



## ***Aleurocyperus humus* gen. et sp. n. (Hemiptera: Aleyrodidae) from Taiwan, with interesting feeding behaviour**

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### **Abstract**

*Aleurocyperus humus* **gen. et sp. n.** is described from Taiwan, feeding on *Cyperus rotundus*, *Kyllinga brevifolia* and *Torulium odoratum* (Cyperaceae), also *Eleusine indica* (Poaceae), with illustrations of the egg, immature stages, adult male and female. The new genus is defined through a combination of tracheal furrows, marginal characters, placement of dorsal setae, and absence of first abdominal setae. Observations are also presented on feeding behaviour.

**Key words:** Whiteflies, new genus, new species, Cyperaceae, Poaceae, Taiwan

### **Introduction**

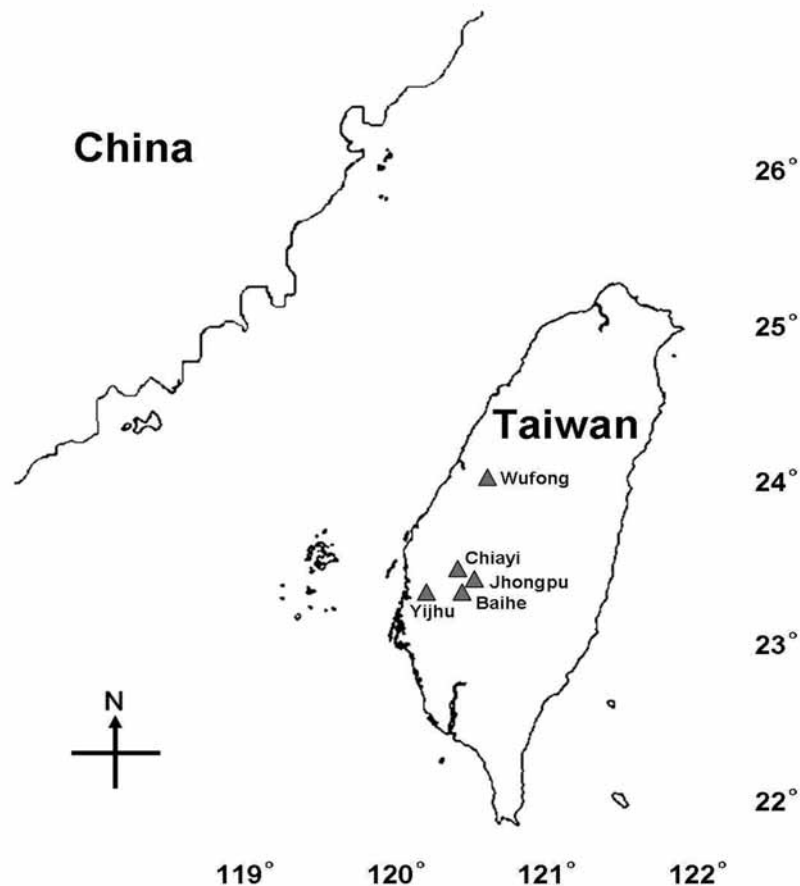
The new species of whitefly described in this paper has been found breeding on cosmopolitan monocotyledonous weeds of the families Cyperaceae and Poaceae in Taiwan. Grass-feeding whitefly species do not usually feed on dicotyledonous plants, and so this species is probably restricted to feeding on these families. Detailed descriptions are provided of the egg, immatures (II, III & IV instars), and adults of both sexes. The new taxon shows similarities to *Aleuromarginatus* Cockerell (known to be specific to leguminous host plants), to *Aleuropteridis* Mound (known from ferns), and to *Extensaleyrodes* Bink-Moenen (known from Caesalpiniaceae). Prior to this investigation 45 genera of whitefly were on recorded from Taiwan.

The feeding behavior of this species is unusual. The immature stages are usually found feeding on the basal leaves of the host, very close to the ground. This is so, even when the upper leaves provide enough space for a colony. Puparia are sometimes hidden among sand particles that have settled over them. A few immatures are also found feeding on the inflorescences of these Cyperaceae, although the tissue appears to be harder than the leaf cuticle, and there is sufficient feeding space on the leaves. The immatures always orientate on the leaf surface with their anterior end upward and their posterior end downward. This behavior remains constant even when the population is high. The pattern of egg laying is also of interest, as the eggs are laid in a linear series mostly near the leaf margins. Sometimes a single egg may be laid on the ventral median area of a leaf, but eggs were not observed on the inflorescences. The orientation of the puparia on the inflorescences was the same as that on the basal parts.

### **Material and methods**

Grass blades with nymphal whitefly were collected (Fig. 1) into A4 size polythene zip covers along with the plant inflorescence and fruits to confirm the host identity. A colony of whitefly was established in the labora-

tory to gather adults for morphological studies. Puparia were mounted using the method suggested by Martin (1987). The morphological terminology used here follows Bink-Moenen (1983), Martin (1985), and Gill (1990). Specimens for scanning electron microscopy were removed from host plants and washed in 95% ethanol with an ultrasonic mini cleaner at 50-60 Hz for 2 minutes, then sequentially dehydrated in 95% and 100% ethanol. Specimens were critical point-dried using CO<sub>2</sub> as the transfer fluid, then mounted on stubs and sputter-coated with a gold-palladium alloy. The scanning electron microscope (JEOL S-800; Japan) was used from the Department of Entomology, National Taiwan University, Taipei, Taiwan.



**FIGURE 1.** Map showing the collection localities in Taiwan.

*Specimen depositories*

ANIC	Australian National Insect Collection, CSIRO Entomology, Canberra, ACT, Australia
BMNH	Natural History Museum, London, U.K.
CDFA	California Department of Food and Agriculture, Sacramento, U.S.A.
IARI	Indian Agricultural Research Institute, New Delhi, India
NMNH	National Museum of Natural History, Tel Aviv University, Israel
NTU	National Taiwan University, Taipei, Taiwan
SMTD	Staatliches Museum für Tierkunde, Dresden, Germany
USNM	U. S. Department of Agriculture, Beltsville, Maryland, U.S.A. (Sternorrhyncha collections of the United States National Museum of Natural History, Washington D.C.)
ZMU	Zoological Museum, Universitetsparken, Department of Zoology, Copenhagen, Denmark
ZSI	Zoological Survey of India, Kolkata

## *Aleurocyperus* gen. nov.

Type species: *Aleurocyperus humus* sp. nov.

**Diagnosis.** Puparia elongate, with thin layer of colourless transparent wax on dorsum, luminous in certain lights, deposition of wax rather prominent at thoracic and caudal tracheal pore openings and in furrows. Margin irregularly crenulate. Longitudinal molting suture ill-defined but present, transverse molting suture reaching submedian area. Anterior and posterior marginal setae present. Paired cephalic, meso-, meta-thoracic and eighth abdominal setae present. First abdominal setae absent. Dorsum with few scattered large pores containing porettes, sometimes with an associated porette. Abdominal segment sutures almost reaching outer subdorsum. Depressions on thoracic segments more clearly visible than on abdominal segments. Seventh abdominal segment not reduced medially. Thoracic tracheal furrows faintly indicated by margin than caudal tracheal furrow. Thoracic tracheal folds with longitudinal ridges, caudal tracheal fold defined with stipples. Vasiform orifice subcordate. Operculum subcordate, filling 1/3rd of orifice. Lingula tip exposed, spinose and included. Antennae short, mesad of and not extending beyond base of prolegs. Ventral abdominal setae present. All four pairs of spiracles visible. One pair of setae visible at base of rostrum.

**Etymology.** The genus name is derived from *Aleuro+cyperus*. The term 'Aleuro-' represents family of the insect, 'Aleyrodidae' and '-cyperus' is a Latin word represents sedge (Cyperaceae) from which the species was collected.

**Remarks.** This genus is similar to *Aleuropteridis* Mound (1961), *Aleuromarginatus* Corbett (1935) and *Extensaleyrodes* Bink-Moenen (1983). It differs from *Aleuropteridis* in (1) dorsal disc not deflexed ventrally, (2) absence of glands at base of marginal teeth, (3) tracheal pores unclearly modified at margin, (4) presence of mesothoracic setae, (5) defined tracheal folds, (6) position of anterior and posterior marginal setae, (7) presence of typical pores on dorsum, (8) shape of operculum, (9) dorsal pores and porettes scattered not arranged in rows, (10) exposed lingula. It differs from *Aleuromarginatus* in (1) absence of submarginal row of papillae, (2) absence of first abdominal setae, (3) transverse molting suture reaching submedian area, (4) defined thoracic tracheal folds, (5) dorsal disc not with 21 pairs of setae (as in *Aleuromarginatus*), (6) presence of anterior marginal setae, (7) presence of typical pores on dorsum, (8) apically truncated operculum, (9) a pair of setae at base of rostrum, (10) ill-defined longitudinal molting suture, (11) presence of thoracic tracheal furrows, (12) seventh abdominal segment not reduced medially. It differs from *Extensaleyrodes* in (1) transverse molting suture reaching outer submedian area, (2) transverse molting suture not curved upward from middle, (3) presence of thoracic tracheal furrows, (4) shape of legs, (5) position of caudal and posterior marginal setae, (6) presence of typical dorsal pores, (7) position of cephalic setae, (8) absence of cephalic subdorsal, first abdominal and abdominal submedian setae, (9) antennae inside of legs, (10) anterior abdominal spiracles distinct.

