



The world species of *Ophthalmothrips* Hood (Thysanoptera; Phlaeothripidae), with new records from Africa, China and Japan

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Abstract

Currently 10 species are listed in the genus *Ophthalmothrips*: *amyae* and *conocephalus* from South Africa, *pomeroyi* from Tanzania, *lesnei* from Mozambique, *breviceps* and *faurei* from India, *formosanus* from Taiwan, *longiceps* and *miscanthicola* from East Asia, and *yunnanensis* from China. Here, *conocephalus* is newly recorded from Madagascar, *faurei* from China and Japan, *lesnei* from Kenya, *pomeroyi* from Zaire (Democratic Republic of Congo), and the first records of males of *lesnei* and *pomeroyi* are provided. A key to males and females of the 10 species is provided.

Key words: fungal spore-feeding, sexual dimorphism, Old World tropics

Introduction

Whole fungal spores are considered to be the food of the 740 species listed in the sub-family Idolothripinae (ThripsWiki 2019). However, this conclusion is based on the possession of maxillary stylets that are relatively broad in comparison to the stylets of species in the larger sub-family, Phlaeothripinae. For species in many genera of Idolothripinae fungal spores have not been identified in the gut. However, a spore-crushing apparatus in the proventriculus of the fore gut has been reported in the members of five genera in one of the nine sub-tribes recognized in this sub-family by Mound and Palmer (1983). These genera are *Dinothrips*, *Elaphrothrips*, *Mecynothrips*, *Ophthalmothrips* and *Tiarothrips* (Tree *et al.* 2010). The genus *Elaphrothrips* is found throughout tropical countries, although it appears to be replaced by *Mecynothrips* east of Sulawesi (Mound & Palmer 1983). The other three genera are similarly all from the Old World tropics, with *Tiarothrips* known from a single species from India, and *Dinothrips* known from five species found between India and the Philippines, but *Ophthalmothrips* is widespread between Africa and Japan. This latter genus is possibly derived from *Elaphrothrips*, and the species have the fore ocellus arising far forward on the head, and the eyes prolonged posteriorly on the ventral surface of the head. *Ophthalmothrips* comprises a series of species that apparently all live at the base of grasses. The species exhibit sexual dimorphism, as well as dimorphism associated with the complete or incomplete development of wings. Species taxonomy in the genus is therefore confused (Mound & Palmer 1983), particularly in the absence of substantial population samples that would provide stronger evidence about the extent of intra-specific structural variation. The objective of the present study was to re-examine the available specimens, and to present an identification key to the 10 known species, in order to facilitate future studies on these polymorphic insects.

Abbreviations: Pronotal setae: am, anteromarginals; aa, anteroangulars; ml, midlaterals; epim, epimerals; pa, posteroangulars. The unit of measurement is microns (µm). Setae S1 refers to any pair of setae that is closest to the midline of the body; S2 is the next pair away from the midline. ANIC, Australian National Insect Collection, CSIRO, Canberra; BMNH, British Museum of Natural History, London; SFM, Senckenberg Frankfurt Museum, Frankfurt.

***Ophthalmothrips* Hood**

Ophthalmothrips Hood, 1919: 67. Type-species: *Ophthalmothrips pomeroyi* Hood

Pyrgothrips Karny, 1924: 35–6. Type-species: *Pyrgothrips conocephalus* Karny. [Synonymised by Mound & Palmer, 1983: 70]

Fulgorothrips Faure, 1933: 62–3. Type-species: *Fulgorothrips priesneri* Faure [Synonymised with *Pyrgothrips* by Mound, 1974: 89]

Derothrips Jacot-Guillarmod, 1940: 133. Type-species: *Derothrips amyae* Jacot-Guillarmod. [Synonymised by Mound & Palmer, 1983: 70]

This genus was effectively unrecognized prior to 1983, although Mound (1974) and Haga (1975) provided accounts of several species under the name *Pyrgothrips*. The species of *Ophthalmothrips* are essentially similar in structure to some species of *Elaphrothrips* but are distinguished by the ventrally prolonged compound eyes.

