stemmaticum often brownish or blackish. Mesosoma brown or blackish; pronotum, mesopleuron, metapleuron and propodeum  $\pm$  reddish; 4 longitudinal stripes on mesoscutum which are confluent frontally, ventral edge of pronotum, scutellum, subtegular ridge and mesopleuron centrally yellowish. Metasoma reddish, often 1<sup>st</sup> and 2<sup>nd</sup> tergites  $\pm$  brownish. Legs red; mid and hind coxae  $\pm$  brownish or blackish; hind tarsus yellowish. Wings hyaline, pterostigma ochreous.

♂ unknown.

**R e m a r k :** This new species belongs to the A-group of *Astiphromma* (sensu NAKANISHI 1969: Scutellum rounded, without apical tubercle, and 1<sup>st</sup> tergite with lateral carina at the level or dorsad of spiracle). It is characterized by the very large ocelli, slender hind femur, characteristic colour pattern of mesosoma and pale yellow hind tarsi.

***Astiphromma himalayaensis* nov.sp. (figs 7-12)**

**H o l o t y p e :** (♂) Nepal: Mahakali, D: Darchula, Bachtal S Taisain, 18.VI.2017, LFH 17-08, leg. A. Weigel, 2910 m, mountain mixed forest, 3<sup>rd</sup> tent place, N 29°51'52'' E 80°40'17'' (Erfurt).

**D e s c r i p t i o n :** ♀: Body length 8 mm. Flagellum with 40 flagellomeres; 1<sup>st</sup> flagellomere length 6.0x width and 0.65x eye length; 2<sup>nd</sup> flagellomere length 3.3x width; preapical flagellomeres 2x longer than wide. Temple strongly and roundly narrowed behind eye, dorsally c. 0.4x as long as eye. Ocelli large, distance of lateral ocellus to eye 0.8x ocellar diameter. Occipital carina complete. Face coarsely punctate and finely granulate, width 1.05x length of face+clypeus and 0.73x eye length; inner eye margins slightly divergent ventrally. Clypeus with dense punctures. Malar space 0.4x as long as width of mandibular bases. Mandible stout, with two equal teeth. Genal carina reaching hypostomal carina away from mandibular base, both carinae low.

Mesosoma covered with pale hairs. Mesoscutum with dense fine punctures. Mesopleuron with dense and fine punctures dorsally and with fine rather scattered setiferous punctures ventrally, speculum smooth. Metapleuron with superficial and moderately dense punctures. Scutellum with lateral carina in basal 0.2 and with strong apical tubercle. Propodeum completely carinate. Area basalis rectangular, 1.5x longer than wide. Area superomedia short, 1.1x longer than wide and 0.7x as long as area petiolaris; costula reaching area superomedia in its frontal 0.3. Area petiolaris large, 0.9x as long as wide. Hind femur 5.6x longer than wide; hind metatarsus 0.47x as long as hind tibia; all claws large, with 3 long teeth.

Areolet slightly wider than long, sessile; 2<sup>nd</sup> recurrent vein slightly proximal to its middle. Nervulus postfurcal (by 2x its width). Nervellus of hind wing interstitial, intercepted at 0.8 of its length; discoidella distinctly developed.

1<sup>st</sup> tergite 2.8x longer than wide, with deep glymma and with some fine transverse ridges in front of glymma; dorsal carina distinct, ventrally of tergal spiracle. Postpetiolus with weak central rim. 2<sup>nd</sup> tergite about as long as wide; thyridium indistinct. Ovipositor sheath entirely pilose, 7.9x as long as wide and 1.05x as long as hind metatarsus,

moderately narrowed in apical 0.4.

Colour: Reddish. Palps, mandible except teeth, clypeus, facial orbit, malar space and gena cream-yellowish. Ventral and hind edges of pronotum, tegula, wing base and fore and mid coxae and trochanters cream-yellowish. Tergites red; 2<sup>nd</sup> to 4<sup>th</sup> sternites cream-yellow medially and apically; 5<sup>th</sup> sternite with cream-yellow apical margin. Pterostigma hyaline-ochreous.

♂ unknown.