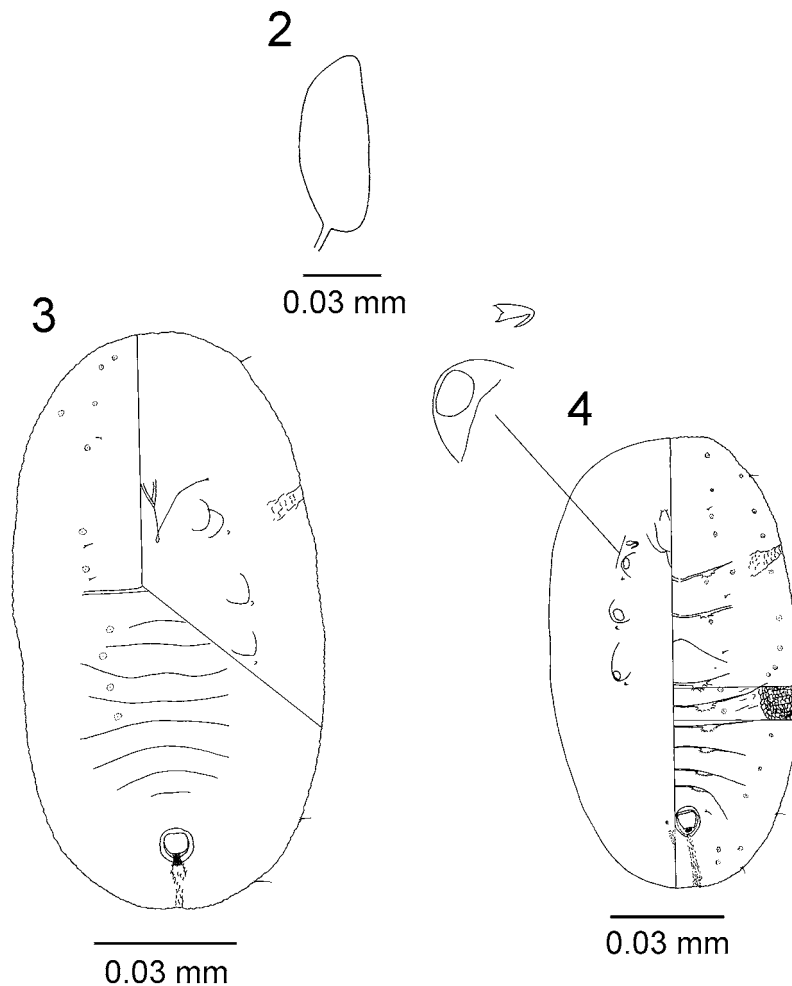
From other genera of grass-feeding whiteflies, such as *Agrostaleyrodes* Ko (Ko *et al.* 2001), this new genus differs in characters of vasiform orifice, absence of raised longitudinal ridges, differentiated tracheal pores, and details of dorsal setae. It differs from *Aleurocybotus* Quaintance and Baker (1914) in the absence of first abdominal setae and details of dorsal setae and the antenna of male and female not extending beyond posterior margin of proleg. Moreover, it differs from *Vasdavidius* Russell (2000) in details of dorsal setae, defined tracheal pores, notched vasiform orifice and concealed lingula; and from *Corbettia* Dozier (1934) in having tracheal pores, absence of chain of small pores on dorsum and prominent marginal setae.

## *Aleurocyperus humus* sp. nov.

(Figs. 5–67)

Puparium (Figs. 5, 30, 66, 67). Pale to white, with secretion of transparent colourless wax on dorsum, luminous in certain lights, but white wax deposition prominent at tracheal pore openings and sometimes in fur-

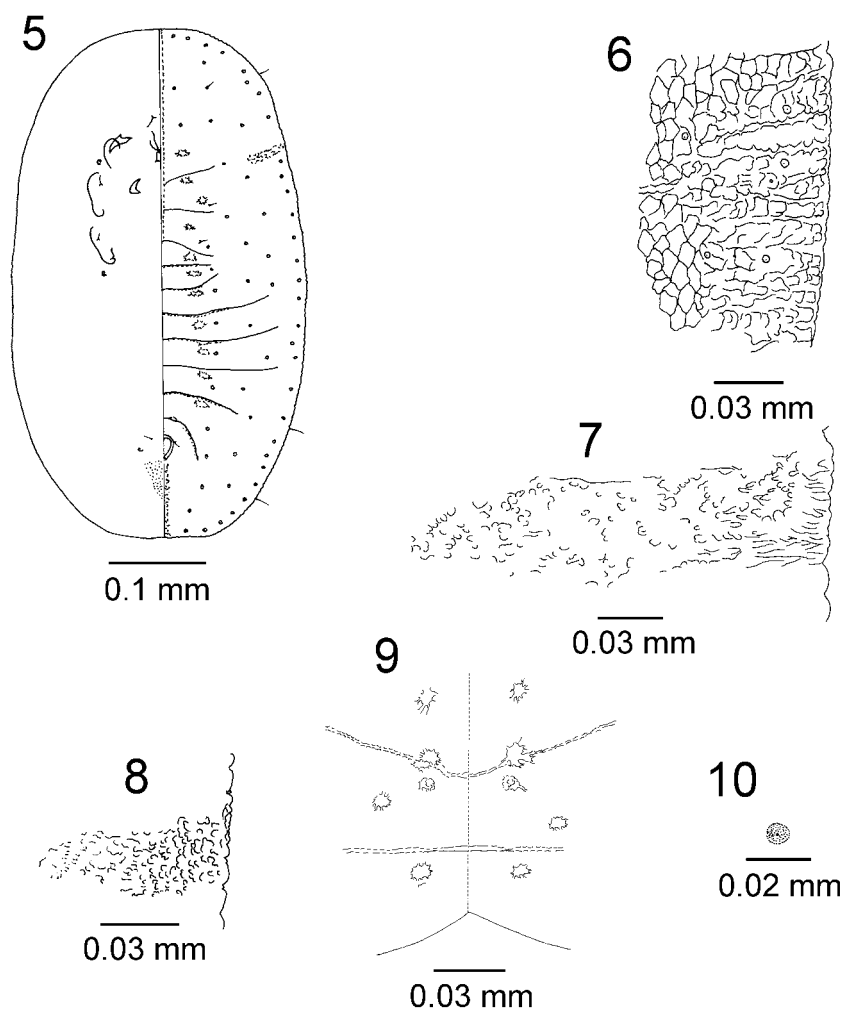
rows; broadly elliptical in shape, broadest at third and fourth abdominal segments, less dimorphic, ♂ 1.47–1.53 mm long, ♀ 2.00–2.02 mm long, ♂ 0.77–0.80 mm wide, ♀ 1.02–1.08 mm wide, found singly on the lower surface of leaves. Overlapping population of previous instars was observed. Margin (Fig. 6) smooth or irregularly crenulate, if crenulate, 8–14 crenulations in 0.1 mm. Caudal tracheal comb (Fig. 7) and thoracic tracheal combs (Figs. 8, 31) unclearly differentiated from margin. Anterior and posterior marginal setae at lateral margins of puparia, each 2.75 µm long.



**FIGURES 2–4.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 2, egg; 3, second instar; 4, third instar.

Dorsum. Submargin not separated from dorsal disc. Submedian pockets and depressions present on all the cephalothoracic and abdominal segment sutures. Longitudinal molting suture very faint but present and reaching margin, transverse molting suture reaching outer submedian area. Cephalothoracic sutures appear to be made up of broken lines (Fig. 9). Submarginal striations absent but reticulations present in the form of polygonal structures. Thoracic and caudal tracheal furrows defined without lateral margins but easily recognizable due to irregular striations. Dorsal pores usually in geminate pairs (Fig. 10). Median length of seventh abdominal segment almost equal to sixth (Fig. 32). Eye spots absent.

Chaetotaxy. A pair of minute setae each on meso- and metathorax 1.25 µm and 2 µm long, respectively, eighth abdominal setae anterolaterad of vasiform orifice, 1.25 µm long. Cephalic setae tiny, present. First abdominal setae absent. Caudal setae 4.25 µm long, placed far from caudal opening. Interestingly, the caudal setae are at the lateral margins of the eighth abdominal segment instead of at the posterior (Fig. 5), a condition not previously reported for any whitefly species.



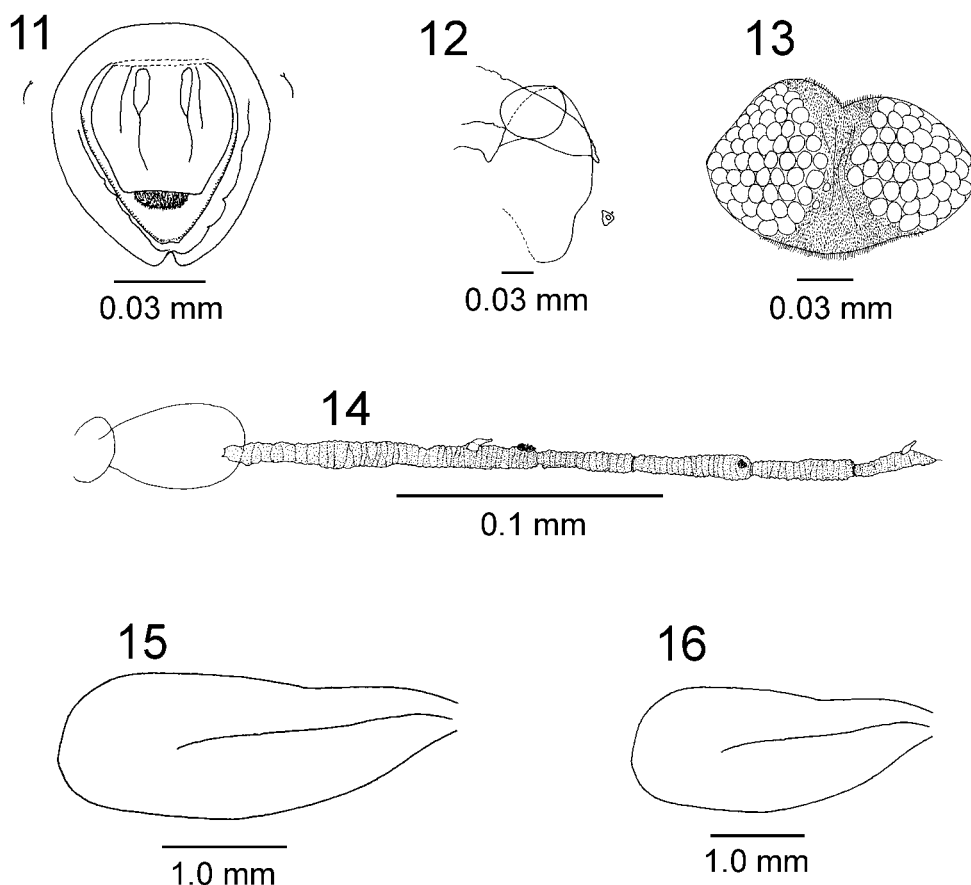
**FIGURES 5–10.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 5, fourth instar; 6, margin; 7, caudal tracheal furrow; 8, thoracic tracheal furrow; 9, cephalothoracic sutures; 10, dorsal pore.

