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Chalcidid parasitoids (Hymenoptera, Chalcididae) of *Phereoeca uterella* (Walsingham) (Lepidoptera, Tineidae): description of a new species and the male of *Epitranus uterellophagus* from southern India

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Abstract *Neohaltichella uterellophaga* Binoy, **sp. nov.** (Hymenoptera: Chalcididae: Haltichellinae) parasitizing the pupa of household-case bearer moth *Phereoeca uterella* (Walsingham) is described with illustrations from southern India (Kerala). Host record for the genus *Neohaltichella* on Tineidae (Lepidoptera) is newly recorded. A male specimen of *Epitranus uterellophagus* Binoy & Santhosh hitherto unknown is also described with illustrations parasitizing case-bearer moth pupa.

Introduction

Household case-bearer moth *Phereoeca uterella* (Walsingham) is a small moth in the lepidopteran family Tineidae represented by four species worldwide (Heppner, 2005). Often misrepresented and named as plaster bagworm due to the erroneous idea that the larvae feed on plaster or even after their habitat (clinging to the plaster), these are small synanthropic moths feeding mainly on various detritus, such as spider webs and webbing of primitive insects and associated debris. They are often quite common and perhaps when in household situations they may occasionally feed on natural fibres or clothing. In nature they are commonly found in crevases on the bark of large trees or logs, feeding on webbings of Psocoptera and spiders, and other debris including old cases from previous generation (Hetrick, 1957). Other than being unsightly clinging onto walls of human dwellings, they are not reported to cause any major economic concern (except for rare cases of feeding on household fibres) (Heppner, 2005). The larvae of *P. uterella* like other members of the genus, make silken cases covered with sand grains or other fine debris, into a flattened, wider in the middle shaped grey coloured cases with openings on either ends. The case also serves in concealing the further pupal cocoon and he adult emerges through either of the exits (Fig. 33: *ext*). Even after a century of description, the limits and distribution of the species is still unclear. Originally described from St. Thomas, Virgin Islands as *Tineola uterella* (Walsingham, 1897), the species was commonly identified under *Phereoeca dubitatrix* (Meyrick) and more often as *Tineola walsinghami* Busck until the identity was

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clarified with synonymy under *P. uterella* by Robinson & Nielsen (1993).

Neohaltichella Narendran (Chalcididae: Haltichellinae) is a small genus of Oriental chalcid wasps represented by only four species till date (three from India and one from Philippines) (Narendran, 1989). With the exception of *N. thresiae* Narendran (represented by two female specimens), all other species are represented by singleton females. No valid report on host association is available till date for the genus.

Hymenopteran parasitoids *Apanteles carpatus* (Say) (Braconidae: Microgastrinae), *Lymeon orbum* (Say) (Ichneumonidae: Cryptinae) and *Epitranus uterellophagus* Binoy & Santhosh (Chalcididae: Epitraninae) are reported to parasitize the moth in its larval and pupal stages (Hetrick, 1957; Binoy et al., 2021). Recent observation on the host (moth) species yielded a new species of *Neohaltichella* Narendran *viz*, *N. uterellophaga* Binoy, **sp. nov.**, parasitizing the pupa of household case-bearer moth *P. uterella* from southern India. The new species is described with illustrations and compared with congener. Host association of the genus is validated for the first time. The hitherto unknown male of *Epitranus uterellophagus* Binoy & Santhosh is also described with illustrations.

Materials and methods

The specimens of the new species and *Epitranus uterellophagus* were retrieved from pupal cases of case-bearer moths collected from Kozhikode district in Kerala, India. Specimens emerging from the pupae were transferred to 70% ethyl alcohol and later dried, and card mounted on triangular cards. The specimens were studied under Leica M205A Stereozoom microscope and images of the new species were captured using a Leica DFC 2900 digital camera attached to the microscope. Measurements of the specimens were obtained using Leica LAS (Leica Application Suite V4.7.1) microsystems by Leica (Heerburg, Switzerland). Images at varying focal planes were stacked into a single image using Leica Automontage Software V4.2 and final illustrations were post-processed for contrast and brightness using Adobe® Photoshop® CS5 (Version 12.0 ×64). The emerged moth specimens were also collected, killed, spread and imaged. The type specimens of the new species are deposited in the National Zoological Collections of the Zoological Survey of India, Western Ghat Regional Centre, Kozhikode(ZSIK), Kerala state.

The terms used are from the Hymenoptera Anatomy Consortium (2021). The nomenclature for cuticular sculpture follows Harris (1979). Abbreviations of terms used are as follows: $\mathbf{fl}_x$ = flagellomere number; $\mathbf{Gt}_x$ = gastral tergum number; **LOD**= diameter of median ocellus; **OOL** = oculo-ocellar distance, minimum distance between a posterior ocellus and eye; ***pmv***= postmarginal vein; **POL** = postocellar distance, the distance between the two posterior ocelli; ***pst***= parastigma; ***smv***= submarginal vein; ***stv***= stigmal vein.

Measurements. The 'height of the head' is the distance from the visible dorsal apex to the anterior clypeal margin, the 'length of the malar space' is the distance from the lower eye margin to the lateral corner of the oral fossa (base of mandible). In dorsal view, 'length of head' is the maximum distance from outer margin of one eye to the outer margin of the other, the width of head is measured from anterior margin of compound eye till the posterior most visible point of the occiput. All measurements are in millimetres unless noted otherwise.