Diagnosis. Medium to large sized species, body slender, and macropterous, brachypterous or micropterous. Head elongate, usually with preocular projection; interocular and postocular setae usually developed; cheeks subparallel with short setae, usually weakly constricted basally. Eyes distinctly prolonged posteriorly on ventral surface. Antennae eight-segmented; elongate; segment III with two sense-cones, IV with four. Mouth-cone short and rounded; maxillary stylets V-shaped and relatively low in head. Pronotum usually shorter than half the length of head; setae on anterior margin usually short, epimeral setae usually developed; notopleural sutures complete. Fore tarsal tooth present or absent in both sexes. Basantra present, ferna developed; prospinasternum and mesopresternum developed. Metanotum usually weakly sculptured with polygonal reticulation; metathoracic sternopleural sutures absent. Pelta usually triangular (Figs 11, 17) or hat-shaped (Figs 9, 10) in a few species; abdominal tergites II to VI each with two pairs of sigmoid or not sigmoid wing-retaining setae (Figs 5, 10); tergite IX setae S1 and S2 well developed. Tube shorter than head.

Key to the world species of *Ophthalmothrips*

[*based on original description]

Females

(Female of *breviceps* unknown)

1. Head with fore ocellus clearly overhanging base of antennae (cf. Fig. 16); fore tarsal tooth present *pomeroyi**
- Fore ocellus not overhanging antennal bases; fore tarsal tooth present or absent 2
2. Fore tarsal tooth absent (cf. Fig. 8); pelta triangular (Figs 11, 17) 3
- Fore tarsal tooth present (Figs 19, 21); pelta triangular or hat-shaped (Figs 9, 10) 5
3. Preocular projection more than 1.0 times as long as wide (Fig. 4) *faurei*
- Preocular projection less than 1.0 times as long as wide 4
4. Head more than 2 times as long as broad (cf. Fig. 14); tube length less than 400 μm *longiceps*
- Head less than 2 times as long as broad; tube length about 400 μm *formosanus**
5. Wing retaining setae small, not sigmoid (Figs 5, 10); pelta triangular or hat-shaped 6
- Wing retaining setae sigmoid; pelta triangular 8
6. Preocular projection distinctly longer than wide (Fig. 3); pelta hat-shaped *conocephalus*
- Preocular projection distinctly wider than long 7
7. Pelta hat-shaped (Fig. 9); preocular projection length about 60 μm (Fig. 1); fore tarsal tooth developed (cf. Fig. 6) *amyae*
- Pelta triangular; preocular projection length 75 μm ; fore tarsal tooth short and broadly-based *yunnanensis**
8. Fore tarsal tooth weakly developed (Fig. 19); head length less than 450 μm (Fig. 13); tergite IX S1 setae subequal to tube in length or shorter *lesnei*
- Fore tarsal tooth short and broadly-based (Fig. 21); head length more than 450 μm (Fig. 15); tergite IX S1 setae much longer than tube *miscanthicola*

Males

(Male of *formosanus* unknown)

1. Head with fore ocellus clearly overhanging base of antennae (Fig. 16); fore tarsal tooth present (Fig. 23) *pomeroyi*
- Fore ocellus not overhanging antennal bases; fore tarsal tooth present or absent 2
2. Fore tarsal tooth absent; fore tibia without a tubercle at inner apex (Fig. 8); pelta always triangular (Figs 11, 17) 3
- Fore tarsal tooth present; fore tibia inner apex with or without a tubercle (Figs 6, 7, 20, 22); pelta triangular or hat-shaped (Figs 9, 10) 5
3. Preocular projection more than 1.0 times as long as wide (cf. Fig. 4) *faurei*

