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A new, remarkable species of *Platystethynium* (*Platypatasson*) (Hymenoptera: Mymaridae) from New Zealand

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Abstract

Platystethynium (*Platypatasson*) *earlyi* Huber, **sp. n.** (Hymenoptera: Mymaridae), is described from both sexes reared from an egg of Rhaphidophoridae (Orthoptera) found in an old mining tunnel in New Zealand. The male is micropterous and has lateral ocelli but no median ocellus, a unique feature in Mymaridae found so far only in males of *Platystethynium* Ogloblin species. The remaining described Eastern Hemisphere species of *Platystethynium* are discussed and *Platystethynium glabrum* Jin & Li, **syn. n.**, is placed in synonymy under *P. onomarchicidum* Ogloblin. A key to females, and males where known, of the described Eastern Hemisphere species of *Platystethynium* is given.

Key words: Chalcidoidea, egg parasitoid, micropterous male, Rhaphidophoridae

Introduction

Platystethynium Ogloblin, 1946 is a small genus of parasitic wasps in the family Mymaridae (Hymenoptera), commonly known as fairyflies in English. Ogloblin (1946) described *Platystethynium* Ogloblin and *Platypatasson* Ogloblin for two species reared by C. Franssen in March and May, 1939, from Tettigoniidae (Orthoptera) eggs at Buitenzorg [now Bogor], Java, Indonesia. At the time, differences in the number of flagellar segments were considered sufficiently important to define genera and Ogloblin's two genera were based mainly on differences in the number of segments in the clava of females. That changed in the 1940s when it was realized that such differences occur in otherwise very similar taxa. As a result, various genera were placed in synonymy, often as subgenera, e.g., *Anaphes* (*Patasson*) Walker (Debauche 1948). Thus, Schauff (1984) synonymized *Platypatasson*, whose females have the clava 2-segmented, under *Cleruchus* Enock, whose females usually have the clava entire, i.e., 1-segmented, though Noyes & Valentine (1989) noted that the clava may also be 2-segmented in some species. Donev & Huber (2002) removed *Platypatasson* from synonymy under *Cleruchus* and instead treated it as a synonym of *Platystethynium*, the latter with a 3-segmented clava. Huber *et al.* (2020) treated *Platypatasson* as a subgenus of *Platystethynium*. Finally, Ortis *et al.* (2020) placed *Pseudocleruchus* Donev & Huber, 2002, whose females also have the clava 3-segmented, in synonymy under *Platystethynium* (*Platystethynium*). *Platypatasson* is treated as a subgenus whereas *Pseudocleruchus* is not because the clava of the latter is 3-segmented, as in *P.* (*Platystethynium*). *Platystethynium* now contains six species in two subgenera: *P.* (*Platystethynium*) *onomarchicidum* Ogloblin and *P.* (*Platypatasson*) *fransseni* (Ogloblin) from Indonesia (Ogloblin 1946); *P.* (*Platypatasson*) *terebrator* (Ogloblin) and *P.* (*Platypatasson*) *vagatus* (Ogloblin) from Argentina (Ogloblin 1959); *P.* (*Platystethynium*) *triclavatum* (Donev & Huber) from Europe (Donev & Huber 2002; Ortis *et al*. 2020); and *P.* (*Platystethynium*) *glabrum* Jin & Li from China (Jin & Li 2016).

Host records for *Platystethynium* species were so far restricted to Tettigoniidae (Orthoptera). Ogloblin (1946) described *P. onomarchicidum* from *Onomarchus uninotatus* (Serville) (Tettigoniidae, Pseudophyllinae) and *P. fransseni* from an unidentified “locustid” [an old name for Tettigoniidae]. Subba Rao (1970) described the first known males for the genus; the specimens were sent to him for identification from the Commonwealth Institute of Entomology and had been reared together with numerous females of *P. fransseni* from an unidentified species of

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Tettigoniidae collected in Papua New Guinea. Ortis *et al.* (2020) described the male of *P. triclavatum* from eggs of *Barbitistes vicetinus* Galvagni & Fontana (Tettigoniidae, Phaneropterinae), a bush cricket endemic to Veneto, northern Italy. Because *P. triclavatum* has been collected also in Bulgaria and the Czech Republic it must parasitize other hosts, either other species of *Barbitistes* that occur further north in Europe, e.g., *B. constrictus* Brunner von Wattenwyl, or species in other genera (Ortis *et al.* 2020). In the present article, we describe both sexes of a new species of *Platystethynium* (*Platypatasson*) from New Zealand that parasitize eggs from a different family, Raphidophoridae (Orthoptera). Also, new distribution records are given for two species, and a key to both sexes of the described species of *Platystethynium* in the Eastern Hemisphere is presented. The phrase "Eastern Hemisphere" is used instead of "Old World" because it encompasses a slightly different area. The former extends from 20°W to 160°E, thus excluding New Zealand, whereas the latter extends from 0°–180°E, which include New Zealand. We briefly discuss adult fairyfly size relative to host egg size.

Methods

Specimens were critical point dried from ethanol (Gordh & Hall 1979) and card mounted (Noyes 1982) using shellac gel as the adhesive (Martin 1978). A male and two females from the series of 15 specimens that emerged from a single host egg were then cleared and slide mounted in Canada balsam and some photographed with a ProgRes™ C14plus digital camera attached to a Nikon Eclipse E800 compound microscope, as described in Huber (2015). Because the two previous descriptions of males of *Platypatasson* are cursory, the male is described below in considerable detail. The female description is relatively much shorter because it includes only the main features useful for separating the new species from previously described ones. Measurements of morphological structures are given in micrometres. Abbreviations used in the keys, text or illustrations mainly follow Gibson (1997) and Huber (2015) with minor changes: fl = flagellar segment (in males), fu = funicle segment (in females), gt = gastral tergum, mps = multiporous plate sensillum or sensilla (longitudinal sensilla, of authors). Abbreviations for institutions are:

CNC	Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada.
NEFU	Northeast Forestry University, Harbin, China.
NHMUK	Natural History Museum, London, UK (formerly BMNH).
NZAC	New Zealand Arthropod Collection, Landcare Research, Auckland, New Zealand.