Repository abbreviation: **QMB**: Queensland Museum, Brisbane, Australia; **ZSIK:** National Zoological Collections of the Zoological Survey of India, Western Ghat Regional Centre, Kozhikode.

SYSTEMATIC TREATMENT

Chalcididae Latreille, 1817

***Neohaltichella* Narendran, 1989**

Neohaltichella Narendran 1989: 156. Type species: *Neohaltichella thresiae* Narendran, 1989: 157, by original designation. [**QMB**].

***Neohaltichella uterellophaga* Binoy, sp. nov.**

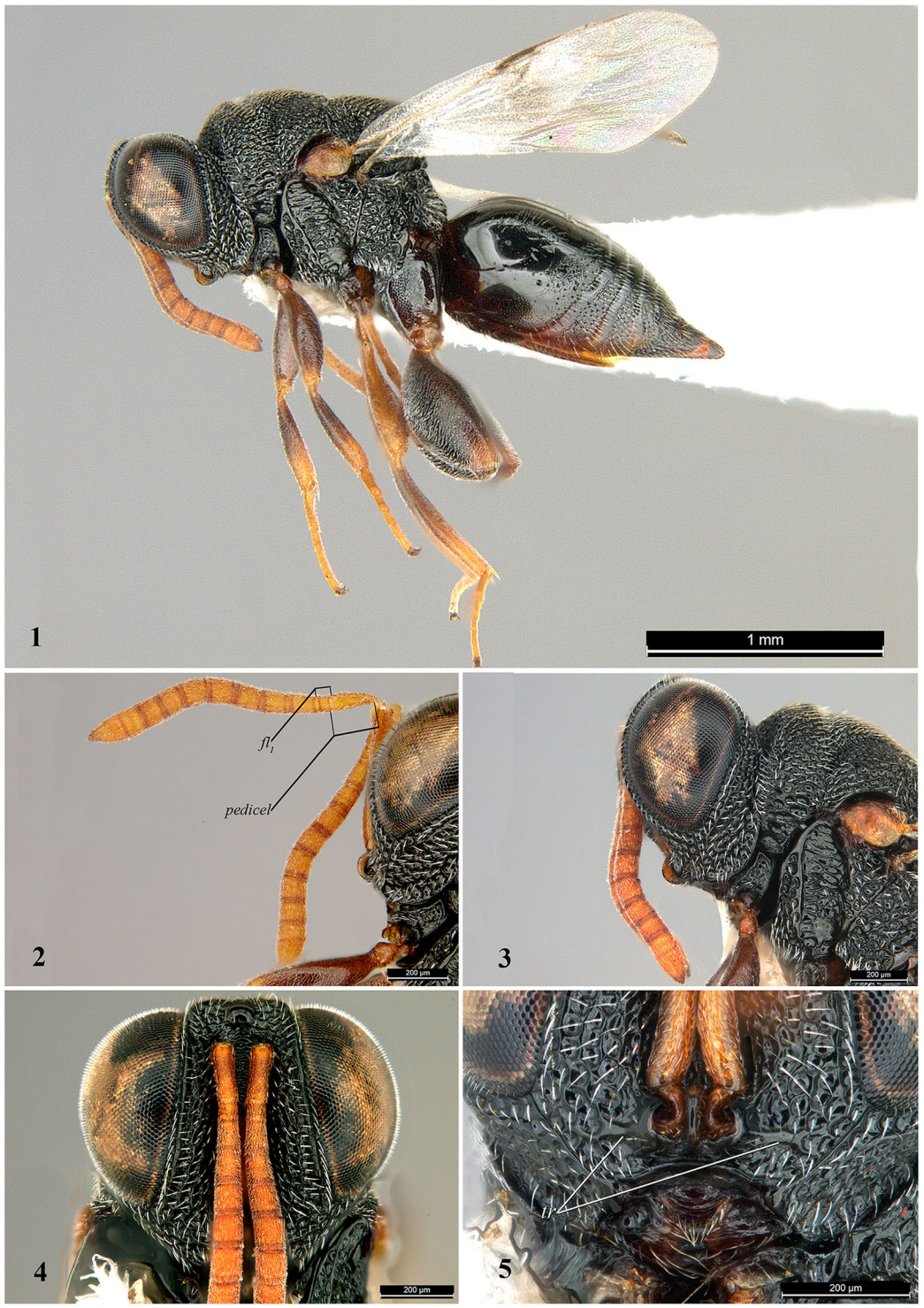
LSID urn:lsid:zoobank.org:act:A72D013B-FD7E-40FF-A7BB-58C6627548D4

(Figs 1–22)