- Preocular projection less than 0.8 times as long as wide 4
- 4. Preocular projection length less than 80 μm (Fig. 14); interocellar setae length more than 100 μm *longiceps*
- Preocular projection length more than 80 μm (Fig. 2); interocellar setae length less than 100 μm *breviceps*
- 5. Preocular projection more than 0.8 times as long as wide (cf. Fig. 3); wing retaining setae small, not sigmoid; fore tibia inner apex with or without a tubercle; pelta hat-shaped (Fig. 10) *conocephalus*
- Preocular projection less than 0.8 times as long as wide; wing retaining setae various 6
- 6. Preocular projection less than 0.5 times as long as wide (cf. Fig. 1); wing retaining setae small not sigmoid (Fig. 5); brachypterous [inner apex of fore tibia with slight tubercle (Fig. 6); pelta hat-shaped] *amyae*
- Preocular projection more than 0.5 times as long as wide; wing retaining setae various; macropterous or micropterous 8
- 8. Wing retaining setae small, not sigmoid; fore tibia inner apex without a tubercle; pelta triangular *yunnanensis*
- Wing retaining setae large and sigmoid (weak in large male of *miscanthicola*); fore tibia inner apex with tubercle (weak in large male of *miscanthicola*) 9
- 9. Inner apex of fore tibia with distinct tubercle (Fig. 20); fore tarsal tooth well developed; head (Fig. 13) length less than 450 μm ; preocular projection 0.6 times as long as wide; macropterous; tergite IX S1 setae almost as long as tube or a little shorter *lesnei*
- Inner apex of fore tibia weakly swollen with tubercle scarcely developed (Fig. 22); fore tarsal tooth short and broadly-based; head (cf. Fig. 15) length more than 450 μm ; preocular projection 0.7 times as long as wide; macropterous or micropterous; tergite IX S1 setae much longer than tube *miscanthicola*

***Ophthalmothrips amyae* (Jacot-Guillarmod)**

(Figs 1, 5, 6, 9)

Derothrips amyae Jacot-Guillarmod, 1940: 135.

Known only from South Africa, this species has a much shorter preocular projection (Fig. 1) than its congeners. Pelta broadly hat-shaped (Fig. 9), wing-retaining setae small and not sigmoid (Fig. 5). Female with tergite IX setae S1 slightly longer than tube, sharply pointed at apex. Male brachypterous, female brachypterous or macropterous.

Specimens examined. SOUTH AFRICA, SW Grahamstown, on the farm Atherstone, 1 male (brachypterous), 1 female (macropterous), iii-1973, C.F. Jacot-Guillarmod (in BMNH).

***Ophthalmothrips breviceps* (Bagnall)**

(Fig. 2)

Phoxothrips breviceps Bagnall, 1914: 380.

Fulgorothrips breviceps (Bagnall): Ananthakrishnan, 1964: 96.

Pyrgothrips breviceps (Bagnall): Mound, 1974: 89.

This species remains known from a single female that is in poor condition. Mound (1974) synonymized *faurei* with *breviceps*, whereas Haga (1975) considered them to be distinct. More specimens are needed to determine the range of structural variation and decide if the two names represent different species.

Specimens examined. Holotype male macroptera. INDIA, W. Himalayas, Simla, 7000ft, 7-v-1910, Annandale (in BMNH).

***Ophthalmothrips conocephalus* (Karny)**

(Figs 3, 7, 10, 12)