Vasiform orifice (Figs. 11, 33, 34). Subcordate, ♂ and ♀ 7.00 µm long, ♂ 6.75–6.87 µm wide, ♀ 7.50–8.00 µm wide, notched at hind end, inner lateral and caudal margin with irregular ridges (Fig. 34) and tiny setae. Operculum subcordate, truncate at caudal end, ♂ 3.75–3.87 µm long, ♀ 4.25–4.50 µm long; ♂ 4.12–4.50 µm wide, ♀ 4.75–5.25 µm wide. Lingula setose, exposed and included.

Venter (Fig. 35). A pair of ventral abdominal setae 4.25 µm long, 4.75–6.50 µm apart. A pair of setae at base of meso- and metathoracic legs, 0.50 and 0.62 µm long, respectively. A pair of setae at base of rostrum, 1.25 µm long, 1.75 µm apart. Antennal base near apical end of prolegs, pads on apical end of legs faintly indicated. Antenna reaching midpoint of prothoracic leg, apical end keel-like (Fig. 12). No clear difference was seen in antennal length of male and female puparia. Thoracic tracheal folds with longitudinal striations (leaf surface impression) (Fig. 36) and caudal tracheal fold (Fig. 37) with fine dots, dots in caudal tracheal fold absent on submarginal area.

**Adult male.** Length from vertex to claspers, 1.425 mm. Upper and lower compound eyes not joined (Figs. 13, 39). A pair of facet-like structures is seen in intervals of upper and lower compound eyes, many microtrichia in intervals. Antenna (Figs. 14, 38): Seven-segmented, elongate with many rows of concentric rings of microtrichia, segment I 2.75 µm long; segment II 5.75 µm long, three minute setae present; segment III cylindrical, longest, 16 µm long, armed with two primary sensoria and one sensorial cone, sensoria located subapically and close together; segment IV sub-cylindrical, 5 µm long, segment V sub-cylindrical, 6 µm long, a primary sensorium subapically; segment VI 5 µm long; segment VII sub-cylindrical, 4 µm long, a sensorial cone subapically, a primary sensorium and an apical seta. Wings: Forewing (Fig. 15) 127.5 µm long, 47.5 µm

wide, widest at apical 1/3rd region, not mottled, wing venation reduced to radius and cubitus, not reaching to margin, radius slightly curved downward in middle; hindwing (Fig. 16) 105  $\mu\text{m}$  long, 40  $\mu\text{m}$  wide, widest at apical 1/3rd region, not mottled. Legs: Mesotibia (Figs. 17A, 17B) 38.5  $\mu\text{m}$  long, with rows of spines, proximal tarsus 11  $\mu\text{m}$  long, 8 long and 3 small setae present, distal tarsus 8.5  $\mu\text{m}$  long; hindtibia (Figs. 18A, 18B, 40) 47.75  $\mu\text{m}$  long, proximal tarsus 13.25  $\mu\text{m}$  long, 11 long and 5 small setae on proximal tarsus, distal tarsus 9.25  $\mu\text{m}$  long, each distal tarsus ending with 2 claws and 1 paronychium, four setae on distal tarsus of meso- and hindtibia; metatibial comb with 17 spines in a row, metatibial brush absent. Four abdominal plates (Fig. 19), each with a minute seta on outer margin, and 2 setae on inner margin, position of setae varies. Anterior and posterior plates usually reduced in size.

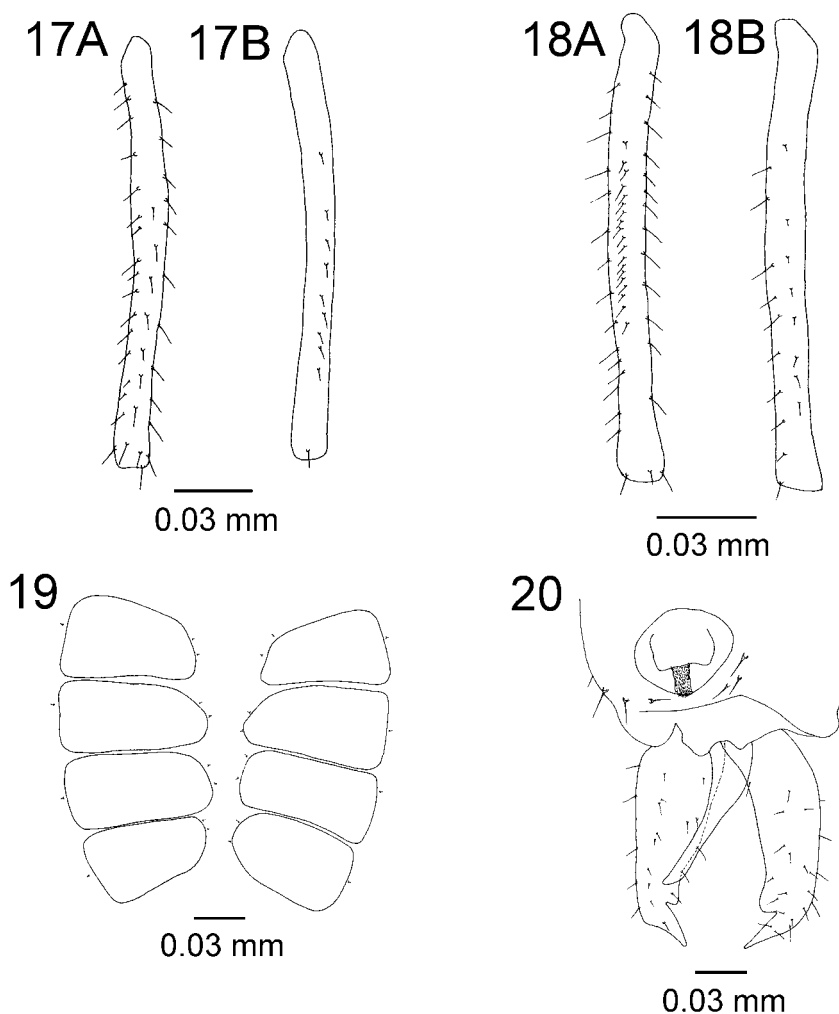


**FIGURES 11–16.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 11, vasiform orifice; 12, proleg and antennae; 13, eye, male; 14, antenna, male; 15, forewing, male; 16, hindwing, male.

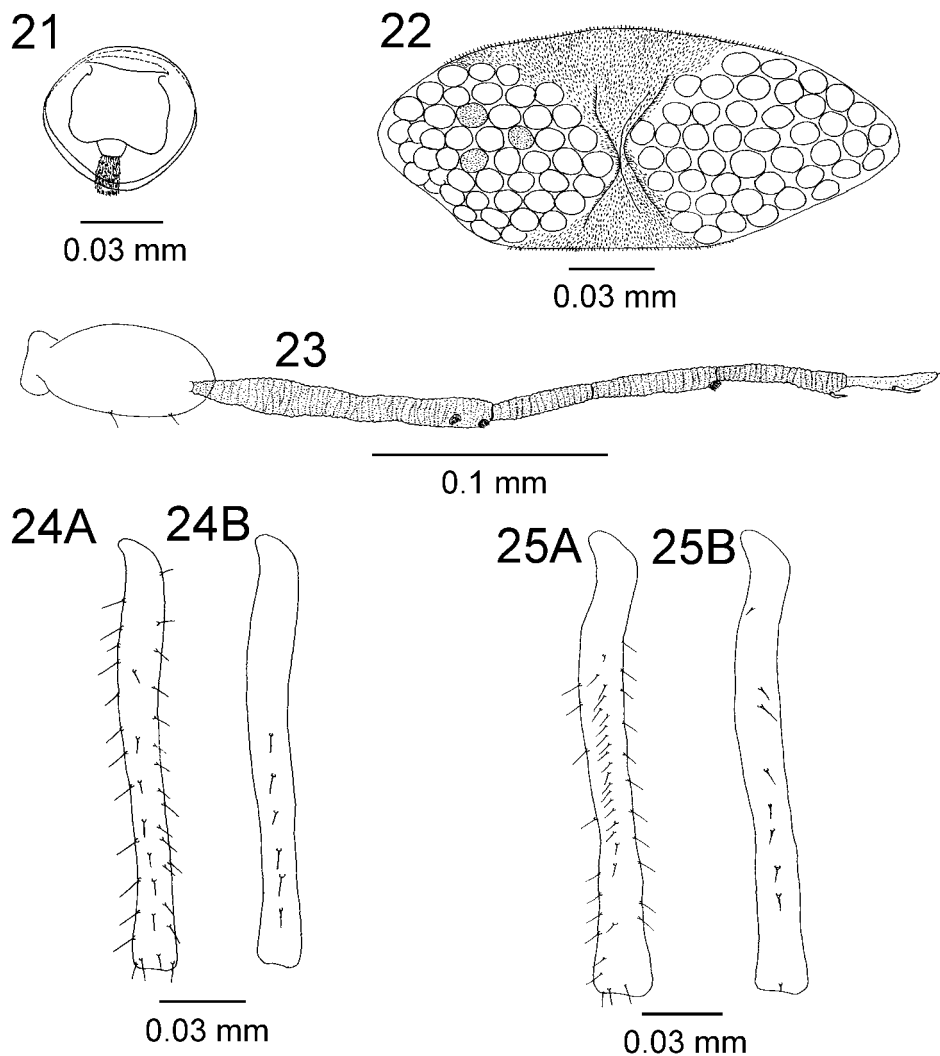
Genitalia (Figs. 20, 41, 42). Clasper broadest at basal 1/3rd region, 4.37  $\mu\text{m}$  wide at base, 13  $\mu\text{m}$  long, 20–22 pairs of setae (usually 5 pairs on outer margin, 8 pairs on centre, 6 pairs on inner margin and 1 pair subapically), subapical tooth present (Fig. 43). Aedeagus 9.5  $\mu\text{m}$  long, 1.5  $\mu\text{m}$  wide at base, shorter than clasper, thick at base and slightly constricted in middle, swollen subapically and bluntly pointed (Fig. 44). Operculum slightly constricted at lateral and apical middle margins, apical lateral margins without setae; lingula exposed and setose (Figs. 21, 45); genital plate with three pairs of long setae, placed dorsally in oblique row.