Platystethynium Ogloblin, 1946

Platystethynium Ogloblin, 1946: 290. Type species: *P. onomarchicidum* Ogloblin, by original designation.
Platypatasson Ogloblin, 1946: 293. Type species: *Platystethynium fransseni* Ogloblin, 1946, by original designation. Synonymy by Donev & Huber, 2002: 118.
Parastethynium Ogloblin, 1964: 106. *Lapsus* for *Platystethynium*.
Pseudocleruchus Donev & Huber, 2002: 118. Type species: *Pseudocleruchus triclavatus* Donev & Huber, 2002, by original designation. Synonymy by Ortis *et al.*, 2020: 10.

Diagnosis. **FEMALE**. Females are distinguished from all other genera by the following combination: head strongly triangular (Fig. 8); mandibles short, without teeth, and with a distinct gap between them (Fig. 2b); pronotum longitudinally divided medially (Fig. 4); mesosoma dorsoventrally flattened (Fig. 9); fore wing with venation at most 0.33× fore wing length.

Remarks. *Platystethynium*, represented in New Zealand by one species of the subgenus *Platypatasson*, is the first new genus reported for the country since the genera were keyed by Noyes & Valentine (1989). In their key, females would key to *Apoxypteron*, at the first half of their couplet 67. Males key to couplet 9 but do not fit either half. Among other features, *Platystethynium* (*Platypatasson*) differs from *Apoxypteron* by the longitudinally divided pronotum (pronotum not divided in *Apoxypteron*), the short and relatively wide parastigma (Fig. 5) (parastigma long and uniformly thin in *Apoxypteron*), and the venation about 0.3× fore wing length (venation 0.4× fore wing length in *Apoxypteron*).

***Platystethynium* (*Platypatasson*) *earlyi* Huber, sp. n.**
(Figs 1–17)

Type material. Holotype ♀ (NZAC), dissected under 2 coverslips on slide (Fig. 6) with three labels as follows: "*Platystethynium* (*Platypatasson*) *earlyi* Huber Holotype ♀ dorsal", "New Zealand BR, Woods Creek Track, SE. of Greymouth, 180m 24.ii.2007, J.W. Early R.F. Gilbert", "Soil in old mining tunnel ex. rhaphidophorid egg L 15842".

Paratypes. 2♀, 1♂ on slides, 14 ♀, 2♂ on cards (CNC, NZAC) with same collecting data as holotype, and all from the same host egg. *Platystethynium earlyi* is the third species of the genus for which males are described.

Diagnosis. **FEMALE**. Females of *Platystethynium earlyi* are distinguished from *P. fransseni*, the only other described species of the subgenus in the Eastern Hemisphere, by the features given in the key and, in addition: gena in dorsal view more rounded posteriorly and eye relatively shorter compared to head length (Fig. 2) (in *P. fransseni*, gena in dorsal view more angular posteriorly and eye relatively longer, Fig. 22); pronotum with 1 long submedial posterodorsal seta (Fig. 4) (in *P. fransseni* with 2 shorter, more laterally placed posterodorsal setae, Fig. 25); fore wing with lobe posterior to parastigma forming a right angle with posterior margin of wing (Fig. 5) (in *P. fransseni* forming an oblique angle, Fig. 24); fore wing with apex more rounded (Fig. 5) (in *P. fransseni* apex more pointed, Fig. 24) and anterior row of microtrichia in basal half of wing distal to venation separated by a distinct gap from posterior row of a few very short microtrichia (in *P. fransseni* anterior row of microtrichia in basal half of wing distal to venation separated by a distinct gap from posterior row of almost equally long microtrichia); genitalia originating near midpoint of gaster (Fig. 10b) and about 1.9× as long as mesotibia (in *P. fransseni* genitalia originating near base of gaster (Fig. 26b), 3.0× as long as mesotibia) (metatibia not oriented well for measurement so comparison made with mesotibia instead of metatibia).

MALE. Males of *P.* (*Platypatasson*) *earlyi* are distinguished from the known males of other *Platystethynium* species by having the flagellum 10-segmented (11-segmented in *P. fransseni*) and most flagellomeres wider than long (Figs 14, 15) (longer than wide in *P. triclavatum*).