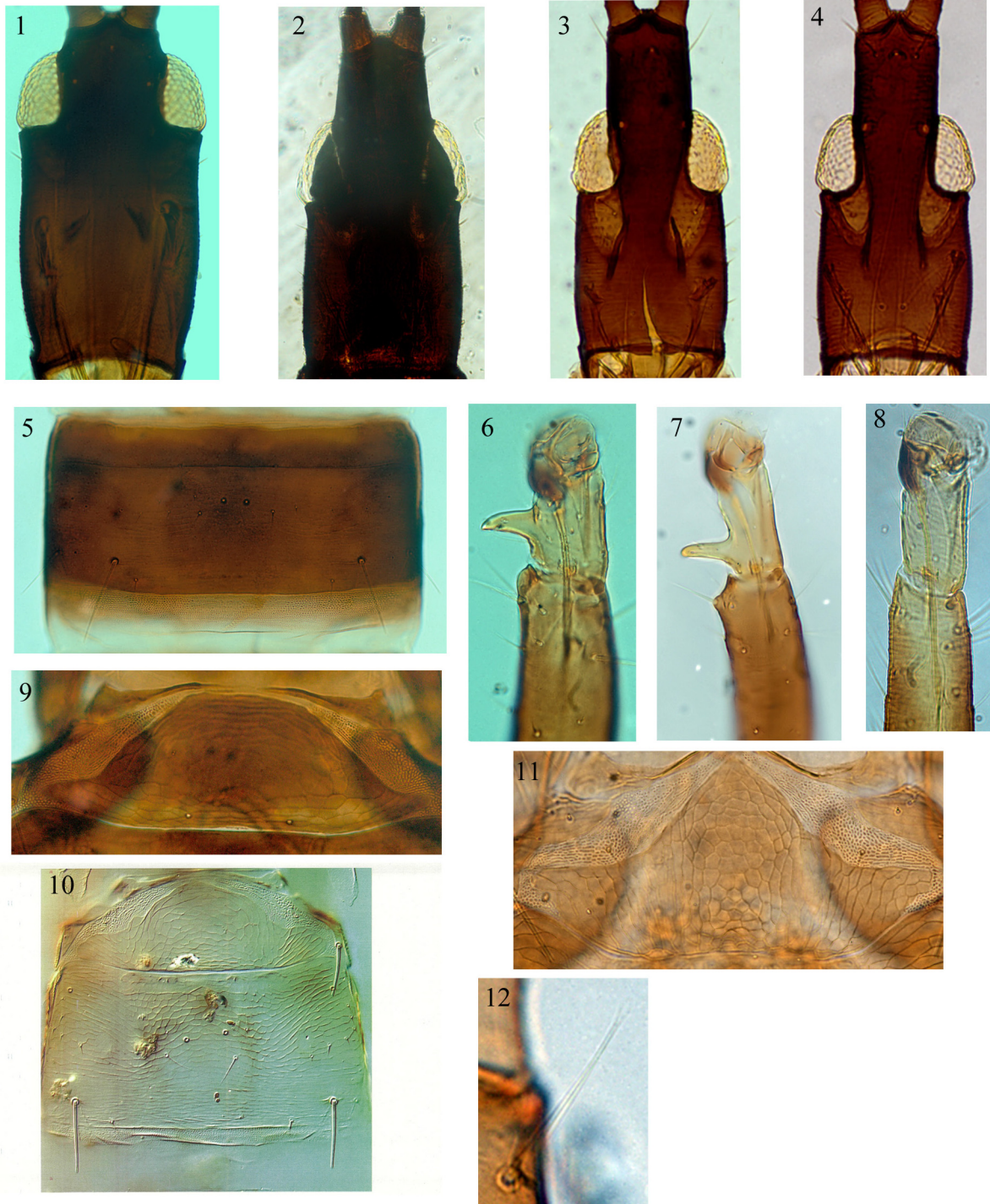
Pyrgothrips conocephalus Karny, 1924: 36.

Fulgorothrips priesneri Faure, 1933: 63–65.

Pyrgothrips priesneri (Faure): Haga, 1975: 278.

Mound (1974) synonymized *priesneri* with *conocephalus*. In contrast, Haga (1975) distinguished these two stating that the inner apex of the fore tibia of *conocephalus* bears a small seta-bearing tubercle. Mound (1974) described a specimen from Pretoria with a well-developed tubercle on the fore tibia, whereas one that was presumably from South Africa but incorrectly reported to be from Australia (Mound 2012) lacks such a tubercle. Previously known

only from South Africa, this species is here recorded from Madagascar. The specimens examined listed below can be identified as *conocephalus* by the following characters: preocular projection more than 0.8 times as long as wide (Fig. 3); intercellular and postocular setae developed and intercellular setae of male slightly expanded at apex (Fig. 12); fore tibiae with apical small tubercle in male (Fig. 7); fore wing reduced; pelta broadly hat-shaped (Fig. 10); tergal wing-retaining setae small, not sigmoid (Fig. 10).



FIGURES 1–12. *Ophthalmothrips* species. Head, 1–4: (1) *amyae* females; (2) *breviceps* male; (3) *conocephalus* female from Madagascar; (4) *faurei* female from Japan. (5) *amyae* female tergite III. Male fore tibia and tarsus 6–8: (6) *amyae*; (7) *conocephalus*; (8) *faurei*. (9) *amyae* female pelta; (10) *conocephalus* male pelta and tergite II; (11) *faurei* male pelta; (12) *conocephalus* male intercellular setae.