**R e m a r k :** This new species belongs to the *dorsale*-group of *Astiphromma* (e.g. with strong apical scutellar tubercle and dorsal carina of 1<sup>st</sup> tergite ventrad of spiracle, B-group sensu NAKANISHI 1969) which are known as hyperparasitoids of Tachinidae (RIEDEL 2015).

In the key of the World *Astiphromma* species of B-group (LEE 1992), this taxon runs to *A. indianensis* LEE. It can be differentiated by its very short area superomedia (as in *A. taiwanensis* LEE), postfurcal nervulus, basal carination of scutellum, and cream-yellow colour of fore and mid coxae and trochanters.

***Mesochorus rufoscutellaris* nov.sp. (figs 20-29)**

**H o l o t y p e :** (♀) Nepal, Prov. Karnali, 29°11'54"N 82°18'36"E Gothichaur, 2850 m, Sumpfwiese, 26.V.-05.VI.2007, leg. F. Creutzburg (Erfurt).

**P a r a t y p e :** (♂) Nepal, Prov. Karnali, 29°11'54"N 82°18'36"E Gothichaur, Hochtal, Zelplatz hinten, WS 2850 m, 5.VI.2007, leg. J. Weipert (Erfurt).

**D e s c r i p t i o n :** ♀: Body length 5.6 mm. Flagellum with 38 flagellomeres; 1<sup>st</sup> flagellomere length 5.8x width and 0.70x eye length; 2<sup>nd</sup> flagellomere length 4.2x width; preapical flagellomere 1.8x longer than wide. Temple moderately and roundly narrowed behind eye, dorsally c. 0.7x as long as eye. Distance of lateral ocellus to eye 1.0x ocellar diameter. Frons punctate, with fine transverse striae above antennal grooves. Face coarsely rugose-punctate, with central rim in dorsal half, 1.1x wider than length of face+clypeus and 1.0 as wide as eye length; inner eye margins parallel. Subantennal transverse carina dipped medially. Ventral 1/3 of facial orbit and malar space with oblique striae. Clypeus densely punctate. Malar space 0.3x as long as width of mandibular base. Mandible with two equal teeth. Genal carina reaching hypostomal carina away from mandibular base, both carinae low.

Side of pronotum coarsely punctate, rugose ventrally. Mesoscutum coarsely punctate, shining. Mesopleuron with very dense coarse punctures, speculum smooth. Metapleuron with finer dense punctures. Scutellum without lateral carina or apical tubercle, rounded in profile. Propodeum completely carinate. Area basalis rectangular, c. 1.2x longer than wide. Area superomedia 2.1x longer than wide and 1.4x longer than area petiolaris; costula reaching area superomedia in its frontal 0.4. Area petiolaris about as long as wide, with some coarse rugae. Hind femur 5.7x longer than wide; hind metatarsus 0.45x as long as hind tibia; distal fore tarsomere slender, 2.9x longer than wide; hind claw with c. 5 long teeth.

Areolet slightly wider than long, pointed; 2<sup>nd</sup> recurrent vein in its middle. Nervulus interstitial. Nervellus of hind wing not intercepted; discoidella absent.

1<sup>st</sup> tergite 3.3x longer than wide. Postpetiolus with weak central rim and some longitudinal rugae, without lateral carina. 2<sup>nd</sup> tergite 1.05x wider than long; thyridium transversely



oval. Ovipositor sheath entirely pilose, 7.8x longer than wide and as long as hind metatarsus, moderately narrowed in apical 0.25.

Colour: Black. Antenna brownish. Palps, clypeus, mandible except teeth, gena, wide facial orbit and triangular spot beside antennal groove cream-yellow. Face brownish-black centrally. Vertical and outer orbits reddish. Mesosoma black; wide upper margin of pronotum, H-shaped median spot on mesoscutum and scutellum (except small brownish basal spot) red; dorsal half of mesopleuron dark reddish. Metasoma black; 2<sup>nd</sup> tergite with narrow cream-yellow hind margin; epipleura of 2<sup>nd</sup> and 3<sup>rd</sup> tergites and median folds of 2<sup>nd</sup> to 3<sup>rd</sup> sternites cream-yellow. Legs red; all distal tarsomeres reddish-brown; hind tibia yellow, narrowly infusate apically (by 0.5x its width). Pterostigma hyaline, with ochreous margins.