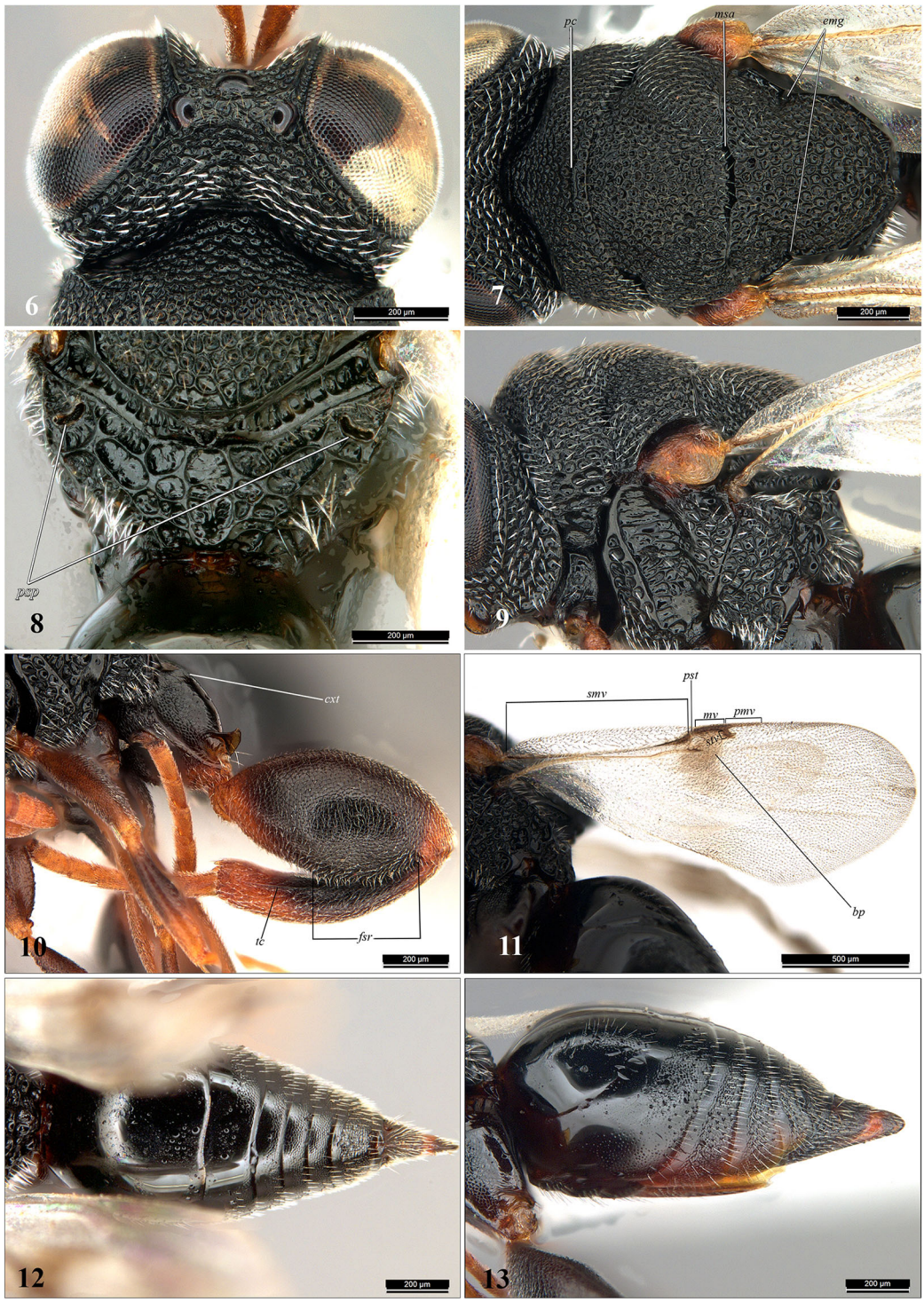
Type-host: Pupa of household case-bearer moth *Phereoeca uterella* (Walsingham) (Lepidoptera: Tineidae) (Figs 33–37).

Type-locality: India: Kerala, Kozhikode district, Malabar Christian College Campus (11°15′50.4″N & 75°46′42.4″E, 18m above sea level), Coll. C. Binoy.

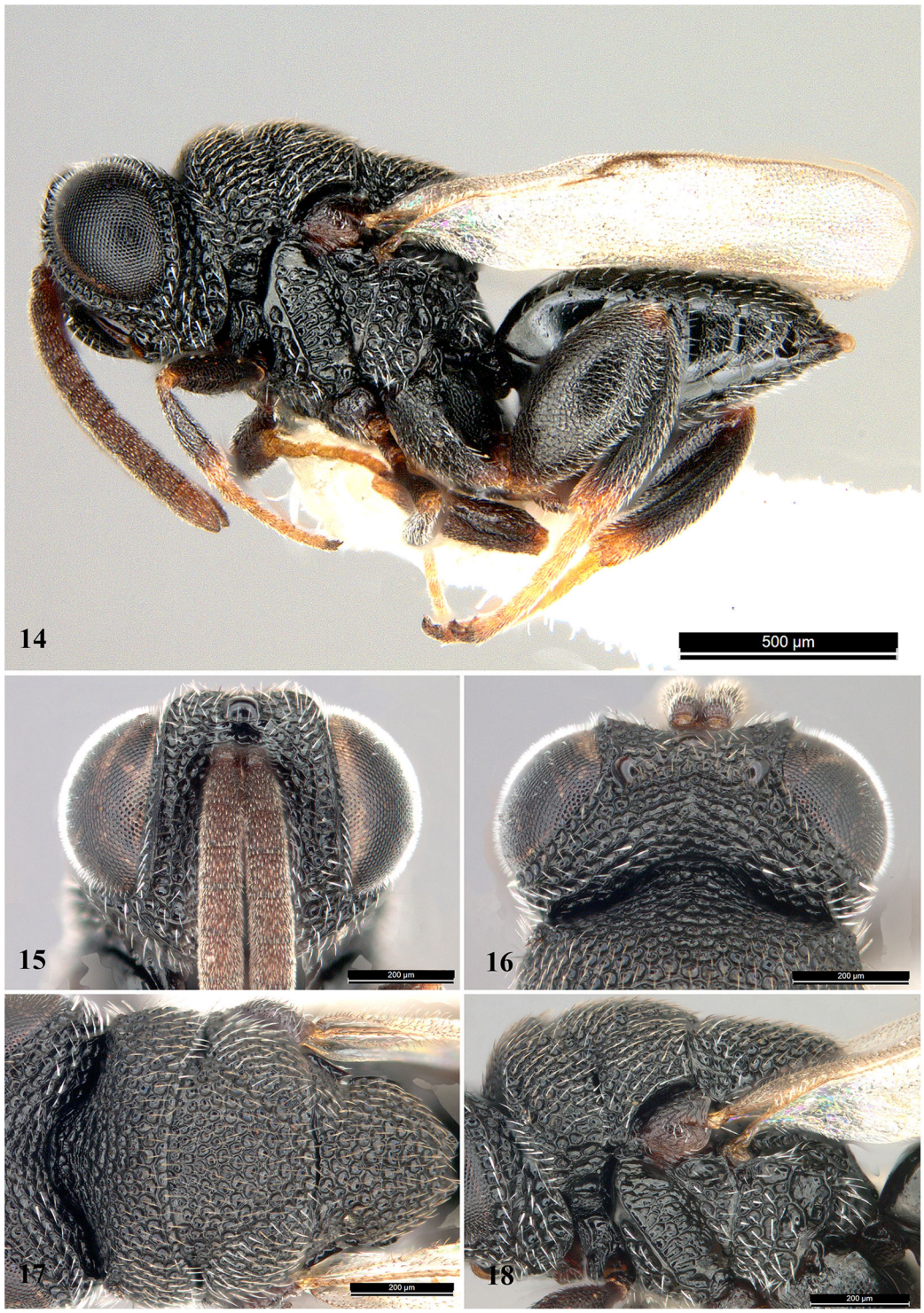
Type-material: Holotype ♀. Paratypes: 10 ♀, 16 ♂ from the same host species and locality. date of emergence:



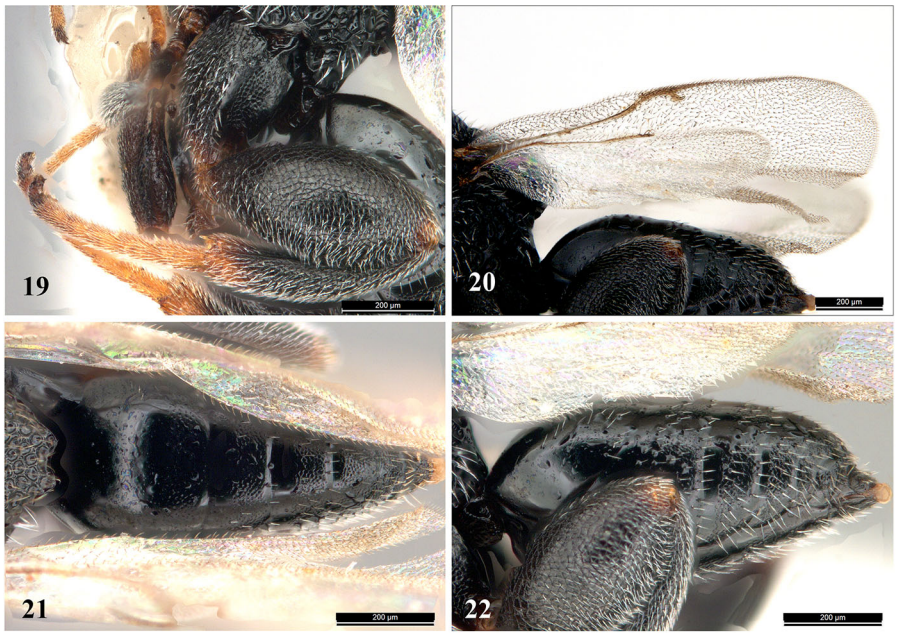
Figures 1-5 *Neohaltichella uterellophaga* Binoy, **sp. nov.** Holotype ♀. 1, habitus, lateral view; 2, antenna; 3, head, lateral view; 4, head, frontal view; 5, lower face, frontal view.



Figures 6-13 *Neohaltichella uterellophaga* Binoy, **sp. nov.** Holotype ♀. 6, head, dorsal view; 7, mesosoma, dorsal view; 8, propodeum; 9, mesosoma, lateral view; 10, Hind leg; 11, fore wing; 12, metasoma, dorsal view; 13, metasoma, lateral view.



Figures 14-18 *Neohaltichella uterellophaga* Binoy, **sp. nov.** Paratype ♂. 14, habitus, lateral view; 15, head, frontal view; 16, head, dorsal view; 17, mesosoma, dorsal view; 18, mesosoma, lateral view.



Figures 19-22 *Neohaltichella uterellophaga* Binoy, **sp. nov.** Paratype ♂. 19, hind leg; 20, fore wing; 21, metasoma, dorsal view; 22, metasoma, lateral view.

Holotype: 08.i.2020, Paratypes: 2♂, 2♀ 08.i.2020; 1♂ 03.viii.2020; 1♀ 12.vii.2020; 1♀ 21.viii.2020; 1♂ 01.ix.2020; 6♀, 12♂ 04.ii.2021–16.iv.2021.

Depositories: Holotype ♀ **[ZSIK]** ZSIK Regd. No. ZSI/WGRC/IR/INV.19038, 10 ♀, 16♂ paratypes — **[ZSIK]** ZSIK Regd. No. ZSI/WGRC/IR/INV.19039–19064.