Measurements (one small–one large male in microns). Distended body length 3004–4217. Head, length 400–530; length from anterior margin of eyes 294–370; width across eyes 193–242; width across cheeks 194–208; preocular projection length 101–156, width 117–131; interocellar setae 54–83, postocular setae 53–118. Pronotum, median length 178–248; width 278–283; setae: aa 13–37, am 22–28, ml 11–53, pa 36–60, epim 57–91. Metanotum median setae 30–46. Fore wing length 182–299. Pelta, median length 112–141, width 268–316. Tergite IX postero-marginal setae S1 305–410, S2 345–380; anal 298–356. Tube, length 237–342; basal width 86–109; apical width 44–58. Antennal segments I–VIII length (width): 54–67(36–49); 64–76(33–44); 134–189(25–39); 112–154(31–38); 85–115(29–37); 72–83(30–34); 50–63(22–26); 49–65(16–20).

Specimens examined. **SOUTH AFRICA**, Transvaal, Kruger N.P., Olifants Camp, 2 males and females from grass tussock, 6-viii-74, B.R.Pitkin 796 (in BMNH); Natal, Pietermaritzburg, 13-viii-1989, 1 male from half-dried bushes and branches, R. zur Strassen (in SMF); Natal, St. Lucia, 1 female from mixed vegetation, 22-x-1981, J. Klapperich (in SMF). **MADAGASCAR**, Antanimieva, Tulear district, 22°22S, 44°43E, 1 male in sweep net, 20-vi-1994, C.C.D. Tingle (in ANIC); Beamalo Tulear district, 24°08'×45°2' males in sweep net, 15, 28-v-1994, C.C.D. Tingle (in ANIC).

***Ophthalmothrips faurei* (Ananthakrishnan)**

(Figs 4, 8, 11)

Fulgorothesis faurei Ananthakrishnan, 1964: 96–97.

Pyrgothrips faurei (Ananthakrishnan): Haga, 1975: 269.

This species has much a longer preocular projection than its congeners apart from *conocephalus*, and previously has been known only from India. It is here newly recorded both from China and Japan.

Specimens examined. **INDIA**, Tambaram, 3 males, 1 female from grass, 24-iii-65 (in BMNH and SMF); Madras, from grass, 1 female 4-iii-67, 1 female, 15-ii-66 (in BMNH). **CHINA**, Guilin, Yaoshan, 1 female, ix-1980, P.W.Hammond (in ANIC). **JAPAN**, Ryukyus, Ishigaki Is, Okinawa, Ishigaki-shi Ohkawa, 2 males, 5 females on grass, 26-ix-2014 & 28-iii-2016, K. Minoura.

***Ophthalmothrips formosanus* (Karny)**

Idolothrips formosanus Karny, 1913: 130.

Pyrgothrips formosanus (Karny): Haga, 1975: 270.

This species is based on a single macropterous female from Taiwan. According to the original description it is distinguished from the females of other species in this genus by length of the tube that is more than 400 µm.

***Ophthalmothrips lesnei* (Priesner)**

(Figs 13, 19, 20)

Fulgorothesis lesnei Priesner, 1952: 878.

This species has been based on a single female from Mozambique but is here newly recorded from Kenya on the male and female specimens listed below. These can be identified as *lesnei* by the following characters: fore tarsal tooth present in both sexes (Figs 19, 20); preocular projection less than 80µm long, less than 130µm wide (Fig. 13); fore wings developed; tergal wing-retaining setae sigmoid; tergite IX setae S1 subequal in length to tube.

Macropterous male. Body length: 3.4mm. Very similar in colour and structure to female. Fore tarsal tooth (Fig. 20) significantly larger than in females. Tibia (Fig. 20) with distinct tooth near inner angle.

Measurements (male in microns). Distended body length 3340. Head, length 439, length from anterior margin of eyes 373; width across eyes 210, width across cheeks 192; preocular projection length 72, width 115; interocellar setae 61, postocular setae 61–79. Pronotum, median length 205; width 311; setae aa 6–11, am 12, ml 33, pa 45–46,

epim 54–67. Metanotum median setae 25–28. Fore wing length 1226. Pelta median length 118, width 260. Tergite IX posteromarginal setae S1 288, S2 327. Tube, length 297; basal width 85; apical width 48; anal setae 303. Antennal segments I–VIII length (width): 55(38); 71(35); 139(33); 114(33); 95(30); 70(30); 55(26); 59(18).

Specimens examined. KENYA, Naro Maru River Lodge 6,500, 1 male, 1 female in grass tussocks, 12-vii-74, B.R.Pitkin (in BMNH).