♂: Body length 5.5 mm. Flagellum with 35 flagellomeres. Temple shortly parallel behind eye, moderately narrowed apically. Distance of lateral ocellus to eye 1.1x ocellar width. Face densely rugose-punctate, width 1.1x length of clypeus+face and 0.9x eye length. Clypeus punctate. Malar space 0.4x as long as width of mandibular base. Hind femur 5.4x longer than wide; hind metatarsus 0.48x as long as hind tibia; hind claw with 4 basal teeth. 1<sup>st</sup> tergite 2.9x longer than wide; postpetiolus with distinct longitudinal striae. 2<sup>nd</sup> tergite 1.1x longer than wide. Clasper long, measured without basal body c. 1.7x longer than 2<sup>nd</sup> hind tarsomere, stab-shaped, slightly clubbed apically. Structure otherwise as described for the ♀.

Colour: Face reddish, darkened below antennal grooves. Pronotum largely reddish; mesopleuron reddish dorsally and with diffuse dark reddish suffusion ventrally; mesoscutum reddish, with one antero-medial and two lateral black stripes. Metasoma black; 2<sup>nd</sup> tergite with narrow cream-yellow apical margin; epipleura of 2<sup>nd</sup> and 3<sup>rd</sup> tergites reddish; median folds of 2<sup>nd</sup> to 6<sup>th</sup> sternites cream-yellow. Legs reddish; hind tibia yellowish, blackish in apical 0.1 (1x tibial width); distal tarsomeres brown. Pterostigma ochreous, with brownish margins. Colouration otherwise as described for the ♀.

**R e m a r k :** This species belongs to the *angustatus*-group of *Mesochorus* sensu SCHWENKE (1999) (e.g. all tergites black). It is characterized by the densely rugose-punctate face, densely punctate mesopleuron, and characteristic colouration of mesosoma. In the key of Nepalese *Mesochorus* species (KUSIGEMATI 1988), it runs to *M. nepalensis* KUSIGEMATI and *M. interruptus* KUSIGEMATI, but differs by the above mentioned features.

### ***Mesochorus weigeli* nov.sp. (figs 13-19)**

**H o l o t y p e :** (♂) Nepal, P: Mahakali, D: Darchula, Denli village, 2400 m, 27.VI.2017, LDD, leg. A. Weigel, # 17-15, 29°48'45''N, 80°47'0''E (Erfurt)

**P a r a t y p e :** (♂) with same data (coll. Riedel).

**D e s c r i p t i o n :** ♂: Body length 3.5-3.7 mm. Flagellum with 29-31 flagellomeres; 1<sup>st</sup> flagellomere length 7.5-7.8x width and 0.71x eye length; 2<sup>nd</sup> flagellomere length 4.8-5.0x width; preapical flagellomere c. 2x longer than wide. Temple strongly and roundly narrowed behind eye, dorsally c. 0.35x as long as eye. Distance of lateral ocellus to eye 1.0-1.1x ocellar diameter. Vertex and frons with fine scattered punctures. Face densely punctate, with weak central rim in dorsal half, 1.0x as wide as length of face+clypeus and 0.9x as wide as eye length; inner eye margins parallel. Subantennal transverse carina dipped medially. Ventral 1/3 of facial orbit and malar space with oblique striae. Clypeus

with scattered punctures. Malar space 0.5x as long as width of mandibular base. Mandible with two equal teeth. Genal carina reaching hypostomal carina away from mandibular base, both carinae low.

Mesoscutum with superficial punctures, apico-medially with dense and longitudinal rugose-punctuation. Mesopleuron with fine dense punctures dorsally and scattered setiferous punctures ventrally, speculum smooth. Metapleuron with finer dense punctures. Scutellum without lateral carina or apical tubercle, rounded in profile. Propodeum completely carinate. Area basalis shortly triangular, with long apical stalk. Area superomedia 1.6x longer than wide and 1.2x longer than area petiolaris; costula reaching area superomedia in its frontal 0.3. Area petiolaris 1.1-1.2x longer than wide, smooth. Hind femur 4.8-5.2x longer than wide; hind metatarsus 0.5x as long as hind tibia; hind claw with 3 basal and widely spaced teeth, 2<sup>nd</sup> tooth longest.