Etymology: The specific name in female gender is derived from the scientific name of the host species.

Diagnosis. Pedicel long, distinctly longer than fl_1 (Fig. 2); metasoma longer than mesosoma (1.4×) (Fig. 1); fore wing with a brown infuscation adjoining *mv* and *pmv* 1.1× *mv* (Fig. 11); genotemporal furrow indistinct; maximum length of eye in profile little less than 4.0× length of malar space (Fig. 3); scutellum with lateral margin distinctly carinate (Fig. 7); propodeum with large irregular lozenge shaped fovea (Fig. 8); hind coxa with a weak dorso-basal tubercle like projection (Fig. 10: *cxt*); hind femur without an inner basal tooth; Gt_1 smooth on dorsal disc, microsculptured laterally; Gt_6 rugose reticulate, epipygium longitudinally carinate (Fig. 12).

Description

Holotype, ♀ (Figs 1–13). Body length 6.01 mm.

Colour. Black with following parts variously coloured: antennomeres yellowish brown; tegula pale brown; all coxae deep brown, apex pale; fore and mid femora brown on outer surface, inner surface and apex testaceous; fore and mid tibiae dark brown with apical third pale brown; hind femur deep brown with base and apex reddish brown; hind tibia brown with base and apical third pale reddish brown; all tarsi testaceous to reddish brown; metasoma black with Gt_2–Gt_5 reddish brown ventro-laterally; ovipositor sheath with a red spot latero-basally (Fig. 13).

Head. In dorsal view 1.9× as wide as long (Fig. 6); in frontal view 1.2× as wide as high; scrobe moderately excavated, foveolate with thick appressed white bristles; parascrobal area transversely reticulate, reaching median ocellus; preorbital carina strongly indicated, running beyond median ocellus (Fig. 4); lower face with transverse ridge (Fig. 5: *tr*) from outer torular margin running towards malar sulcus, branching and obsolete posteriorly; interantennal projection small, as long as radicle; antennal toruli closely place, only separated by interantennal projection (Fig. 4); eye distinctly setose, 3.1× as high as malar space in profile; fronto-genal sulcus distinct, carinate; post orbital carina conspicuously indicated, running along outer eye margin enclosing a row of setigerous fovea,

meeting beyond posterior ocelli (Figs 3, 4); OOL vestigial, POL more than 10.0× (12.9×) OOL; LOD 0.5 × POL (Fig. 6); antennal radicle small, distinctly curved; scape long, not reaching median ocellus; pedicel 4× as long as fl_1; terminal flagellomere (clava) two segmented; relative lengths of scape: pedicel: flagellomeres (I–X)= 12: 4: 1: 2: 2: 2: 2: 2: 2: 2: 2: 3 (Fig. 2).

Mesosoma. Pronotum, mesoscutum and scutellum with dense round umbilicate setigerous punctures; interstices narrow, shiny, carinate; pronotal collar laterally carinate, obsolete medially, an indistinct carina (Fig. 7: *pc*) along posterior margin enclosing a row of punctures; lateral lobe of mesoscutum distinctly bulging, similarly sculptured as mesoscutum with white setae; mid-lobe of mesoscutum with brown setae; axilla with similar sculpture, posterolateral margin sharply emarginated inward, discontinuous from lateral margin of scutellum (Fig. 7: *emg*); anterior margin of scutellum with narrow smooth median area (Fig. 7: *msa*), lateral margin carinate, dorsum with larger punctures with brown setae, apically emarginate, forming two blunt teeth like projections (Figs 7, 8); dorsellum wide, foveolate; propodeum with large irregular lozenge shaped fovea, propodeal spiracle (Fig. 8: *psp*) bean-shaped, subhorizontal; mesopleura with medial area shiny having transverse irregular rugae flanged by densely punctate area on either side; metapleura with conspicuous setigerous areola, posterior margin carinate (Fig. 9).

Legs. Fore and mid femora slightly enlarged, fine serrations on ventral side, surface reticulate; hind coxa markedly reticulate ventrally, faintly setose, dorso-basally smooth, shiny with weak dorso-basal tubercle (Fig. 10: *cxt*); hind femur engraved reticulate with dense setigerous micropunctures, finely serrated on apical third (Fig. 10: *fsr*); hind tibia moderately setose, with a distinct carina on the outer surface, not reaching the apex (Fig.10: *tc*).

Wings. Fore wing length 3.26 mm; subhyaline with moderate brown setosity; distinct linear brown patch (Fig. 11: *bp*) adjoining *mv* (till midlength of wing); *pst* obsolete, concolourous; relative measurements of *smv*: *mv*: *stv*: *pmv*= 35: 6: 6: 2 (Fig. 11).

Metasoma. Distinctly longer than mesosoma (1.4×); Gt_1 smooth anteriorly, microsculptured laterally; Gt_2–Gt_4 polished at anterior margin, posteriorly and laterally shagreened to reticulate with distinct setosity; Gt_5 and Gt_6 rugose reticulate; epipygium with median carina; ovipositor sheath visible dorsally (Figs 12, 13).

Male. Paratype, ♂ (Figs 14–22). Body length 6.01 mm, fore wing length 3.26 mm**.**

Description

Black with following parts variously coloured: antenna stout, compact, liver brown with distinct multi-porous plate sensilla; relative lengths of scape: pedicel: flagellomeres (I–XI)= 9.6: 1.6: 1.3: 2.9: 2.8: 2.8: 2.9: 2.7: 2.6: 4.5; hind coxa entirely engraved reticulate (Fig. 19); sculpture on head, mesosoma and metasoma similar to female.