***Ophthalthrips longiceps* (Haga)**

(Figs 14, 17)

Pyrgothrips longiceps Haga, 1975: 273.

Known only from macropterae of both sexes, this species occurs in grass tussocks mainly in the tropical region of East Asia. It is similar to *O. faurei* from India, China and southern Japan in having a relatively long preocular projection, and in lacking a fore tarsal tooth in both sexes. It is distinguished from *faurei* by the slightly shorter preocular projection (less than 1.0 times as long as wide), and the pelta sharply pointed laterally in both sexes (Fig. 17).

Specimens examined. JAPAN, Okinawa-prefecture, Ginowan-shi, 1 female on *Miscanthus sinensis*, 27-iii-2005; Ishigaki-shi, 5 males, 11 females on Poaceae, 28-iii-2016; Yaeyama-gun, Yonaguni-cho, on Poaceae, 1 female, 3-iii-2016, 1 male, 1-iii-2017. CHINA, Henan Prov. Xinyan, 1 male on grass, 20-viii-1957; Henan Prov., 1 female on grass, 13-vii-1985 (in ANIC).

***Ophthalthrips miscanthicola* (Haga)**

(Figs 15, 21, 22)

Pyrgothrips miscanthicola Haga, 1975: 273.

Known from macropterae and micropterae of both sexes, this species is recorded from Japan, China and Korea (Okajima 2006), mainly in temperate regions. It is similar to *O. lesnei* from Mozambique and Kenya, but it can be distinguished by the longer preocular projection on the head (Fig. 15) and the tergite IX setae S1 subequal in length to the tube.

Specimens examined. JAPAN, Okinawa-prefecture, Urasoe-shi, 1 male on *Miscanthus sinensis*, 11-iii-2006; Aichi-pre., Nagoya-shi, 2 males on *Miscanthus* sp., 18-ix-2006; Aichi-pre., Yatomi-shi, 1 male on *Miscanthus* sp., 27-ix-2011; Shizuoka-pre., Hamamatsu-shi, Mikkabi-cho, 2 males, 2 females on Poaceae, 5-v-2018. CHINA, Sichuan Prov., 1 male, 11-vii-1984; Henan Prov., Xinyan, 1 female on grass, 20-viii-1957 (in ANIC).

***Ophthalthrips pomeroyi* Hood**

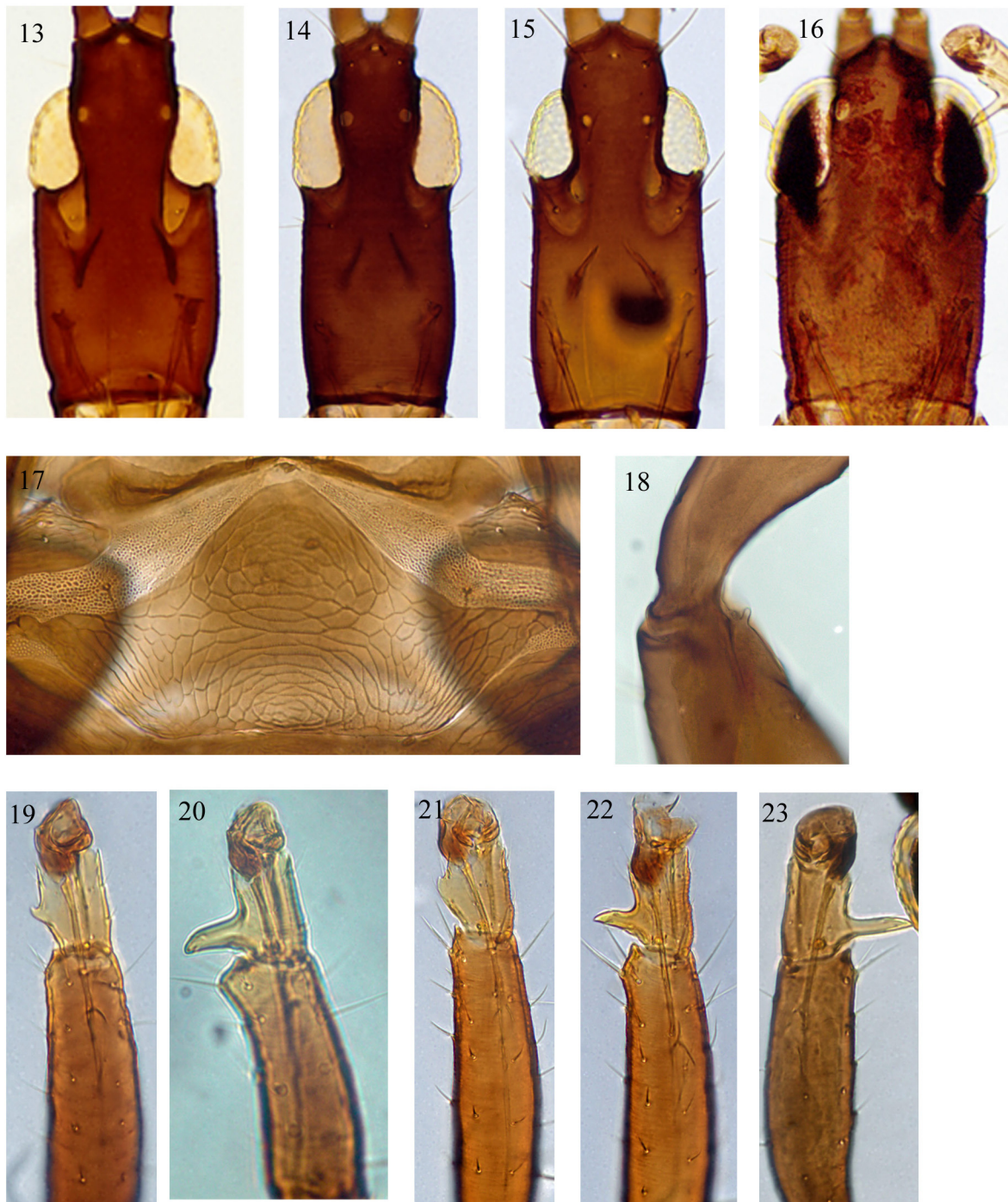
(Figs 16, 18, 23)