Areolet quadrangular, shortly sessile; 2<sup>nd</sup> recurrent vein in its middle. Nervulus interstitial. Pterostigma c. 3.6x longer than wide. Nervellus of hind wing slightly reclivous, not intercepted; discoidella absent.

1<sup>st</sup> tergite 3.1x longer than wide. Postpetiolus with coarse striation, without lateral carina. 2<sup>nd</sup> tergite 1.05x wider than long; thyridium transversely oval. Ovipositor sheath completely pilose, 6.8-7.5x longer than wide and 0.95-1.0x as long as hind metatarsus, moderately narrowed in apical 0.25.

Colour: Mainly reddish. Antenna reddish-brown. Head reddish; stemmaticum and occiput partly black; palps, mandible except teeth and malar space cream-yellow. Mesosoma reddish; two lateral stripes and one small anteromedial spot on mesoscutum, pronotum centrally, propleuron, mesopleuron and metapleuron blackish. Metasoma reddish; 1<sup>st</sup> tergite brown to black, red basally; 2<sup>nd</sup> tergite brown or black, ± reddish centrally, with narrow apical yellow band; following tergites reddish, ± brown laterally. Legs reddish; fore and mid coxae and all trochanters cream-yellow; hind coxa and hind femur with brownish-red suffusion; hind tibia cream-yellow, narrow base and subbasal ring weakly infuscate, apical 0.2 blackish (1.5x tibial width). Pterostigma brown, proximally and distally hyaline.

♂ unknown.

**R e m a r k :** This species belongs to the *declinans*-group of *Mesochorus* (sensu SCHWENKE 1999). It is characterized by the stalked area basalis, partly rugose-punctate surface of mesoscutum, strongly striate postpetiolus, and pectination of hind claw. In the key of Nepalese *Mesochorus* (KUSIGEMATI 1988), it runs to *M. nepalensis* KUSIGEMATI and *M. interruptus* KUSIGEMATI, but differs by many features, such as the surface structure of mesoscutum, striated postpetiolus, stalked area basalis and different colouration.

### Acknowledgement

I thank Dr. Jochen Müller (Jena/Germany) who sorted the Nepalese Mesochorine material from the Naturkundemuseum Erfurt/Germany for further studies and Matthias Hartmann (Erfurt/Germany) who kindly sent the material for determination.