**Adult female** (Figs. 62, 63). Most characters are that of male. Vertex to tip of ovipositor 1.63 mm long. Upper and lower compound eyes not joined (Figs. 22, 51, 52), some facets pigmented, a pair of small facet-like structures are seen in intervals of upper and lower compound eyes (Fig. 52), sometimes not clear; intervals filled with many microtrichia. Antenna (Figs. 23, 46): Seven-segmented, many concentric rings of microtrichia, segment I 3.25  $\mu\text{m}$  long; segment II 7.25  $\mu\text{m}$  long with 6 setae; segment III longest, 13.75  $\mu\text{m}$

long; segment IV 3  $\mu\text{m}$  long; segment V 5  $\mu\text{m}$  long; segment VI 5.75  $\mu\text{m}$  long; segment VII 3.87  $\mu\text{m}$  long; 4 primary sensoria (Fig. 50)- 2 on segment III sub-apically (Fig. 47), these 2 sensoria are not close together as in male, and 1 each on segment V and VII sub-apically, segment VII with a apical seta (Fig. 48), 1.5  $\mu\text{m}$  long. Two sensorial cones- 1 each on segment VI and VII subapically (Fig. 49), sensorial cone absent on sixth antennal segment of male but present in female, interestingly, sensorial cone absent on third antennal segment of female but present in male, perhaps, it is a useful documentation of sexual dimorphism in adults. Wings: As for males, forewing 146.25  $\mu\text{m}$  long, 52.5  $\mu\text{m}$  wide; hindwing 122.5  $\mu\text{m}$  long, 43.75  $\mu\text{m}$  wide, radius not reaching apical margin. Legs: Mesotibia (Figs. 24A, 24B) 39.5  $\mu\text{m}$  long, proximal tarsus 10.75  $\mu\text{m}$  long, 9 long and 3 small setae, distal tarsus 9.25  $\mu\text{m}$  long, 1 seta and 5 long setae; hindtibia (Figs. 25A, 25B, 54, 55) with a row of 19–21 setae, 51.25  $\mu\text{m}$  long, proximal tarsus 13.25  $\mu\text{m}$  long, 12 long and 3 small setae present, distal tarsus 9.25  $\mu\text{m}$  long, 1 small and 5 long setae present, each distal tarsus ending in a pair of claws and a paronychium (Fig. 53). Two abdominal plates (Fig. 26), each with 1 minute seta on outer margin and 2 setae on inner margin, position of setae varies.



**FIGURES 17–20.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 17A, mesotibia dorsal view on slide, male; 17B, mesotibia ventral view on slide, male; 18A, hindtibia dorsal view on slide, male; 18B, hindtibia ventral view on slide, male; 19, abdominal plates, male; 20, genitalia, male.



**FIGURES 21–25.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 21, lingula, male; 22, compound eye, female; 23, antenna, female; 24A, mesotibia, dorsal view on slide, female; 24B, mesotibia, ventral view on slide, female; 25A, hindtibia dorsal view on slide, female; 25B, hindtibia, ventral view on slide, female.

Genitalia (Figs. 27, 56). Two pairs of long setae on gonapophysis on outer subapical margin and 1 pair on basal region. A pair of setae on median area of unpaired gonapophysis (Fig. 57), unpaired gonapophysis diverted apically. Gonapophysis with row of transverse bands only on apical inner margin, giving serrated look to outer apical margin (Figs. 58, 59). Microtrichia abundant on gonapophysis and basal abdominal segment. A pair of setae on eighth abdominal segment, lateral to basal part of female genitalia present. Operculum subrectangular, concave in middle, 3.5  $\mu\text{m}$  long, 5.25  $\mu\text{m}$  wide at base, anterolateral margins with a seta (Figs. 28, 60, 61); lingula setose, excluded and two-segmented, basal segment longer (3  $\mu\text{m}$  long) than apical segment (2.25  $\mu\text{m}$  long), however, exposed basal segment is smaller than apical segment. Cement gland like a coiled ribbon and constricted at many places (Fig. 29).

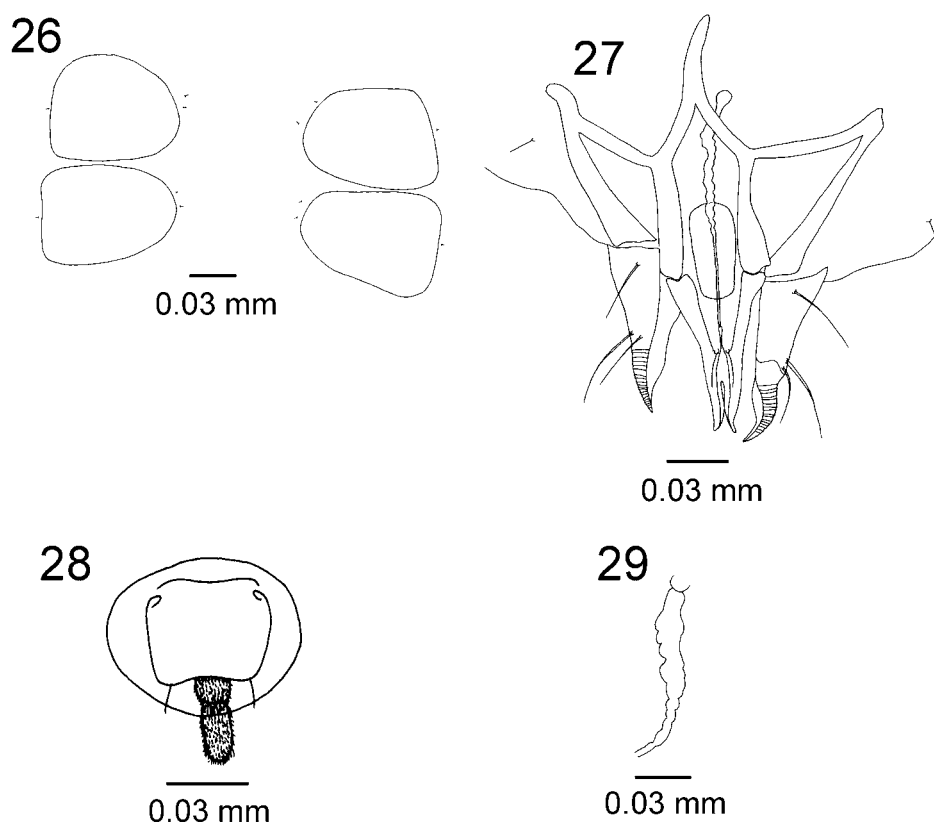
**Egg** (Figs. 2, 64). Elliptical, surface smooth and shining in certain lights, 33.8  $\mu\text{m}$  long, 12.5  $\mu\text{m}$  wide. Distal end broadly acute and basal end with a pedicle attached to the leaf surface, pedicle 7.5  $\mu\text{m}$  long. Mostly on lower surface and lateral margins of leaves; laid singly, sometimes in rows.

**Second instar** (Fig. 3). Broadly elliptical, 0.52–0.62 mm long, 0.25–0.37 mm wide; margin smooth or irregularly crenulate, if crenulate, 10–12 major crenulations in 0.1 mm. Anterior and posterior marginal setae 1.75 and 2.25  $\mu\text{m}$  long respectively, eighth abdominal setae 0.38  $\mu\text{m}$  long, caudal setae 1.75  $\mu\text{m}$  long and first