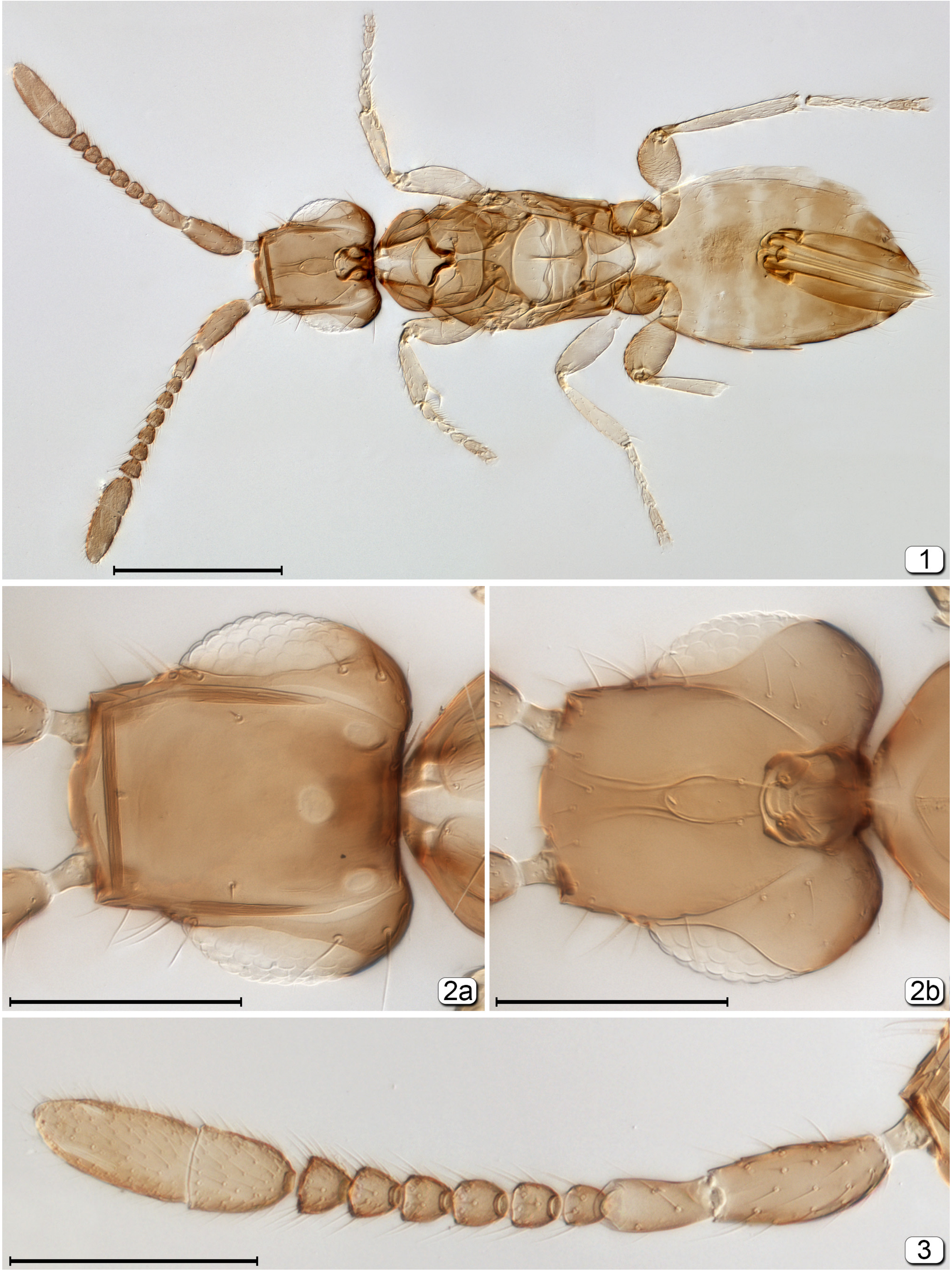
Description. **FEMALE**. Body length 643–812 (n=13, card mounts), 785–900 (n=3, slide mounts). ***Colour***. Body light brown except frenum, legs, and underside of mesosoma almost white; outer ovipositor plate and genitalia brown. ***Head***. Width 158–162 (n=2), vertex with 1 short seta laterally about midway between median ocellus and transverse trabecula (Fig. 2a). ***Antenna***. Funicle apparently without mps on any segment (Figs 1, 3) but with 2 mps on clava segment 1 and 4 mps on clava segment 2. Funicle segments slightly increasing in width from fu_1 to fu_6 and each usually slightly longer than wide except for fu_6, which is slightly wider than long. Length/width measurements (ratios) (n=2): scape 116–118/32–34 (3.48–3.63), pedicel 50–52/24–30 (1.74–2.21), fu_1 22–24/18–19 (1.24–1.30), fu_2 24–26/20 (1.20–1.28), fu_3 23–24/18–20 (1.16–1.28), fu_4 22/20–22 (1.00–1.10), fu_5 21–23/21–24 (0.95–1.00), fu_6 22–24/24–30 (0.75–0.97), clava 109/34–41 (2.68–3.17). ***Mesosoma***. Width 146–148 (n=2), scutellum with fairly long scutellar setae and sharply triangular fenestra (Fig. 4). ***Wings***. Fore wing (n=3) with anterior row of microtrichia in basal half of wing distal to venation separated by a distinct gap from posterior row of a few very short microtrichia (Fig. 5); length 628–641, width 38–39, length/width 16.1–16.9, longest marginal setae 130–137. Hind wing length 622–629, width 26, longest marginal setae 122–149. ***Metasoma***. Gaster with terga about equal in length and each with about 4 setae sublaterally and laterally near their posterior margins (Figs 7a, 10a). Ovipositor length 212–215, distinctly longer than metatibia length (175–182) and arising near base (Fig. 7b) or near apex of gt_4 (Fig. 10b).