### Zusammenfassung

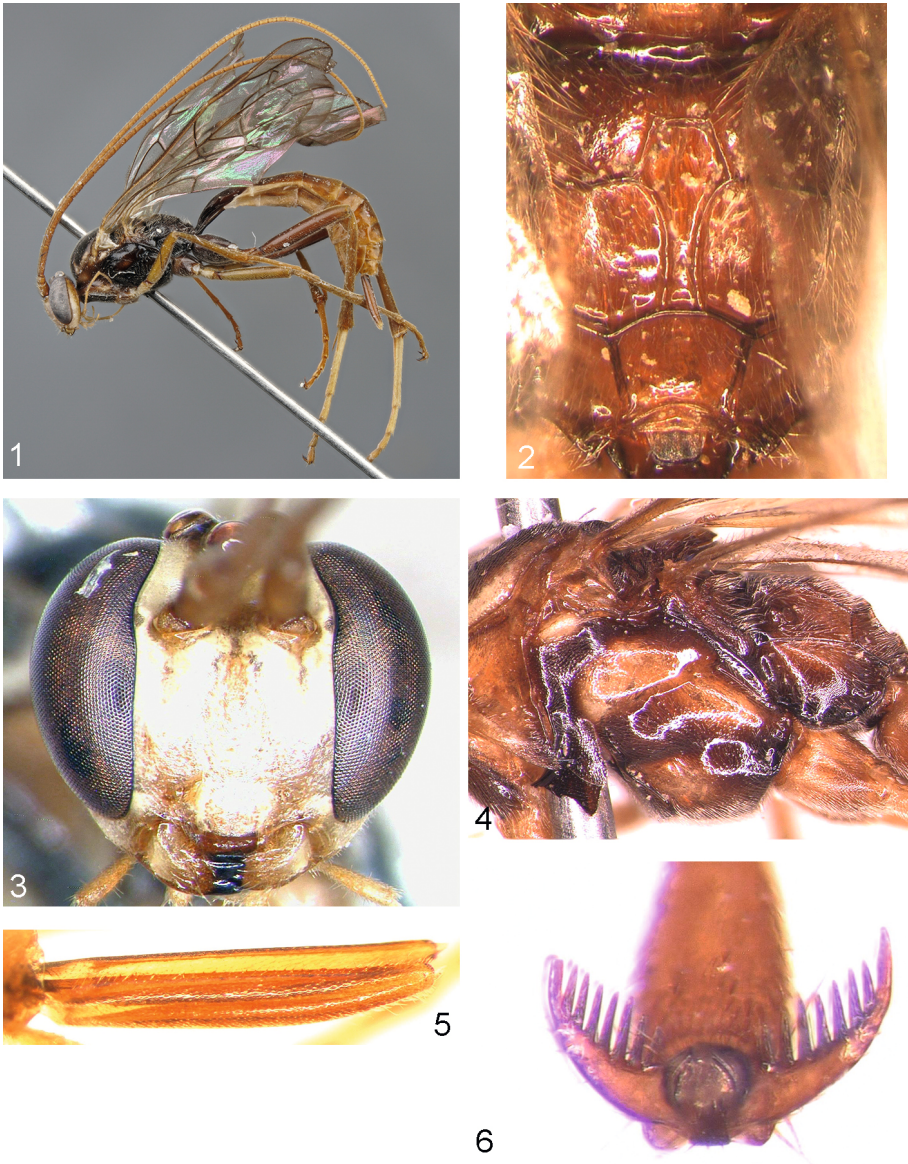
In der vorliegenden Arbeit werden vier neue Arten der Subfamilie Mesochorinae (Hymenoptera, Ichneumonidae) aus Nepal beschrieben: *Astiphromma flavitarsis* nov.sp., *Astiphromma himalayaensis* nov.sp., *Mesochorus rufoscutellaris* nov.sp. und *Mesochorus weigeli* nov.sp.

Für diese neuen Arten werden ausführliche Beschreibungen, Abbildungen, und Differentialdiagnosen zu den bisher bekannten nepalesischen Mesochorinen gegeben.