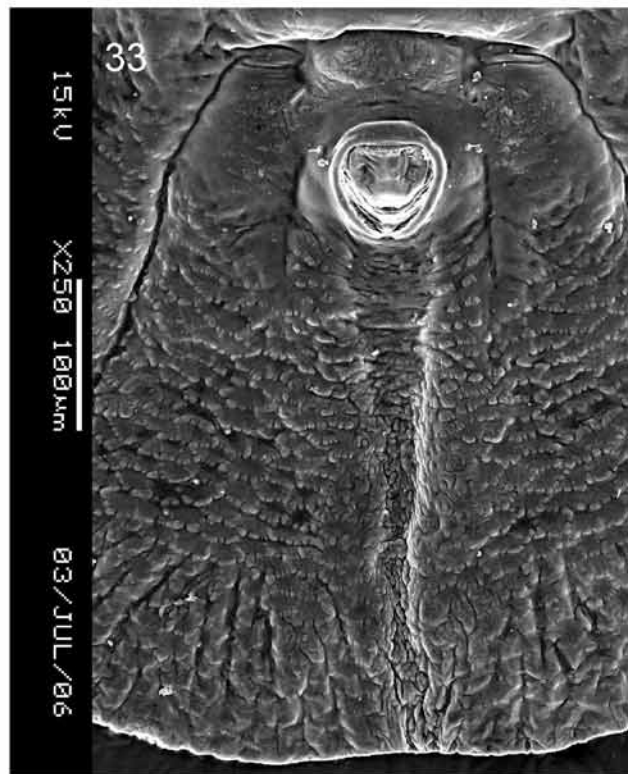
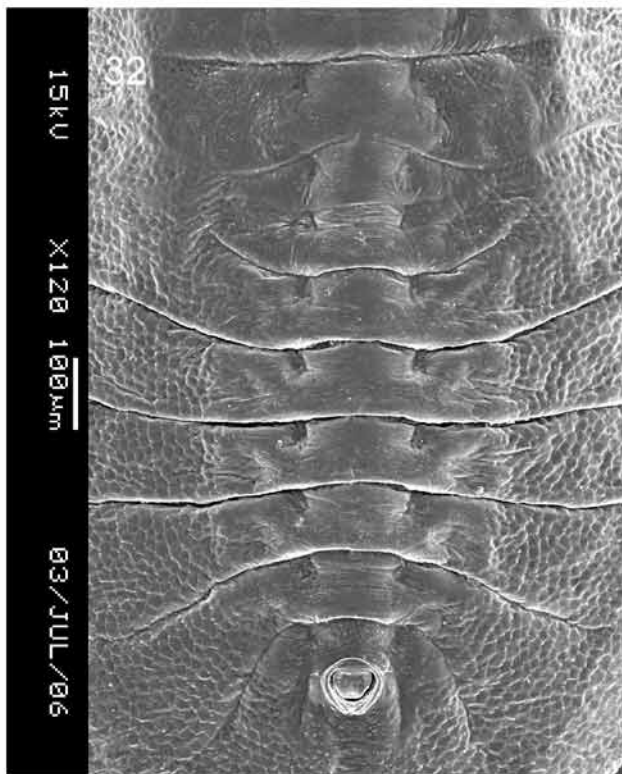
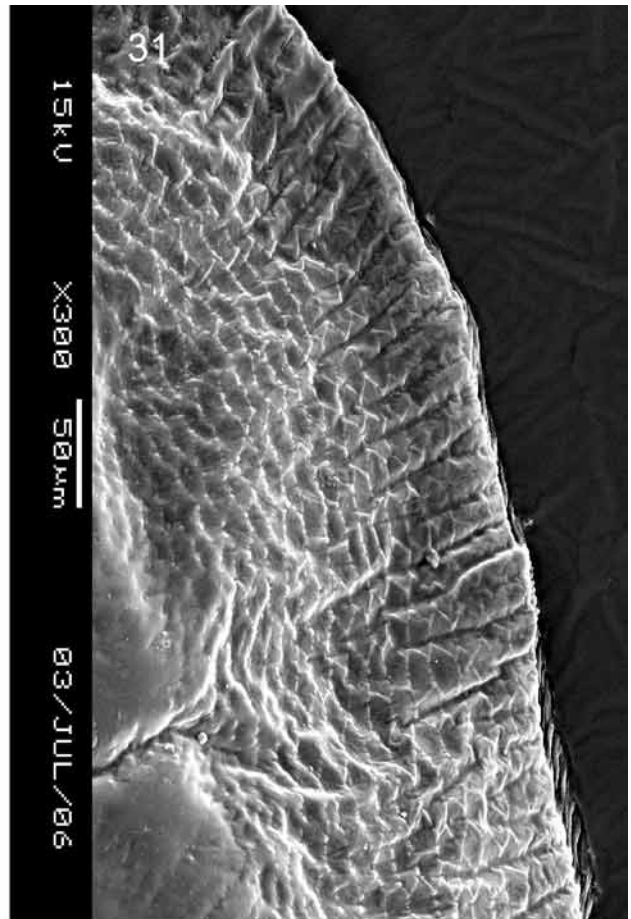
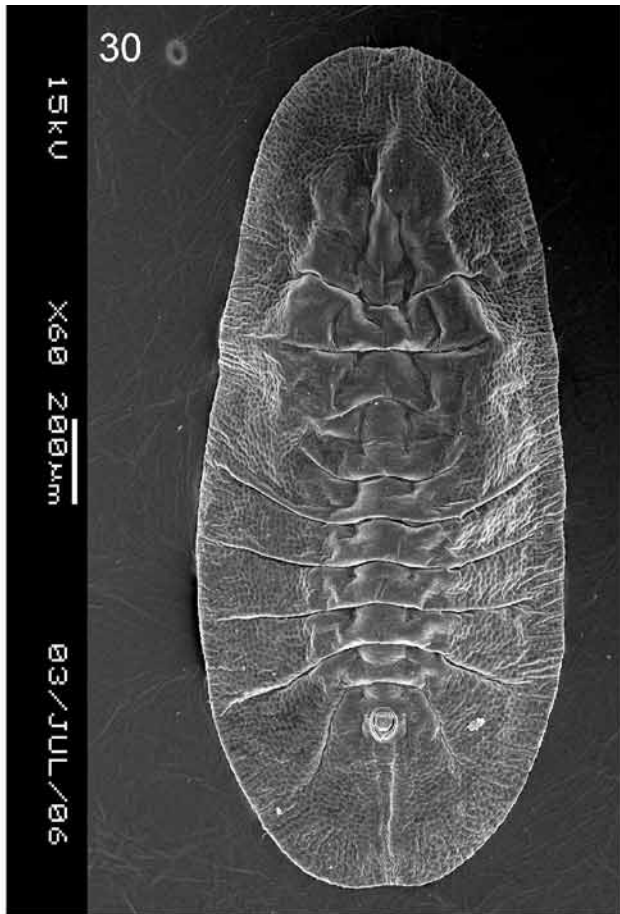


abdominal setae absent. A pair of setae on submedian area of meso- and metathorax present. Thoracic and caudal tracheal furrows indicated without definite margins, distinguished by semicircular markings or striae. Longitudinal molting suture reaching margin, transverse molting suture reaching submedian region. Cephalothoracic and abdominal segment sutures visible. Vasiform orifice subcordate, 3.25–3.5  $\mu\text{m}$  long, 4.00–4.25  $\mu\text{m}$  wide; operculum subrectangular, 2.00–2.75  $\mu\text{m}$  long, 2.87–3.25  $\mu\text{m}$  wide. Lingula exposed, setose and included. Caudal furrow visible without definite margins, 4.12–5.25  $\mu\text{m}$  long. A pair of minute setae at base of prolegs, 0.5  $\mu\text{m}$  long, mesolegs 0.37  $\mu\text{m}$  long, metalegs 0.12  $\mu\text{m}$  long and at base of rostrum 1.12  $\mu\text{m}$  long. Antennae small, 1.87  $\mu\text{m}$  long, above prolegs, the distance between base of proleg and antenna measured 2.75  $\mu\text{m}$ . Thoracic tracheal folds without dots but caudal tracheal fold indicated with dots. Legs conical and pads not clear. All four pairs of spiracles visible.

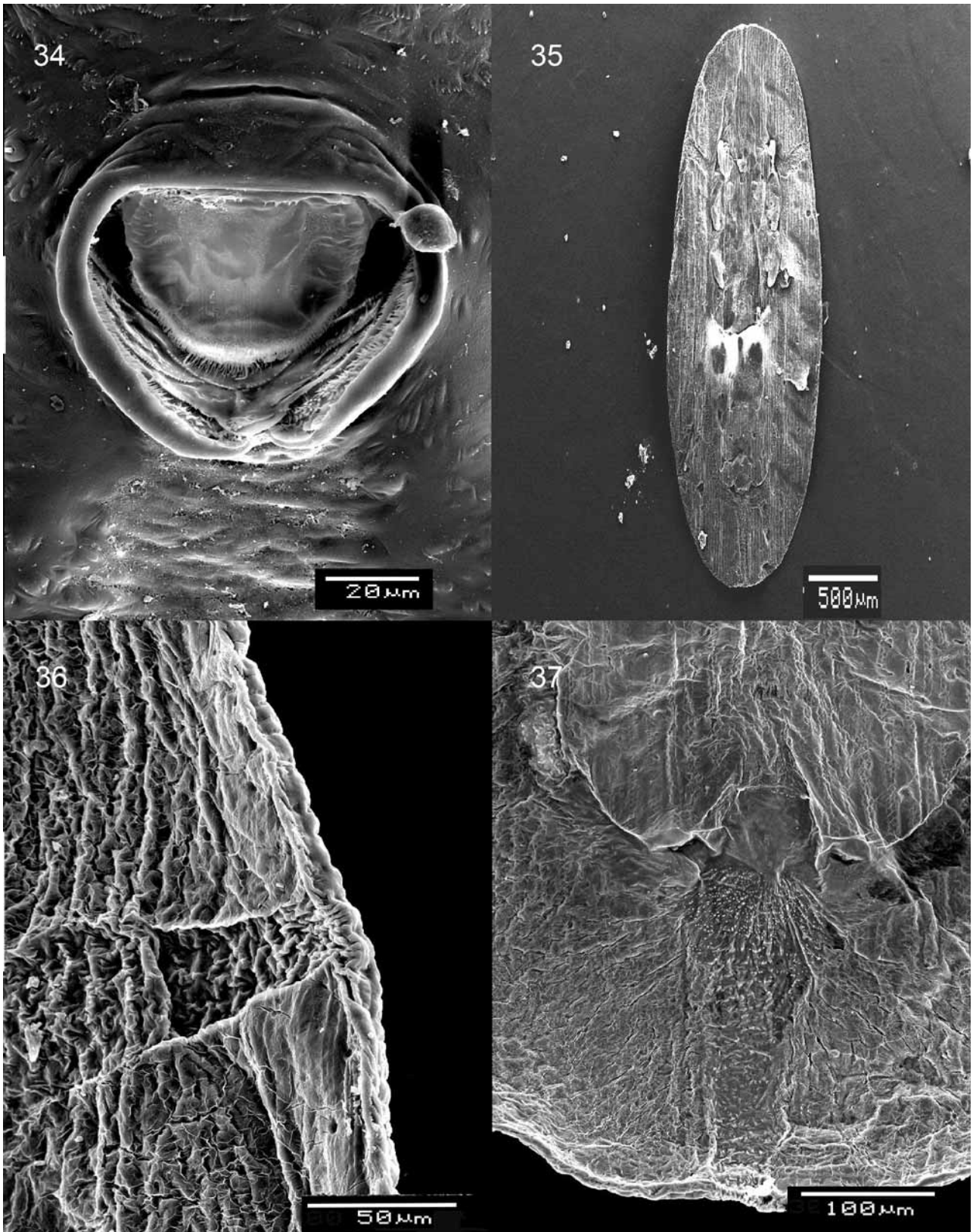
**Third instar** (Figs. 4, 65). Broadly elliptical, 1.05–1.10 mm long, 0.57 mm wide. Margin smooth or irregularly crenulate, if crenulate, 19–26 crenulations in 0.1 mm. Anterior and posterior marginal setae each 2.75  $\mu\text{m}$ . Eighth abdominal setae 1.25  $\mu\text{m}$ , caudal setae 2.25  $\mu\text{m}$ , first abdominal setae absent. A pair of setae on submedian area of meso- and metathorax, each 0.62  $\mu\text{m}$ . Cephalothoracic and abdominal segment sutures and pockets visible. Longitudinal molting suture faint, transverse molting suture visible, reaching submedian area. Vasiform orifice subcordate, 5.75–6.12  $\mu\text{m}$  long, 5.5–5.75  $\mu\text{m}$  wide; operculum subrectangular, 3.25–3.50  $\mu\text{m}$  long, 4.00–4.5  $\mu\text{m}$  wide. Lingula exposed, setose and included. A pair of setae at base of mesothoracic legs 0.5  $\mu\text{m}$  long, metathoracic legs 0.75  $\mu\text{m}$  long. Pair of setae at base of rostrum 1  $\mu\text{m}$  long, 0.87  $\mu\text{m}$  apart. Antennae anterior to prolegs, curved and forming hook-shaped structure, distance between bases of proleg and antenna 1.87  $\mu\text{m}$ . Paired ventral abdominal setae 2.00  $\mu\text{m}$  long, 0.42  $\mu\text{m}$  apart.