Ophthalthrips pomeroyi Hood, 1919: 67.

Known from macropterae of both sexes, this species is easily distinguished by having the fore ocellus clearly overhanging the base of the antennae. It was described from a single female from South Africa and is here newly recorded from Zaire (Democratic Republic of Congo) based on the male listed below. This male is identified as *pomeroyi* by having the fore ocellus clearly overhanging the base of the antennae (Fig. 16). The fore femur of this male has a small tubercle at the apex (Fig. 18).

Measurements (male from Zaire in microns). Distended body length 2630. Head, length 353, from anterior margin of eyes 204; width across eyes 228; width across cheeks 202; preocular projection length 37, width 84; interocellar setae 37, postocular setae damaged. Pronotum, median length 193; width 299; setae aa 26, am 13–16, ml 44, pa 44–49, epim 85. Metanotum median setae 22–25. Fore wing length 1295. Pelta median length?, width 251. Tergite IX posteromarginal setae S1 306, S2 376. Tube, length 261; basal width 90; apical width 50; anal setae 332. Antennal segments I–VIII length (width): 33(36); 54(36); 107(27); 98(33); 75(32); 62(30); 47(28); 47(21).

Specimen examined. ZAIRE (Prov. Orientale), Gebiet des Parc Natn. de la Garamba, 1 male, 1951. Gekätschert (in SMF).



FIGURES 13–23. *Ophthalmothrips* species. Head, 13–16: (13) *lesnei* female from Kenya; (14) *longiceps* male; (15) *miscanthicola* female; (16) *pomeroyi* male from Zaire. (17) *longiceps* female pelta. (18) *pomeroyi* male from Zaire, fore femur. Fore tibia and tarsus 19–23: (19) *lesnei* female from Kenya; (20) *lesnei* male from Kenya; (21) *miscanthicola* female; (22) *miscanthicola* male; (23) *pomeroyi* male from Zaire.

Ophthalmothrips yunnanensis Cao, Guo & Feng

Ophthalmothrips yunnanensis Cao, Guo & Feng, 2010: 265–267.

This species is known only from Yunnan, China. It is similar to *O. miscanthicola* from Japan, China and Korea in

having the female with the fore tarsal tooth short and broadly-based, also the preocular projection distinctly wider than long. It is distinguished by the presence of small, non- sigmoid wing-retaining setae.

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