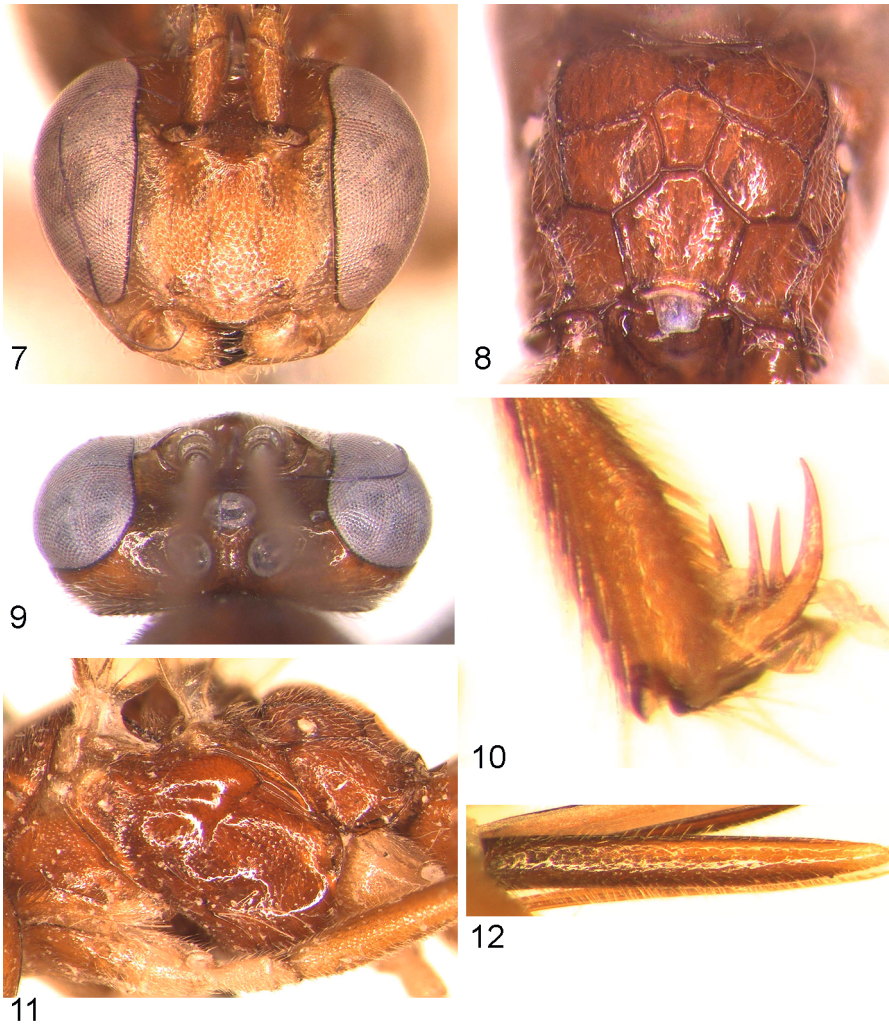
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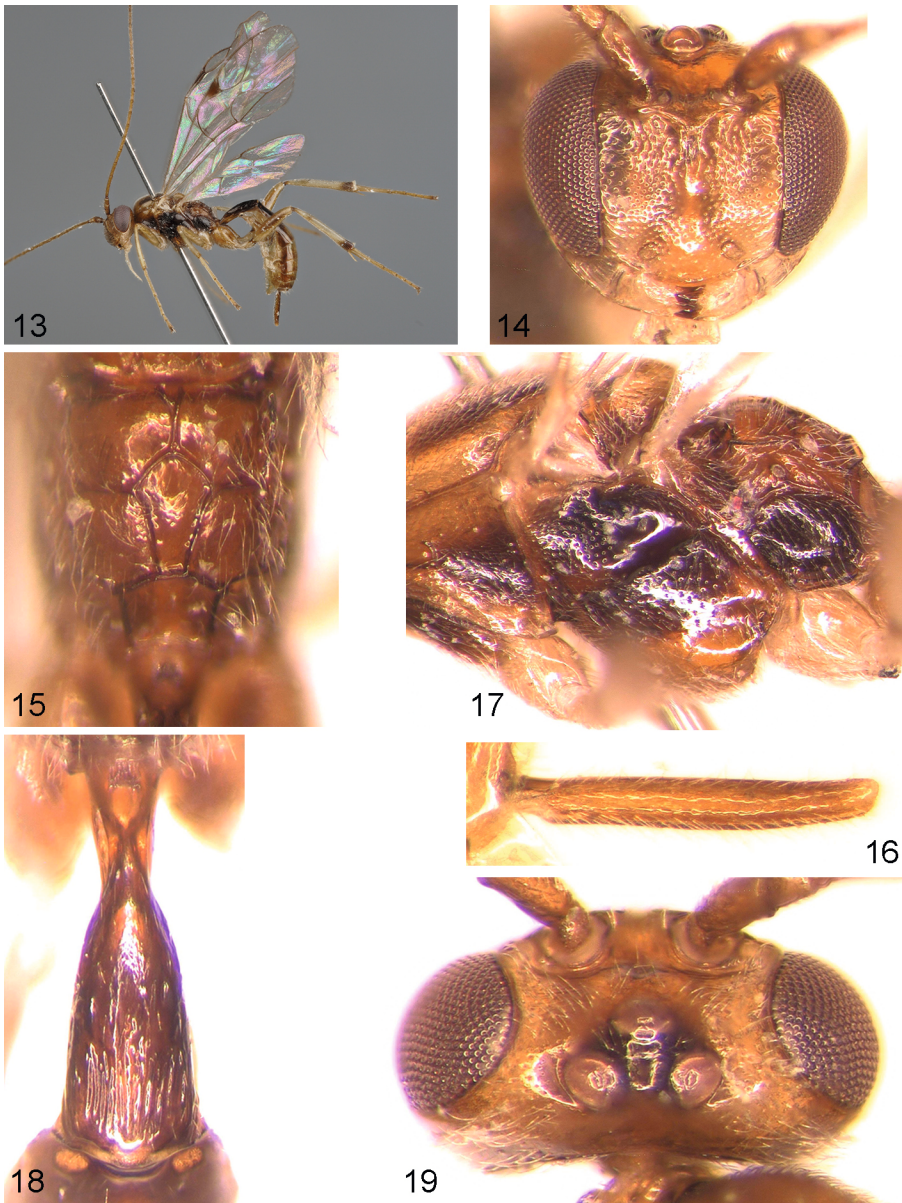