**FIGURES 26–29.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 26, abdominal wax plates, female; 27, genitalia, female; 28, operculum, female; 29, cement gland.

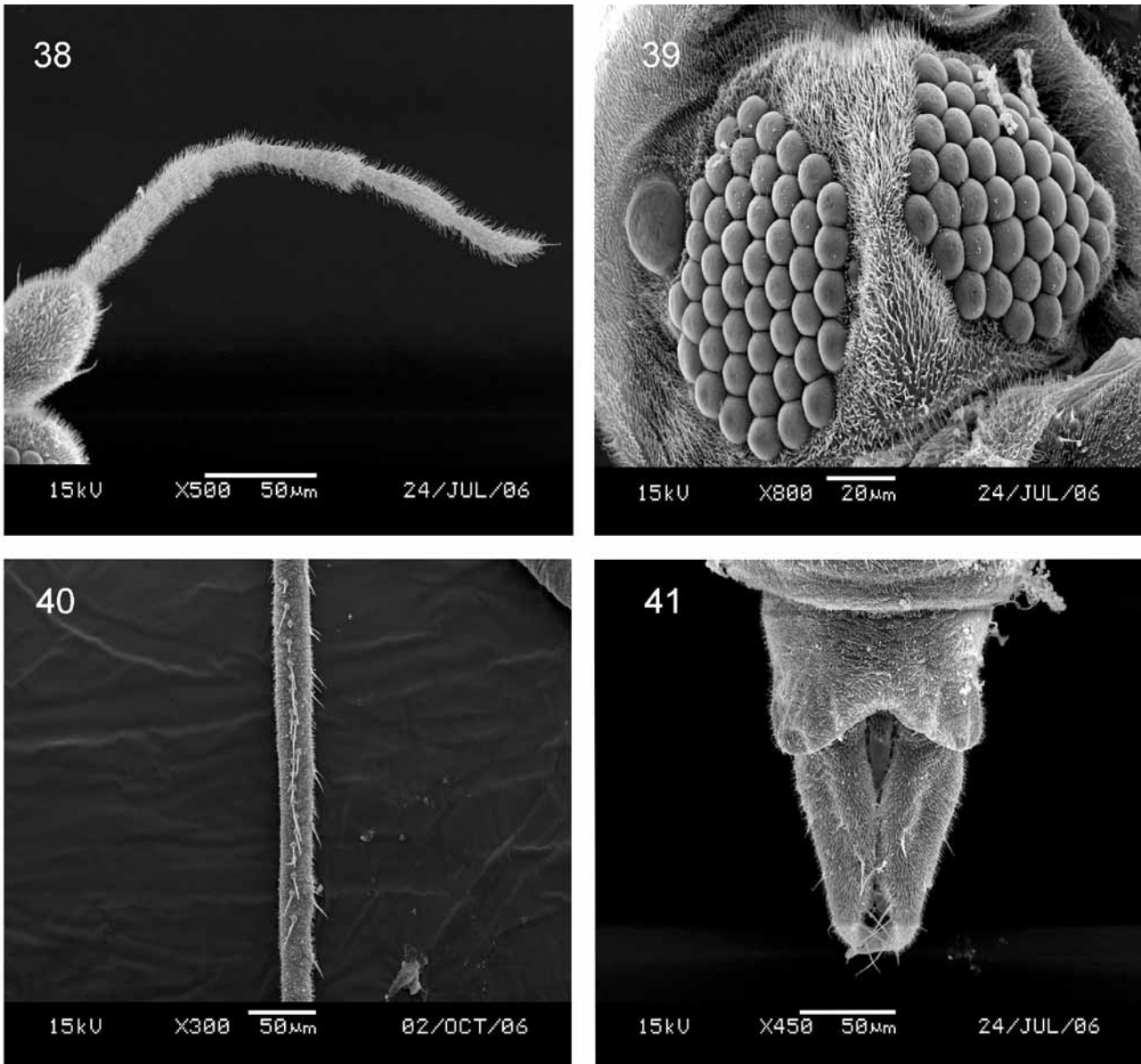


**FIGURES 30–33.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 30, puparium dorsal view; 31, thoracic tracheal pore; 32, abdominal segments; 33, posterior abdominal area and caudal furrow.



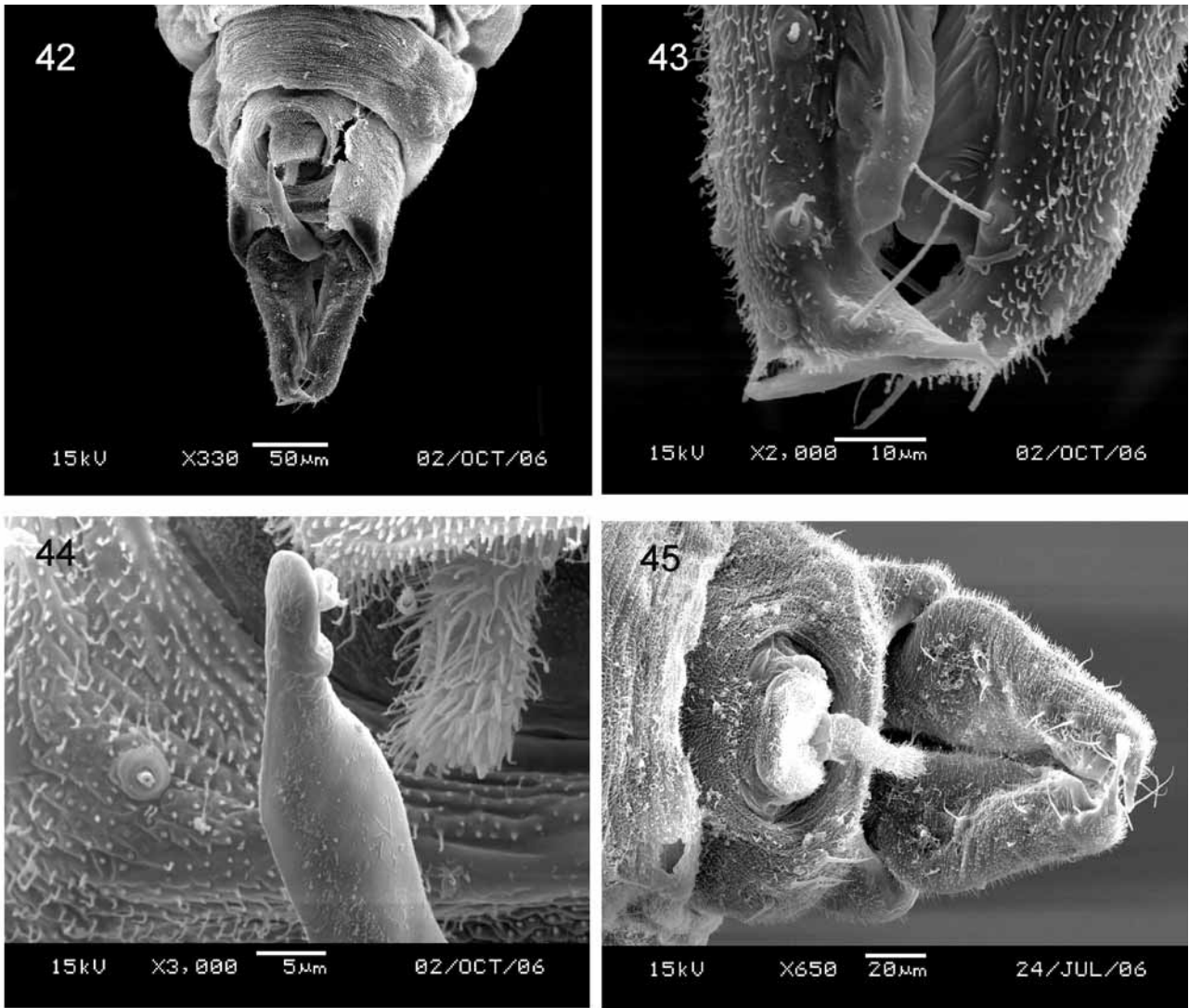
FIGURES 34–37. *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 34, vasiform orifice; 35, puparium ventral view; 36, thoracic tracheal fold; 37, caudal tracheal fold.

**Holotype puparium.** Taiwan, Tainan Hsien, Baihe, 28.ix.2003, on *Eleusine indica* (Poaceae), (C. C. Ko) (NTU).



**FIGURES 38–41.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 38, antenna, male; 39, compound eye, male; 40, metatibial comb on hindtibia in dorsal view, male; 41, genitalia ventral view, male.

**Paratypes.** Taiwan, Tainan Hsien, Baihe, 207 puparia, 18 second instar, 23 third instar, 15 ♂, 22 ♀ on 52 slides, 28.ix.2003, on *Eleusine indica*, C. C. Ko (one paratype slide deposited each in the collections of ANIC, BMNH, CDFA, IARI, NMNH, NTU, SMTD, ZMU, ZSI and rest in NTU collection); Chiai Hsien, Zhongpu, 10 puparia, 24.vi.2006, on *Cyperus rotundus* (Cyperaceae), C. C. Ko, 102 puparia on 9 slides, 15 puparia, 8 second instar, 7 third instar, 8 ♂, 12 ♀ on 16 slides, Taichung Hsien, Wufong, 30.viii.2005, on *Cyperus rotundus*, C. C. Ko; one puparium on a slide, 21.ii.2004, on *Cyperus rotundus*, C. C. Ko; Chiai Hsien, Zhongpu, 15 puparia, 6 second instar, 5 third instar, 8 ♂, 4 ♀, on 18 slides, 24.vi.2006, on *Cyperus rotundus*, C. C. Ko; Chiai Hsien, Yijhu, 12 puparia on 4 slides, 10.ix.2006, on *Cyperus rotundus*, C. C. Ko; Chiai Hsien, Zhongpu, 10 puparia on 2 slides, 17.ix.2006, on *Cyperus rotundus*, C. C. Ko; Tainan Hsien, Baihe, 10 puparia, 11 second instar, 15 third instar, 20 ♂, 18 ♀ on 17 slides, 29.viii.2004, on *Torulinium odoratum* (Cyperaceae), Chiai Hsien, Zhongpu, 14 puparia on 5 slides, 17.ix.2006, on *Kyllinga brevifolia*, C. C. Ko (all NTU COLL.).