MALE. Body length 782–822 (n=2, card mounts), ~800 (n=1) (slide mount, head measured separately from rest of body). ***Colour***. Head, antenna**,** wing remnants, legs and metasoma almost white except as follows: gena except malar area brown, vertex light brown, mandible dark reddish brown, scape and pedicel light brown, mesoscutum, gt_1 and sterna light brown (Figs 11, 12). ***Head***. Width 265, distinctly wider than mesosoma (182); face about 3.5× as wide as high, smooth except with engraved reticulations laterally near torulus (Fig. 13a); each torulus slightly closer to mouth margin than to transverse trabecula and each preorbital trabecula much thinner than transverse trabecula; vertex smooth, slightly wider than long, with each supraorbital trabecula much thinner than transverse trabecula and not divided into segments; median ocellus absent; lateral ocellus small, about 0.3× diameter of a torulus and at posterolateral corner of vertex; eye small, in anterior view about 3.1× as high as wide, with few facets; gena large, in lateral view about 3.4× width of eye and with strong vertical rugae; back of head smooth (Fig. 13b); mouth opening huge, about 4.0× greatest diameter of foramen magnum. Entire head with very few, minute setae as follows: 1 on gena lateral to supraorbital trabecula, 1 medial to ventral apex of preorbital trabecula, 4? on malar area near lateral angle of mouth opening, 2 dorsolateral to foramen magnum. ***Mouthparts***. Mandibles large, when closed overlapping for over half their length, each with 3 equal teeth (Fig. 13a). ***Antenna*** (Figs 14, 15). Scape smooth, in lateral view about 0.5× as wide as long and almost twice as wide as pedicel; pedicel smooth, about 1.6× as long as wide, longer than any flagellomere and 0.5× as long as scape; flagellum 10-segmented, length 255 and less than head width, with 1 mps on fl_1–fl_4 and apparently 1 or 2 mps on remaining flagellomeres, apical flagellomere the narrowest and tapering towards apex, with blunt or pointed apex (each antenna different), and with two apical setae about as long as basal width of flagellomere; length/width (ratios): scape 71/44 (1.62), pedicel 40/28 (1.41), fl_1 30/22 (1.36), fl_2 28/17 (1.60), fl_3 24/17 (1.37), fl_4 26/16 (1.65), fl_5 23/16 (1.49), fl_6 28/14 (2.00) and 26/16 (1.63), fl_7 18/14 (1.29), fl_8 22/14 (1.57) and 32/15 (2.13), fl_9 22/16 (1.37), fl_{10} 36/10 (3.5) (fl_6 and fl_8 have different dimensions so measurements for both antennae are given). ***Mesosoma*** (Fig. 16). In dorsal view 1.5× as long as wide, width 182; propodeum slightly the widest segment; pronotum almost smooth, with trace of longitudinal reticulations, and longitudinally divided medially, in dorsal view clearly visible, in lateral view almost horizontal, with 1 minute anterior and 1 posterior submedian seta (or at least a sensillum) and 1 slightly longer posterior sublateral seta; mesoscutum slightly less than 1.5× as long as wide, smooth, with notaulus evanescent in posterior half, except with small shallow depression on anterior margin just lateral to notaulus, without adnotaular setae, and with 1 lateral seta just anterior to spiracle; mesoscutellum medially slightly shorter than mesoscutum, with scutellum 1.5× as long as strongly transverse frenum, with frenal line separating the two present only laterally; axilla with a minute seta on dorsal and lateral panels; scutellum with a seta at lateral margin about midway between anterior margin and frenal line; fenestra (only visible internally) occupying most of scutellum except for a narrow crescent along anterior margin; metanotum with dorsellum medially about 0.6× as long as frenum and about 3.8× as wide, as long and extending narrowly laterally along anterior margin of propodeum to lateral margin of lateral panel of metanotum; lateral panel of metanotum distinct, narrow medially, wider laterally, with a distinct pit along anterior margin midway between median and lateral margins, and with 2 minute setae at lateral margin in anterior and posterior corners; propodeum, smooth, about 0.4× as long as wide, with spiracle small and without propodeal seta. ***Wings***. Reduced to minute translucent balloon-like vestiges with hind wing slightly larger than fore wing (Fig. 16, left side) and shorter than half length of tegula (Fig. 16, right side). ***Legs***. Short, with femora stout, tibiae distally stout and not much longer than femora, and tarsi short, with tarsal segments 1 and 4 about as long as wide, and tarsal segments 2 and 3 shorter than wide (Figs 11, 12). ***Metasoma***. About 1.4× as long as mesosoma; petiole about 12× as wide as long and almost as wide as gt_1; gaster with all segments about equal in length and weakly sclerotized, collapsing in air dried specimens, truncate posteriorly with last visible segment in dorsal view almost as wide as gt_1 and without externally visible spiracle (Fig. 11); each gastral segment apparently with 2 minute setae laterally along posterior margin. ***Genitalia***. Capsule rectangular, about 0.4× as long as aedeagal apodemes + aedeagus (Fig. 17).

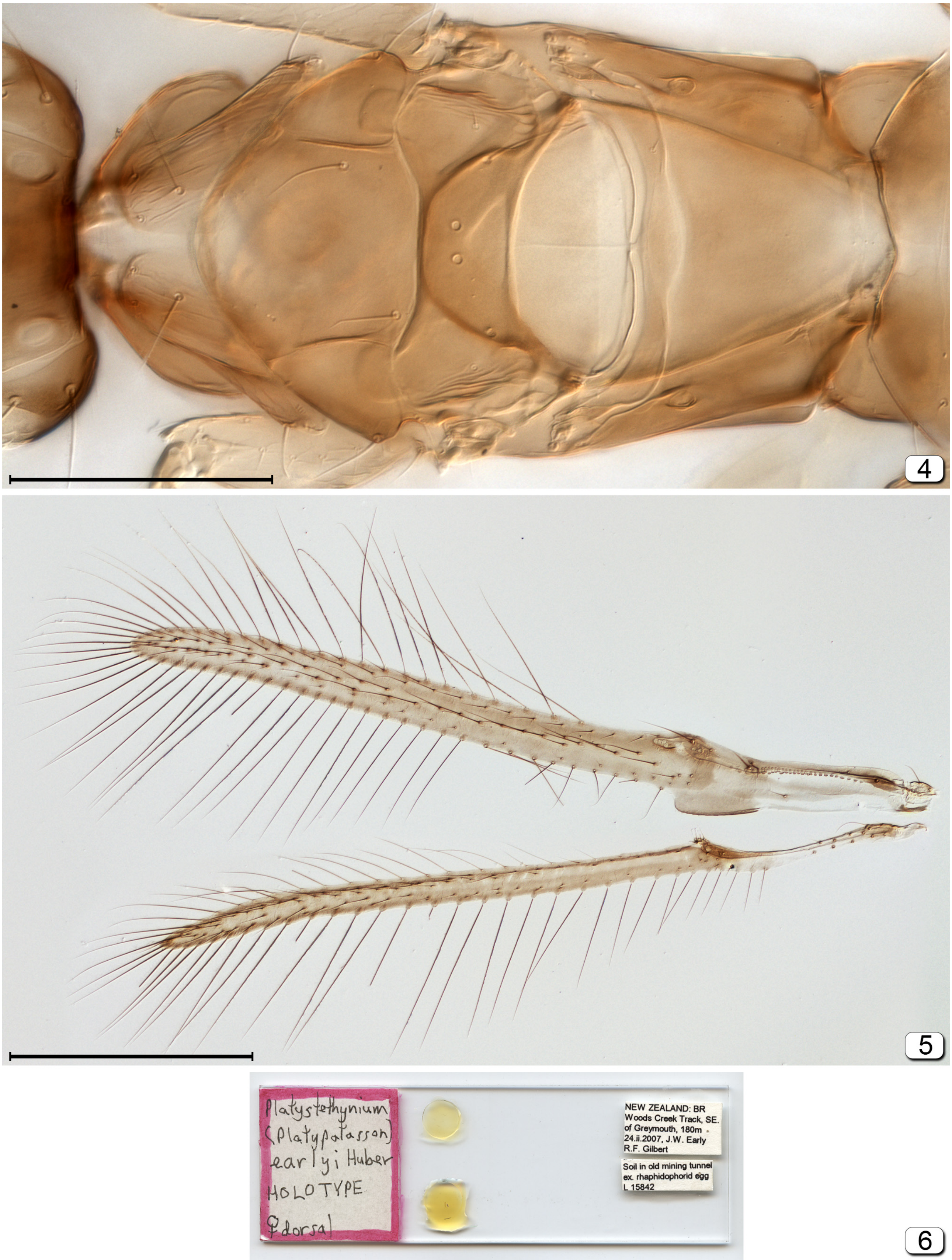
Host. Rhaphidophoridae (Orthoptera), unidentified to genus and species. The egg remains was preserved and glued to a card together with one of the *P. earlyi* females. The egg measured 4 mm in length and, though slightly crushed, measured about 1.7 mm in diameter. Its volume was calculated as 1.22825 mm^3. The volume of a female of *P. earlyi* was calculated as 0.0052 mm^3 so an estimated 24 individuals would have completely occupied the host egg. Given that the host egg is not cylindrical but somewhat oval and that the chorion thickness also would slightly reduce the egg internal volume, the maximum possible number of *P. earlyi* individuals that could have filled the egg completely would only be about 20, i.e., almost the same number as was actually reared from the egg. This indicates that the entire egg contents must have been used to feed the developing larvae of *P. earlyi*, whose bodies ultimately filled the egg completely. Though the egg chorion was somewhat torn, at least one hole and perhaps two or three holes were made, likely by at least one of the three males, for parasitoid emergence.