Remarks

Neohaltichella uterellophaga **sp. nov.** resembles the Indian species *N. thresiae* Narendran in the key to world species of *Neohaltichella* (Narendran, 1989) in having POL more than 10.0× OOL, pedicel longer than fl_1; brown infuscation adjoining *mv*, hind femur without an inner basal tooth, Gt_1 without any basal carina; epipygium with a median carina. However, *N. uterellophaga* **sp. nov.** can be differentiated from *N. thresiae* in having Gt_1 smooth (in *N. thresiae* Gt_1 with microsculptures on disc); length of eye 2.9× length of fronto-genal sulcus in profile (in *N. thresiae* length of eye less than 2.5× length of fronto-genal sulcus in profile); antenna throughout yellowish brown (in *N. thresiae* antenna with red and black colour pattern); genotemporal furrow carinate (in *N. thresiae* genotemporal furrow indistinct); propodeum areolate (in *N. thresiae* propodeum with distinct submedian and lateral carinae).

Prey. Pupae of household case-bearer moth *Phereoeca uterella* (Walsingham) (Lepidoptera: Tineidae) (Figs 33–37).

Distribution. India: Kerala.

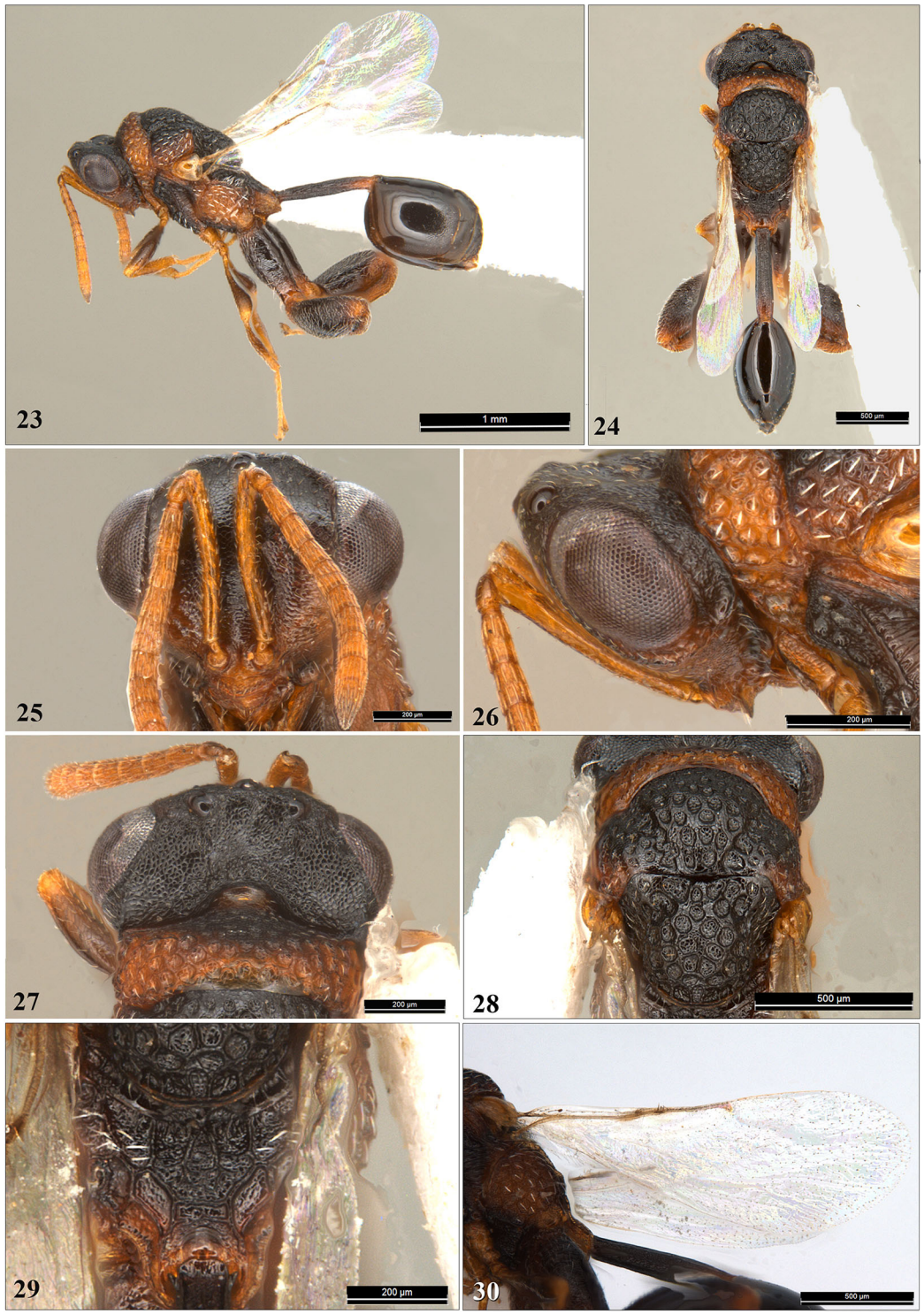
Genus *Epitranus* Walker, 1834

Epitranus Walker, 1834: 21, 26. Type species: *Epitranus fulvescens* Walker, by monotypy.