**FIGURES 42–45.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 42, genitalia dorsal view, male; 43, subapical tooth on claspers, male; 44, aedeagus apical end; 45, vasiform orifice and lingula, male.

**Host plants.** Cyperaceae: *Cyperus rotundus*, *Kyllinga brevifolia*, *Torulinium odoratum*; Poaceae: *Eleusine indica*.

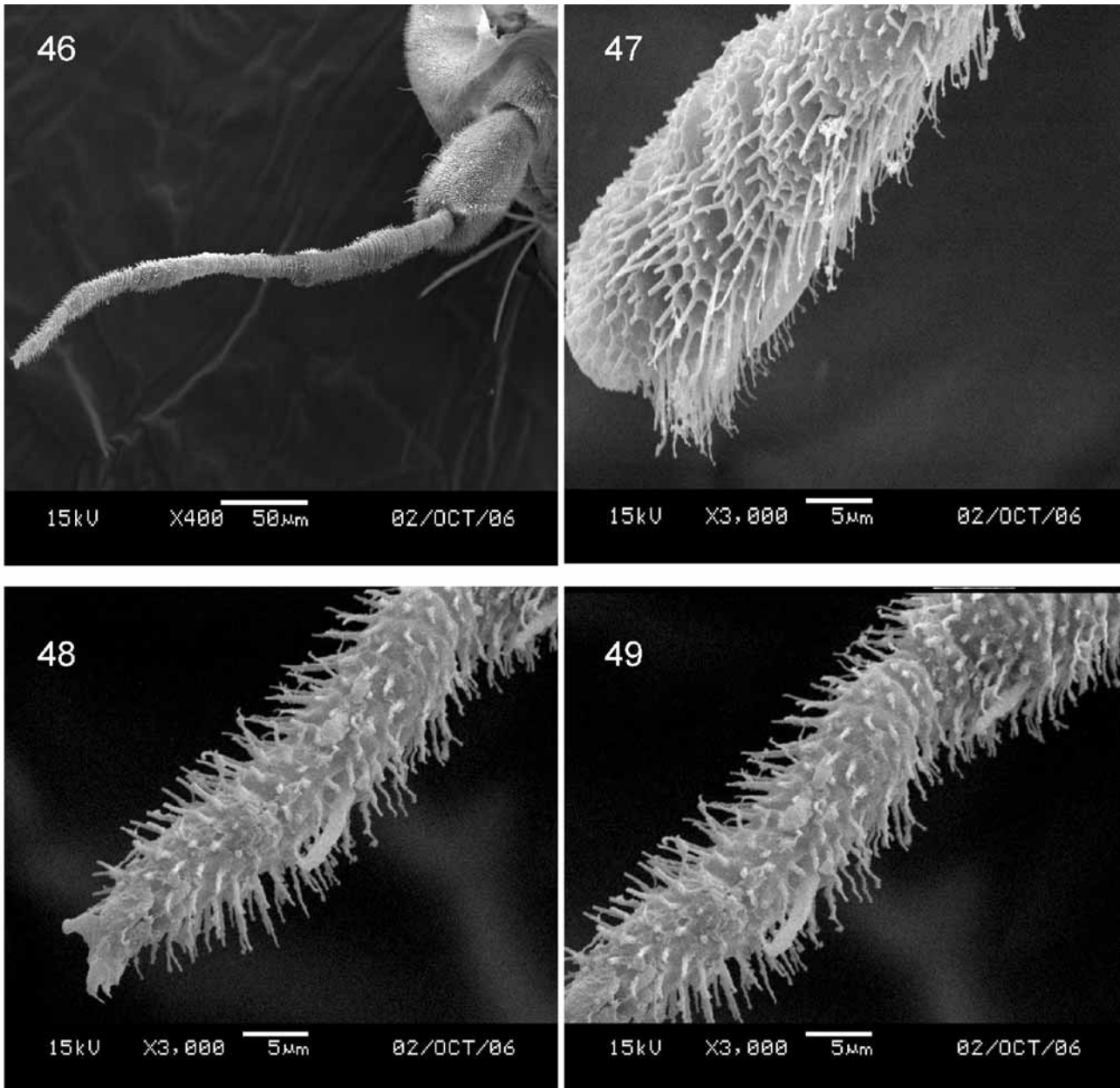
**Distribution.** Known only from Taiwan.

**Etymology.** The species epithet is a Latin word ‘*humus*’, it means ground, soil or earth, emphasizing the unique behaviour of the species feeding at the basal region of its host.

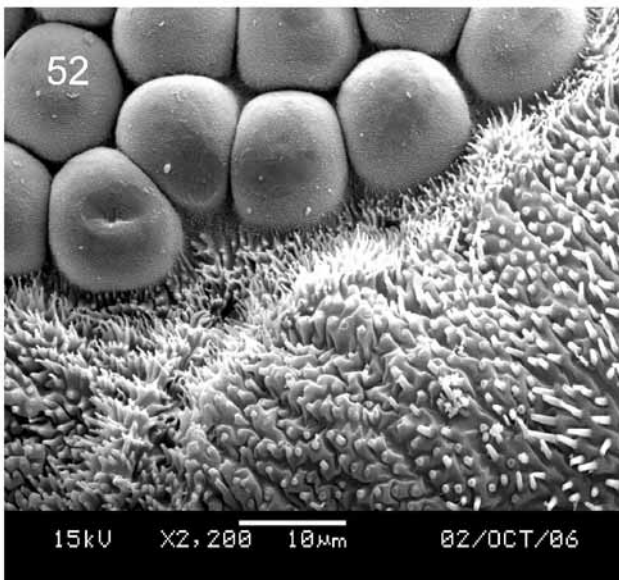
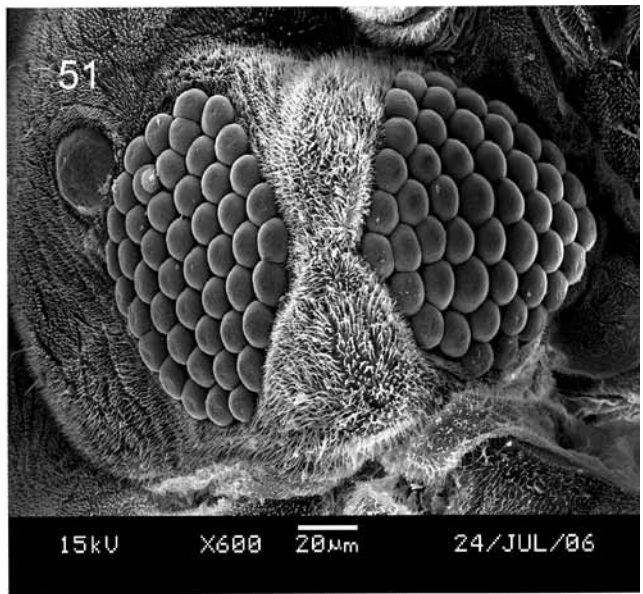
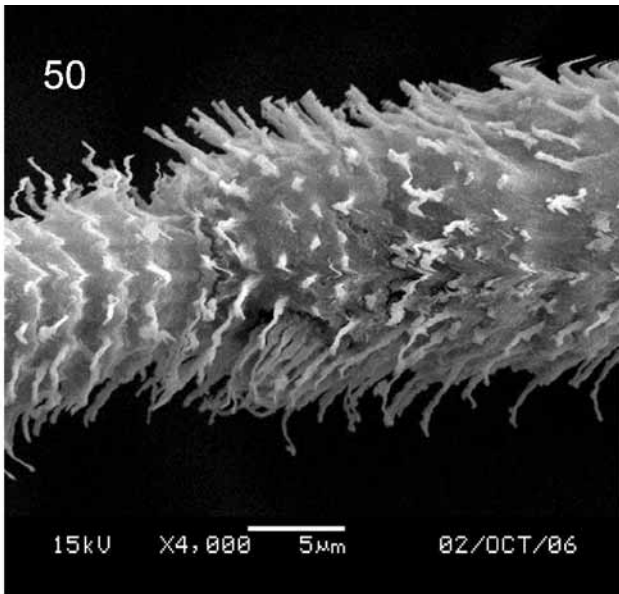
### Acknowledgements

We thank Jon Martin, BMNH for confirming the identity of the new genus and species, and for evaluation of the manuscript. The plants were identified by S. C. Wu (NTU), and H. F. Hung (NTU) assisted with the scanning electron microscope study. Publication is supported by part of a grant received under postdoctoral program from National Taiwan University, Taiwan (NTU 95R0044), and National Science Council (NSC95-2621-B-002-012).