Derivation of species name. The species is named in honour of John W. Early, Curator (retired) of Entomology, Auckland Museum, Auckland, New Zealand, one of the collectors of the new species.

Distribution. New Zealand.



FIGURES 1–3. *Platystethynium* (*Platypatasson*) *earlyi* Huber, holotype. 1, habitus, ventral; 2, head, dorsal; 3, head, ventral. Scale bars: 1 = 200 µm; 2, 3 = 100 µm.



FIGURES 4–6. *Platystethynium* (*Platypatasson*) *earlyi* Huber, holotype. 4, mesosoma, dorsal; 5, wings; 6, holotype slide. Scale bars: 4 = 100 µm; 5 = 200 µm.

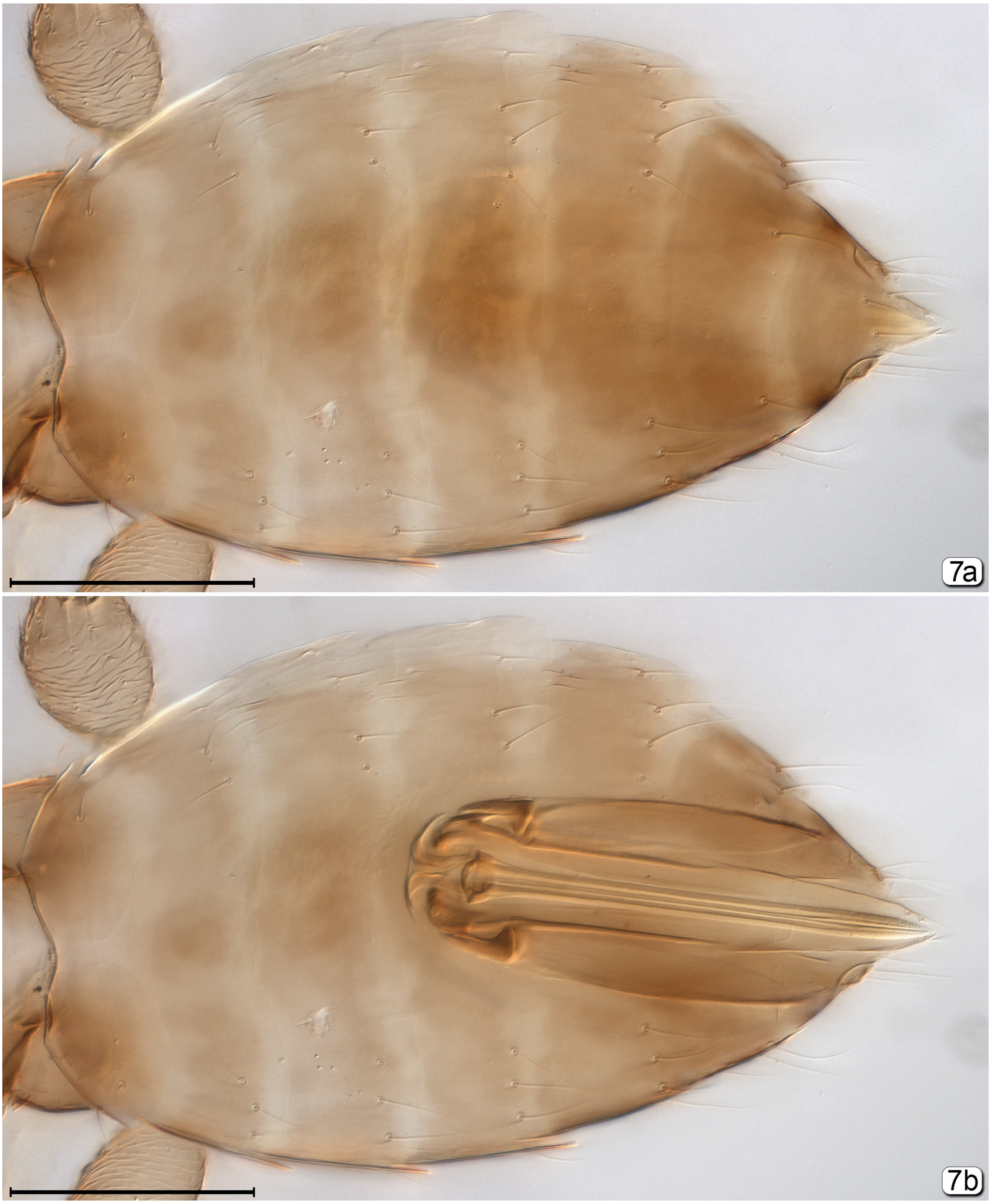
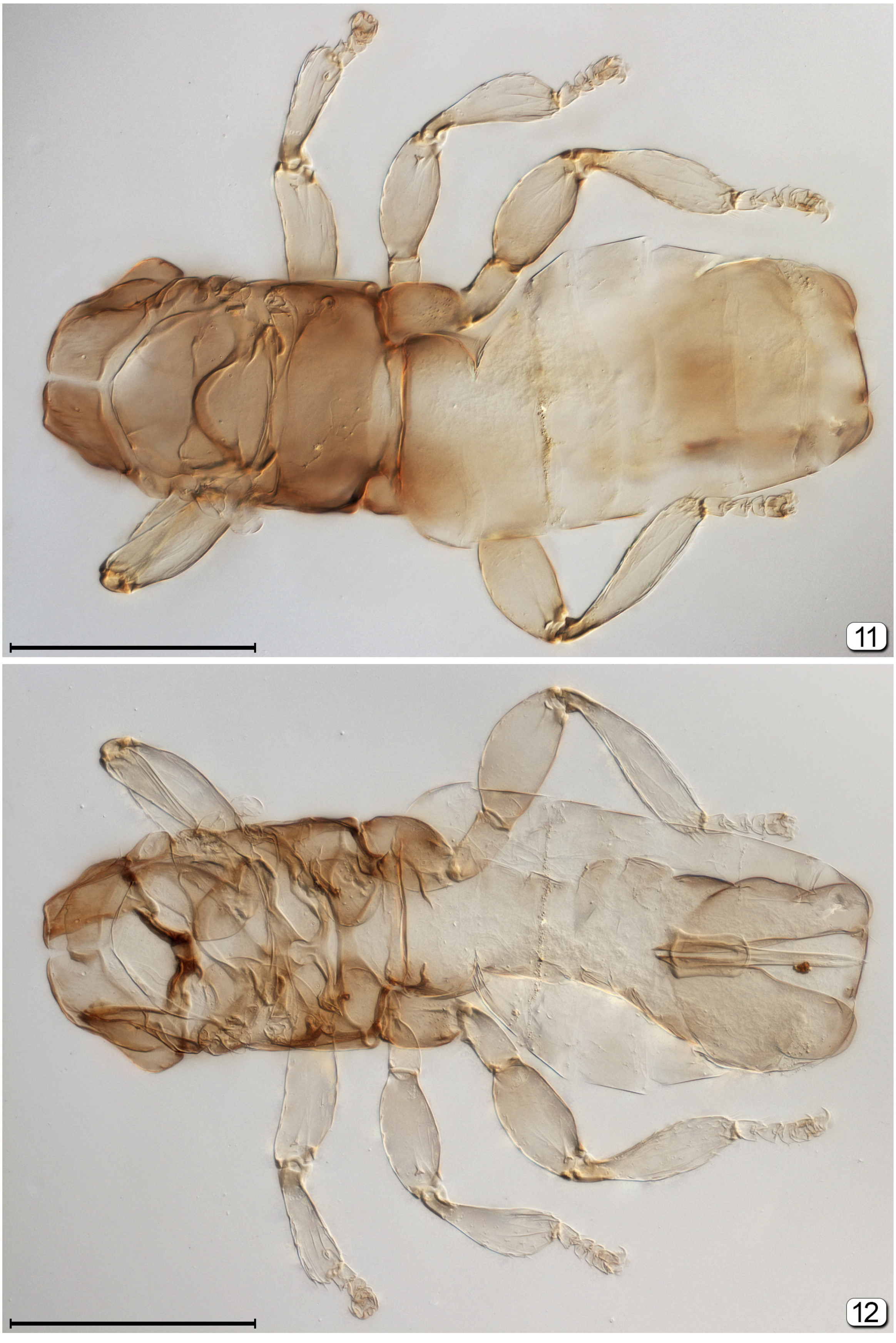
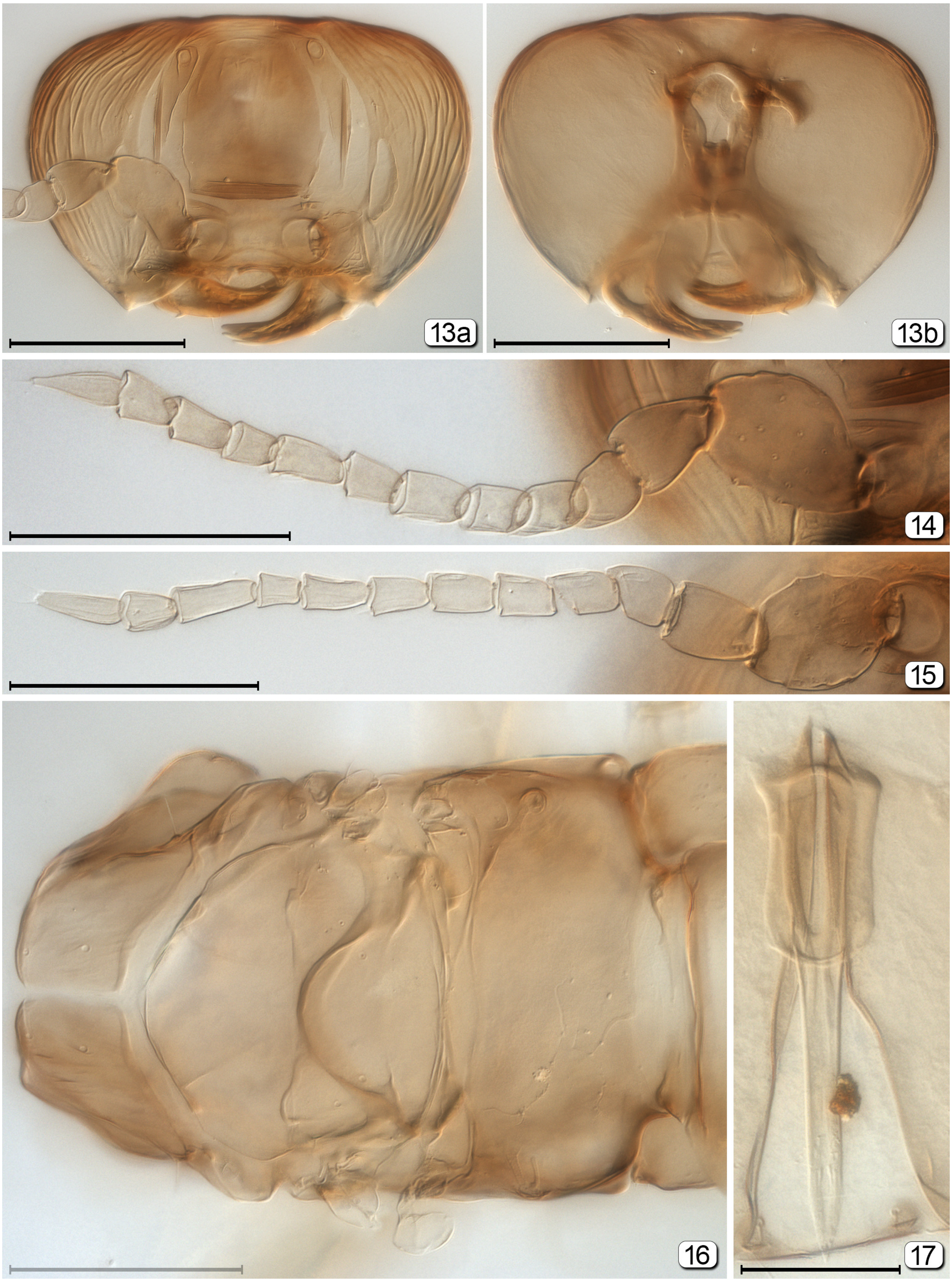