**Figs 1-6:** *Astiphromma flavitarsis* nov.sp. ♀: (1) habitus, (2) propodeum, (3) face, (4) mesopleuron, (5) ovipositor sheath, (6) hind claw.

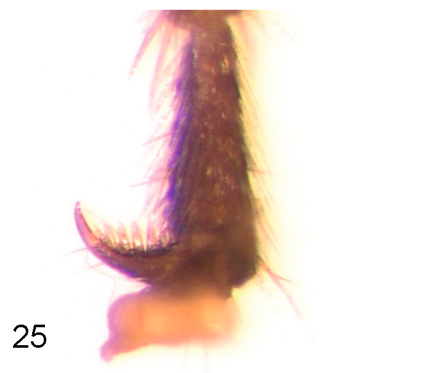
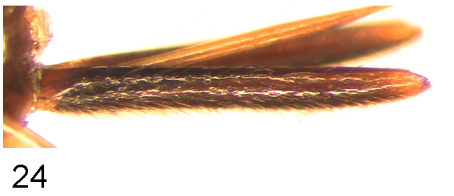
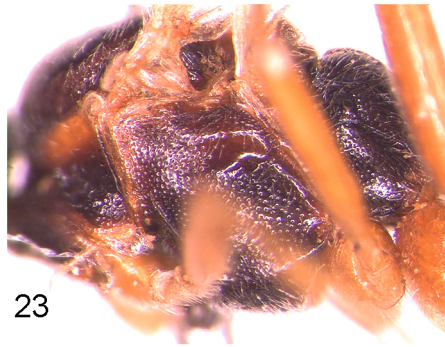


**Figs 7-12:** *Astiphromma himalayaensis* nov.sp. ♀: (7) face, (8) propodeum, (9) head from dorsal, (10) hind claw, (11) mesopleuron, (12) ovipositor sheath.





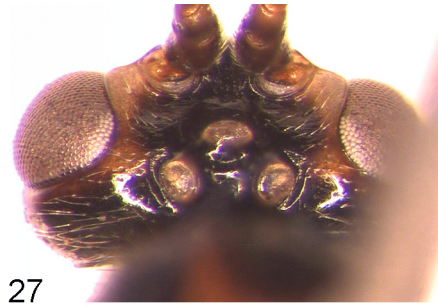
**Figs 13-19:** *Mesochorus weigeli* nov. sp. ♀: (13) habitus, (14) face, (15) propodeum, (16) ovipositor sheath, (17) mesopleuron, (18) postpetiolus, (19) head from dorsal.



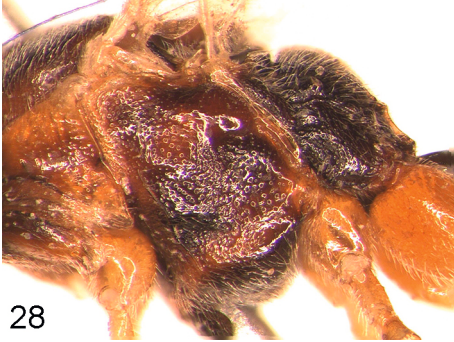
**Figs 20-25:** *Mesochorus rufoscutellaris* nov.sp. ♀: (20) habitus, (21) face, (22) propodeum, (23) mesopleuron, (24) ovipositor sheath, (25) hind claw.



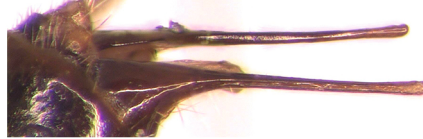
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**Figs 26-29:** *Mesochorus rufoscutellaris* nov.sp. ♂: (26) face, (27) head from dorsal, (28) mesopleuron, (29) stylets.



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