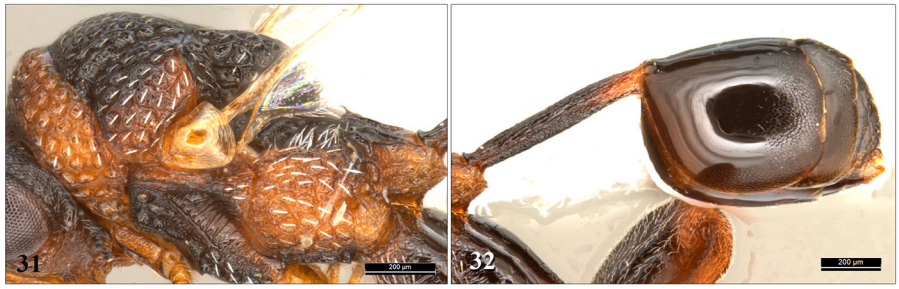
Epitranus uterellophagus Binoy & Santhosh, 2020

Epitranus uterellophagus Binoy & Santhosh, in Binoy et al. (2021): 3. Holotype ♀, India (Kerala).

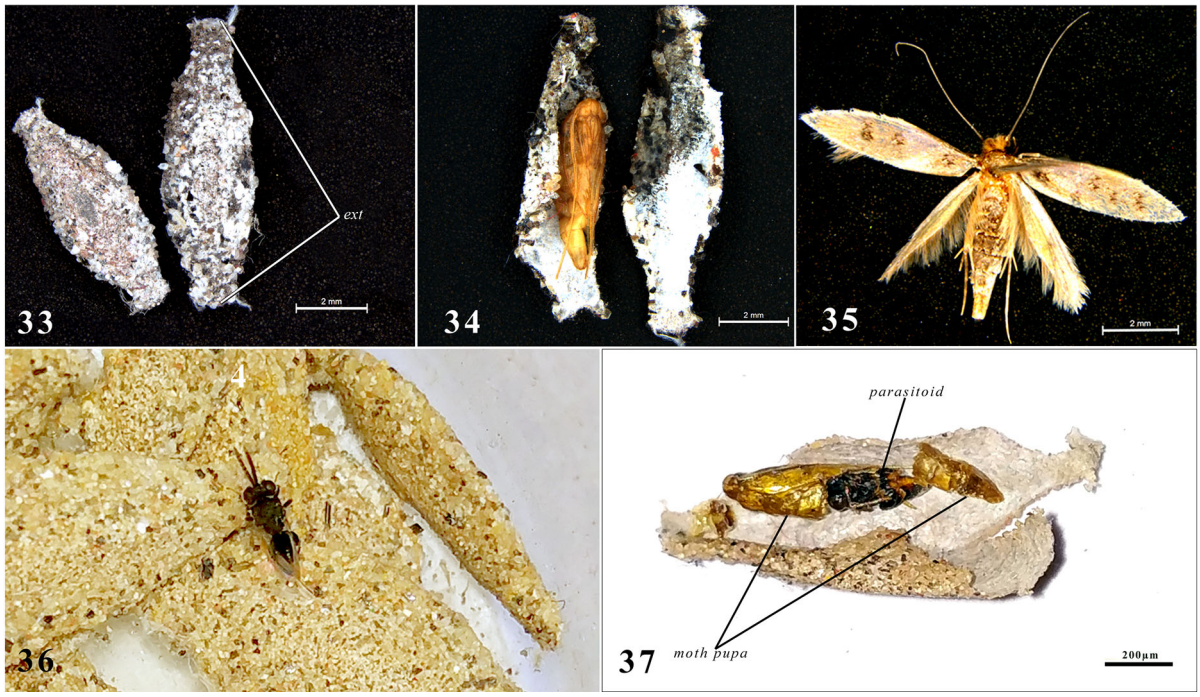
(Figs 23–32



Figures 23-30 *Epitranus uterellophagus* Binoy & Santhosh ♂. 23, habitus, lateral view; 24, habitus, dorsal view; 25, head, frontal view; 26, head, lateral view; 27, head, dorsal view; 28, mesosoma, dorsal view; 29, propodeum; 30, fore wing.



Figures 31-32 *Epitranus uterellophagus* Binoy & Santhosh ♂. 31, mesosoma, lateral view; 32 Metasoma, lateral view.



Figures 33-37 *Phereoeca uterella* (Walsingham, 1897). 33, larval case; 34, moth pupa within the case; 35, adult moth; 36 *Neohaltichella uterellophaga* **sp. nov.** adult female, host searching; 37, adult parasitoid in dissected moth pupa.

Material Examined: 1 ♂ 2♀ , India: Kerala, Kozhikode district, ZSIK Campus, Jafferkhan Colony (11°15'50.0"N & 75°47'12.0"E, alt 18m above sea level), 20.iii.2021, coll. K. S. Surya, ex. pupa of *Phereoeca uterella* (Walsingham), [**ZSIK**] ZSIK Regd. No. ZSI/WGRC/IR/INV.17630–17632.

Diagnosis. Interantennal carina shallow (Fig. 25); clypeal shield dorsally concave; pronotum and mesoscutum dorsally with coarsely granulate setaceous pits and wide imbricate interstices (Fig. 28); propodeum with sublateral carina converging onto a granulate median area in anterior half not extending beyond and not meeting adpetiolar carina, with longitudinally radiating carinae (Fig. 29); hind femur ventrally with basal large tooth followed by nine black teeth; metasoma subglobose; Gt_1 smooth with posterior third and ventrally engraved reticulate; ovipositor sheath visible dorsally in female.