FIGURE 7. *Platystethynium* (*Platypatasson*) *earlyi* Huber, holotype. 7a, metasoma, dorsal; 7b, genitalia (seen through metasoma). Scale bars = 100 μm.

FIGURES 8–10. *Platystethynium* (*Platypatasson*) *earlyi* Huber, paratype female. 8a, head, lateral; 8b, head, lateral showing ocular apodeme; 9, mesosoma, lateral; 10a, metasoma, lateral; 10b, genitalia. Scale bars = 100 µm.



FIGURES 11, 12. *Platystethynium* (*Platypatasson*) *earlyi* Huber, paratype male. 11, mesosoma + metasoma, dorsal; 12, mesosoma + metasoma, ventral. Scale bars = 100 µm.



FIGURES 13–17. *Platystethynium* (*Platypatasson*) *earlyi* Huber, paratype male. 13a, head, anterior; 13b, head, posterior; 14, right antenna; 15, left antenna; 16, mesosoma, dorsal; 17, genitalia. Scale bars: 13, 17 = 50 µm; 14–16 = 100 µm.

***Platystethynium* (*Platypatasson*) *fransseni* (Ogloblin, 1946)**
(Figs 18–26)

Platypatasson fransseni Ogloblin, 1946: 293; holotype ♀ (USNM). Type locality: Indonesia, Java, Bogor. Subba Rao, 1970: 664 (distribution, male description).

Remarks. Subba Rao (1970) briefly described and illustrated the male of this species, identified by him as *Platypatasson fransseni*, and his species identification is confirmed here. Subba Rao mentioned that he had remounted the 70 specimens, including 2 males, from Canada balsam into chloral hydrate but he did not state how many slides he had made. We borrowed the only two slides that could so far be found. Careful examination by both N. Dale-Skey (NHMUK) and J. Huber failed to locate either of the two male specimens on these slides. There should therefore be at least one other slide with these males. Twenty-two females on one slide (NHMUK), labelled: "New Guinea, Manaus.- 1932, J.L. Froggatt, ex eggs of locustid." and "*Platypatasson fransseni* A. Ogloblin B.R. Subba det. 1969" were examined. The mounting medium of the second slide, somewhat similarly labelled, was completely dark brown so almost nothing could be seen.

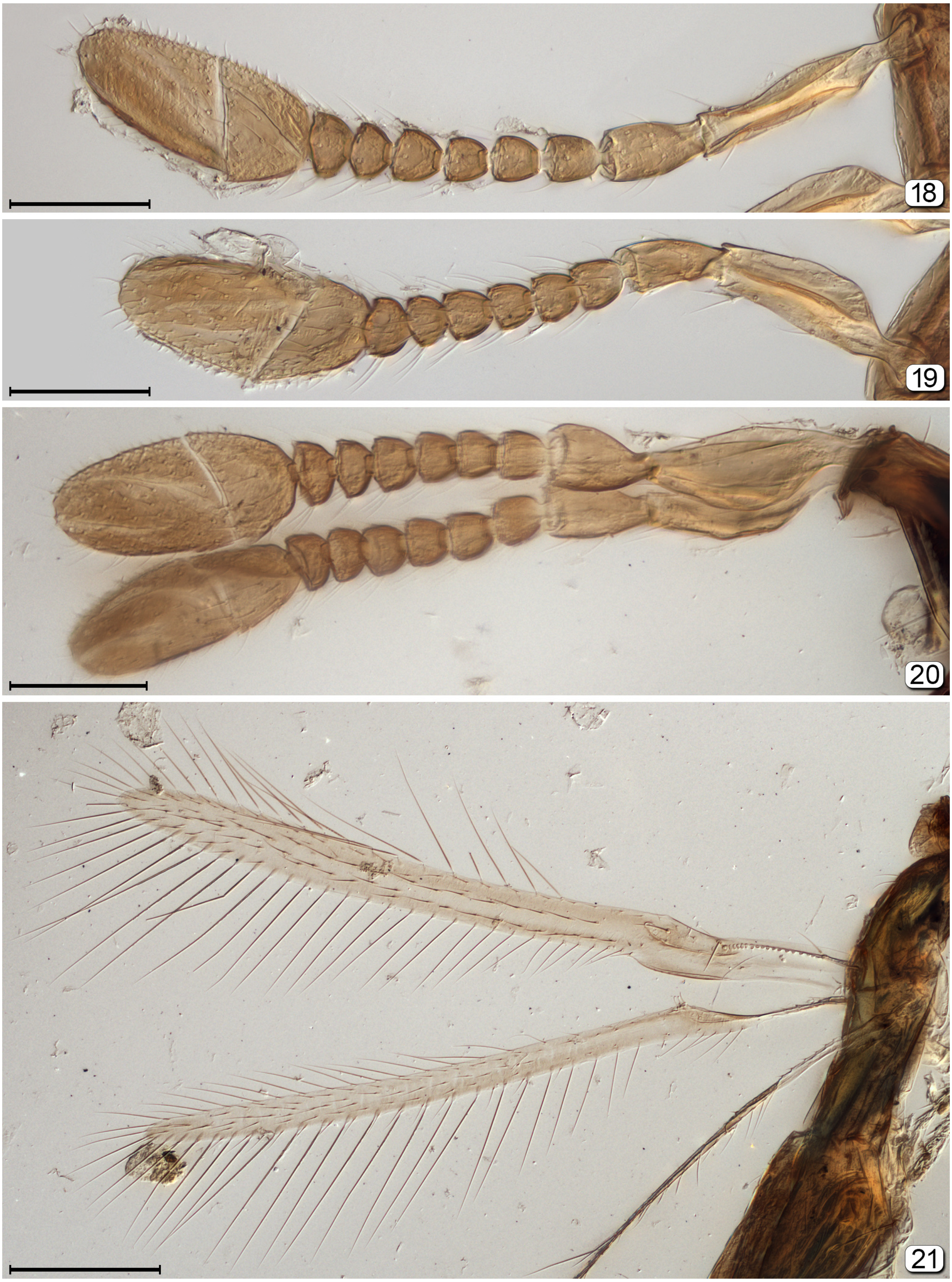
The head in dorsal view (Fig. 22), a pair of wings (Fig. 21) and two sets of antennae (Figs 18–20) from specimens on the first slide are illustrated for comparison with the wings and antennae of a paratype of *P. fransseni* in the CNC (Figs 23, 24). The short lateral seta on the vertex between the median ocellus and transverse trabecula is apparently absent. The fore wings are almost identical, with two distinct rows of microtrichia in the basal half beyond the apex of the venation, but the antennae vary slightly. Measurements are: clava length/width 2.12–2.60 (the two Papua New Guinea specimens) compared to 2.86 (the paratype). Simple inspection of the funicle segments, especially the apical segment, shows that length/width differs, in this case mainly because of apparently different orientation (dorsal versus lateral, especially the scape and pedicel) of each pair of antennae.