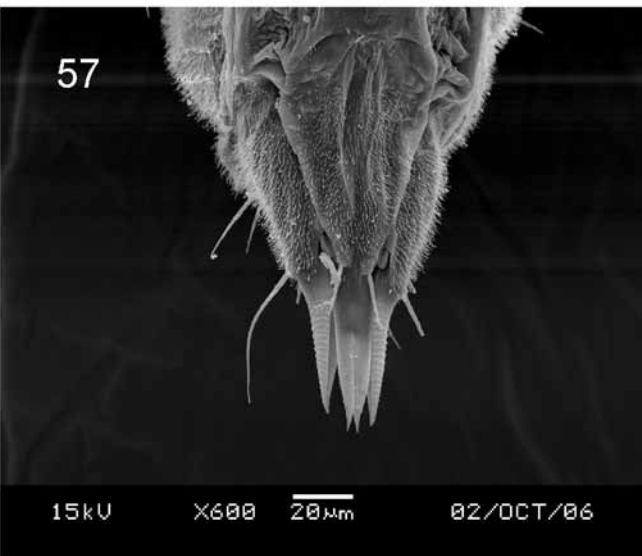
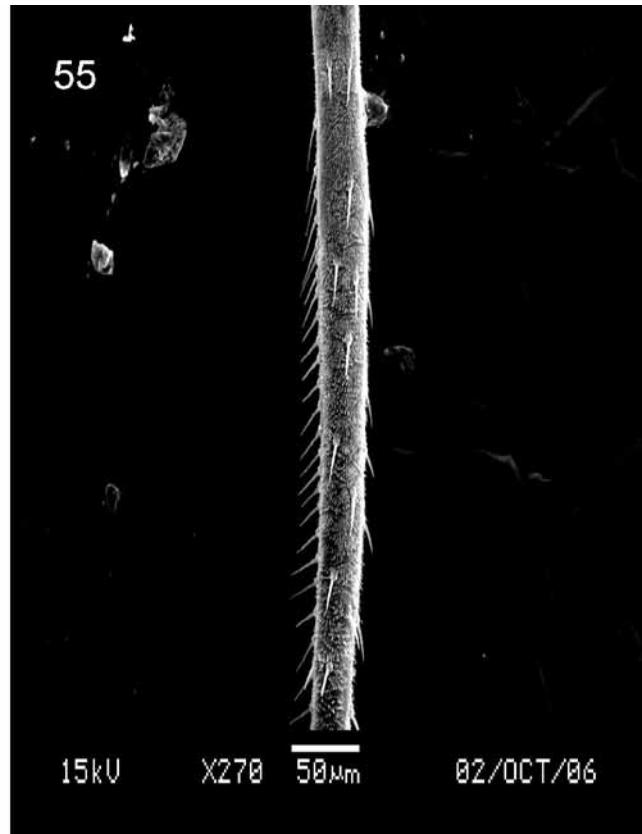
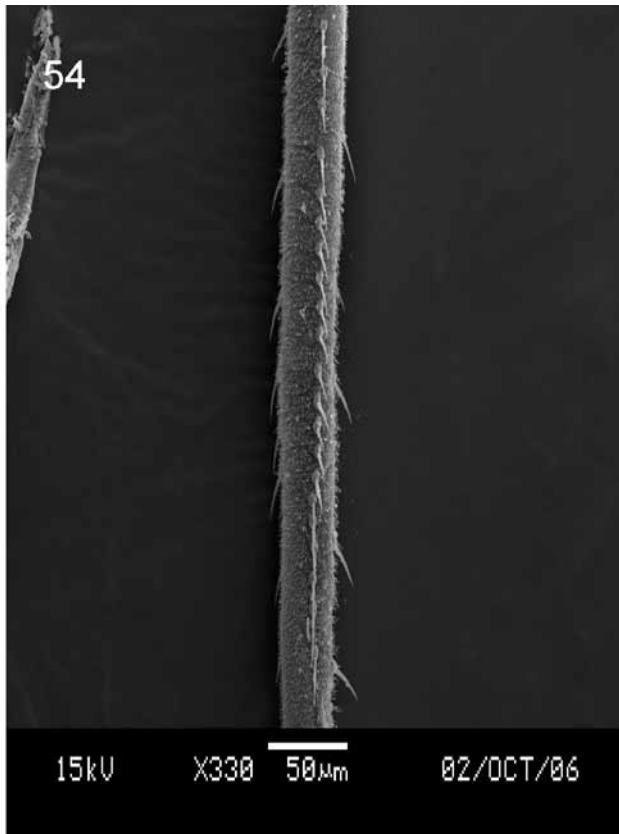




**FIGURES 46–49.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 46, antenna, female; 47, primary sensoria on antennal segment III, female; 48, antennal segment VII with apical seta; 49, sensorial cone on segment VI and VII, female.

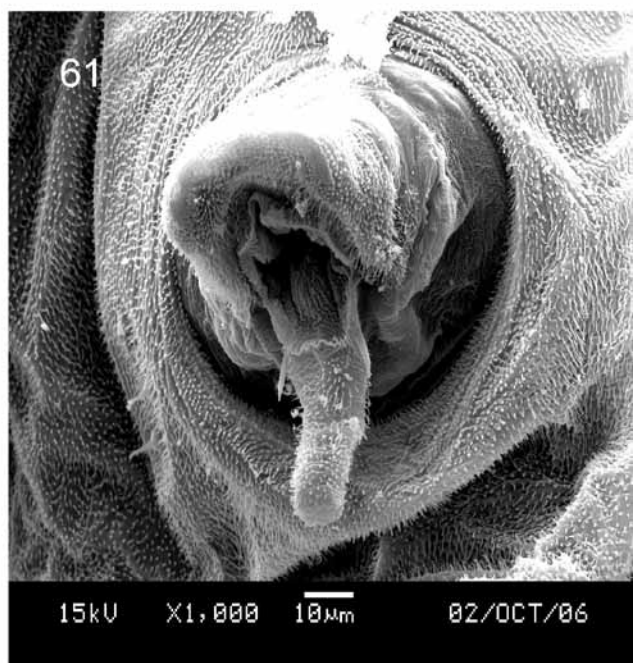
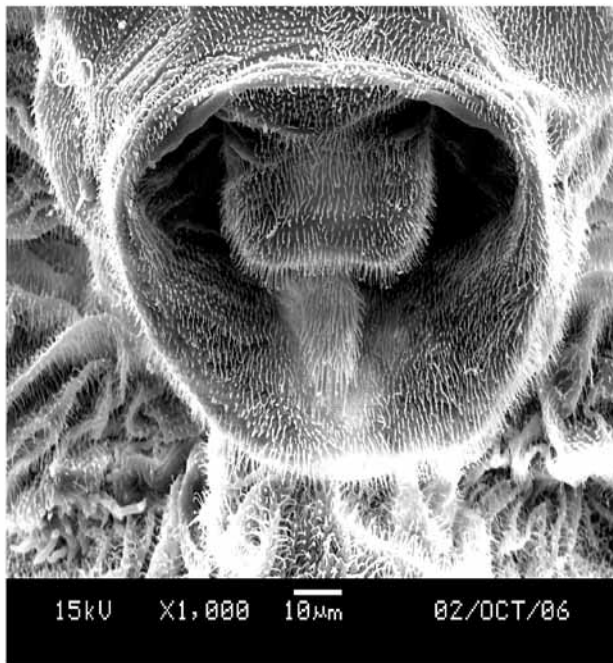
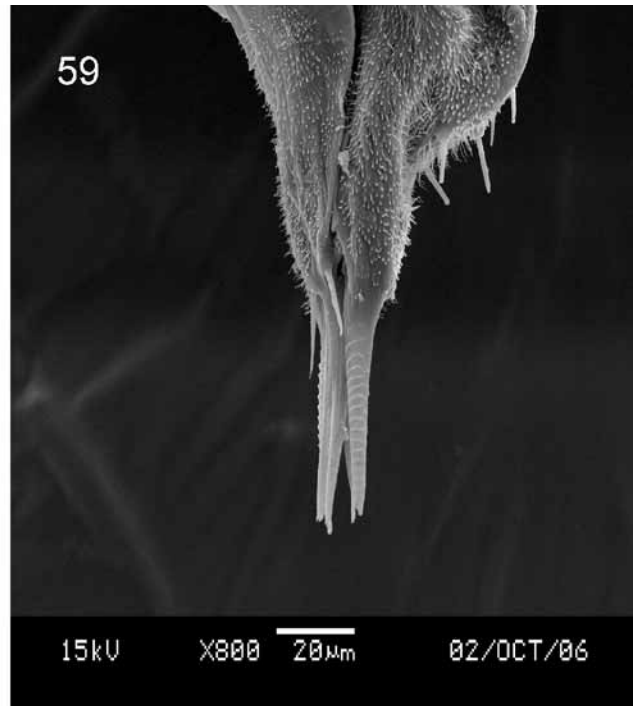
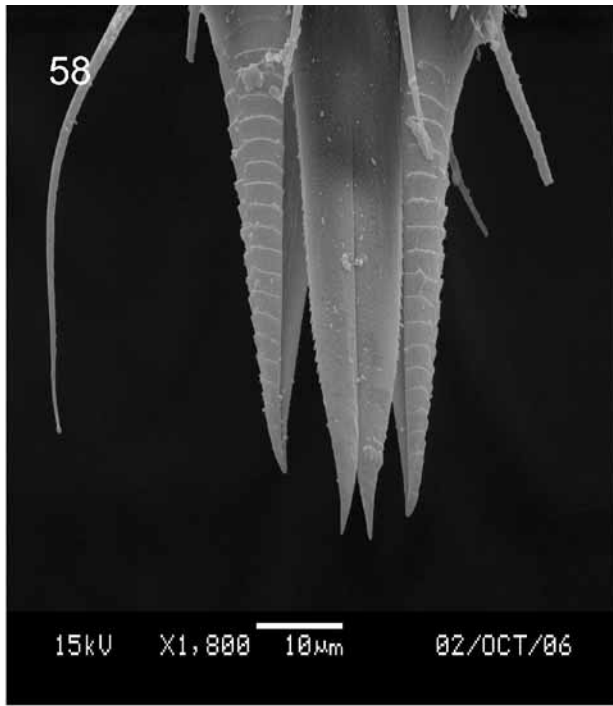


**FIGURES 50–53.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 50, primary sensoria; 51, compound eye, female; 52, facet-like structure in intervals of upper and lower compound eyes, female; 53, claw and paronychium.



**FIGURES 54–57.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 54, metatibial comb on hindtibia, dorsal view, female; 55, metatibial comb on hindtibia, lateral view, female; 56, genitalia, female; 57, genitalia, setae on unpaired gonopophysis, female.





**FIGURES 58–61.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 58, gonapophysis apical end, dorsal view, female; 59, gonapophysis apical end, lateral view, female; 60, vasiform orifice and lingula, female; 61, vasiform orifice and lingula, female.



**FIGURES 62–67.** *Aleurocyperus humus* Ko and Dubey, **sp. nov.**, 62, adult female, lateral view; 63, adult female, lateral view; 64, egg attached to leaf margin; 65, third instar; 66, puparium; 67, infestation on leaf.

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