Description

Male (hitherto unknown) (Figs 23–32). Body length 2.84–2.91 mm, fore wing length 1.78–1.84 mm.

Sexual dimorphism. Following part variably coloured from female: head brownish black (except lower face pale brown); pronotum anteriorly brownish

black, remainder brown; mesoscutum brownish black; fore and mid femora dark brown with apex paler; hind coxa dark brownish black, brown apically; hind femur brownish black with base and apex pale brown, outer and inner disc with dense white setae; metasoma brownish black with pale brown tinge basally; head in frontal view with impressed reticulate to imbricate; petiole 7× as long as maximum dorsal width, slightly arching (Fig. 32).

Prey. Pupae of household case-bearer moth *Phereoeca uterella* (Walsingham) (Lepidoptera: Tineidae) (Figs 33–37).

Distribution. India: Kerala.

Discussion

Members of *Neohaltichella* are all tropical in distribution, within the limits of the Oriental region. Prior to this study, only four species of *Neohaltichella* were described *viz. N. brevigena* (India: Tamil Nadu), *N. nilgirica* (India: Tamil Nadu), *N. nitigastra* (Philippines: Northern Mindanao), *N. thresiae* (India: Kerala) (all by Narendran, 1989). Till date no data on host association for the genus is recorded. The present study provides the first valid host association for the genus on Lepidoptera, Tineidae.

Phereoeca Hinton & Bradley is a small genus of tropical tineid moths, the larvae of which are case making scavengers that feed on animal hair and dead insects (Aiello, 1979). All species of *Phereoeca* are presumed to have a similar biology and larval case form associated with human dwellings, but little is known concerning their biology or distribution of these moths. Adults of most species are not much attracted to light and are seldom found in collections. Fletcher (1914) reported damage by "plaster bagworm" in India, but this has been confirmed to be a misidentification of a species of true clothe moth genus *Tinea*. The case bearer moth species, *P. uterella* enjoys a much cosmopolitan distribution in the tropical countries and also in temperate climatic conditions with high humidity (Hetrick, 1957; Heppner, 2005). These however causes no economic concern in its life traits, other than being unsightly, are found clinging onto walls. There have been persistent remarks that larvae have been found feeding on woollens and furs (Mallis, 1990), but may seem to be mere misidentification of true clothes moths, and not the case bearer (Heppner, 2005). These feed mainly on debris associated with spider webs, but also are found to act as opportunistic feeders, particularly in instances of high larval density cannibalizing on other larval cases to re-ingest the case materials. They are not readily seen out in the nature and always found associated to human settlements and urban habitats. This has never ceased or proved a hindrance to the biology of the species and have become semi-domesticated to human environments. Parasitoids reported along with the case-bearer moth are found to complete their life cycle and repeat their generations within these confined spaces, associated with the moth species.

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Authors' contributions NA.

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Availability of data and material NA.

Code availability NA.

Declarations

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Aiello, A. (1979). Life history and behavior of the case-bearer *Phereoeca allutella* (Lepidoptera: Tineidae). *Psyche* (Cambridge, Ma), 86, 125–136.

Binoy, C., Santhosh, S., Nasser, M. & Jyolsna, K. (2021). A new report on the parasitisation of *Epitranus* Walker (Chalcidoidea: Chalcididae) on *Phereoeca uterella* (Walsingham) (Lepidoptera: Tineidae) with the description of a new species from India. *Oriental Insects*. 55(4): 475–483. https://doi.org/10.1080/00305316.2020.1838965.

Fletcher, T. B. (1914). *Some South Indian insects and other animals of importance considered especially from an*

economic point of view. Madras Ministry of Agriculture. Madras Government Press, India, 23, 565 pp.

Harris, R. A. (1979). A glossary of surface sculpturing. *Occasional Papers in Entomology*, 28, 1–31.

Heppner, J. B. (2005) Notes on the plaster bagworm, *Phereoeca Uterella*, in Florida (Lepidoptera: Tineidae). *Holarctic Lepidoptera*, 10(1–2), 31–32.

Hetrick L. A. (1957). Some observations on the plaster bagworm, *Tineola walsinghami* Busck (Lepidoptera: Tineidae). *Florida. Entomologist (Gainesville)*, 40(4), 145–146. doi: https://doi.org/10.2307/3492042.

Hymenoptera Anatomy Consortium. (2021). Hymenoptera anatomy ontology portal. Retrieved 13 October, 2021, from http://glossary.hymao.org/.

Mallis, A. (1990). *Handbook of pest control: the behavior, life history, and control of household pests*. 7th ed. MacNair-Dorland, New York. 1152 pp.

Narendran, T. C. (1989). *Oriental Chalcididae (Hymenoptera: Chalcidoidea)*. Zoological Monograph. Kerala: Department of Zoology, University of Calicut. 441 pp.

Robinson, G. S. & Nielsen, E. S. (1993). *Tineid Genera of Australia* (Lepidoptera). *In*: Monographs on Australian Lepidoptera. Vol. 2. Canberra: CSIRO. 344 pp.

Walker, F. (1834). Monographi Chalciditum (continued.). *Entomological Magazine*, 2(1), 13–39.

Walsingham, T. de G. (1897). Revision of the West-Indian Micro-Lepidoptera, with descriptions of new species. *Proceedings of the Zoological Society of London*, 18897(1), 54–183.