Distribution. Indonesia, Papua New Guinea.

***Platystethynium* (*Platystethynium*) *onomarchicidum* Ogloblin, 1946**

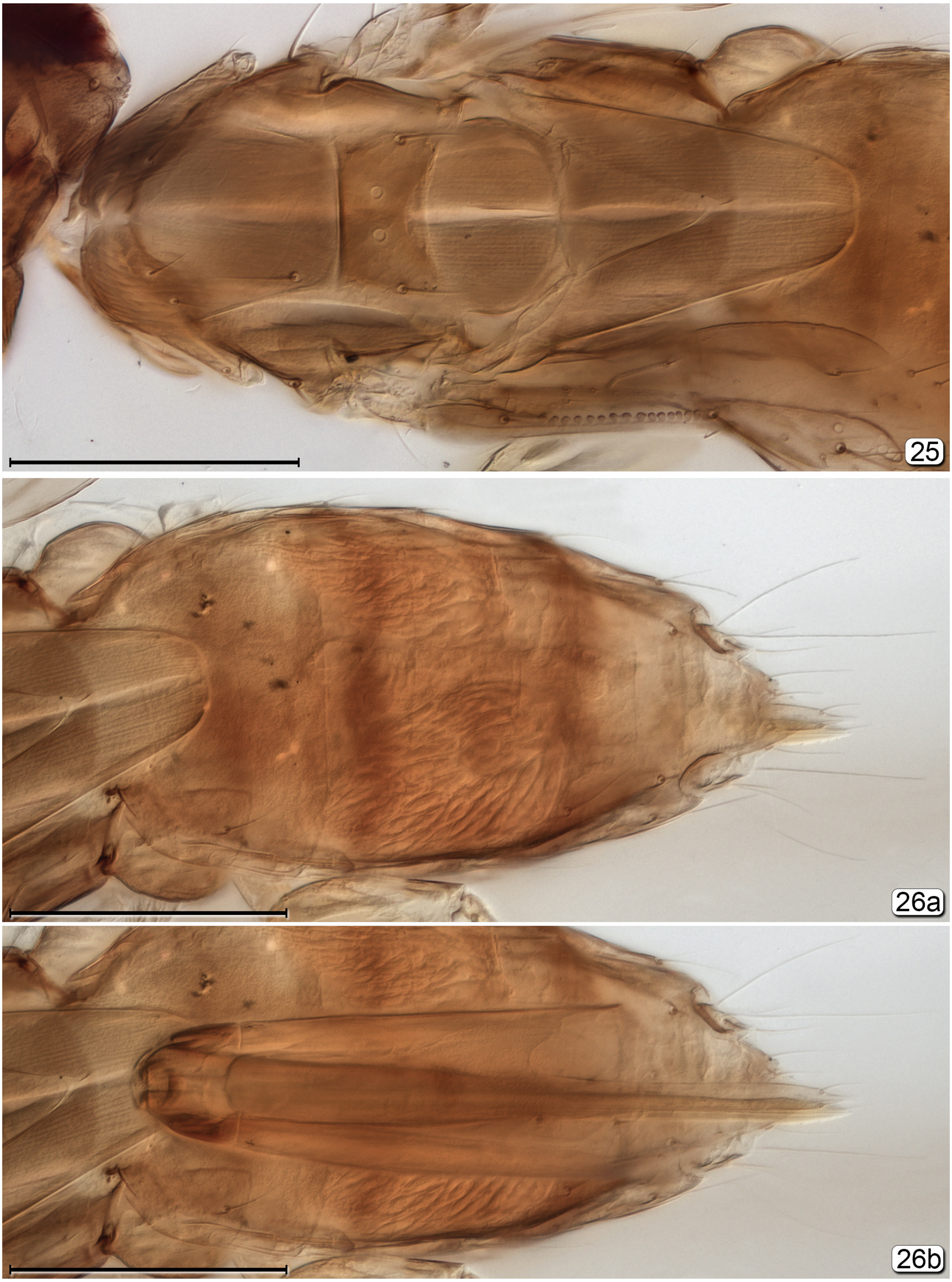
Platystethynium) *onomarchicidum* Ogloblin, 1946: 291; holotype ♀ (USNM). Type locality: Indonesia, Java, Bogor. Triapitsyn, 2018: 159 (comparison with *P*. *glabrum*).
Platystethynium glabrum Jin & Li, 2016: 204, **syn. n.** Holotype ♀ (NEFU). Type locality: China, Yunnan, Mannanxing.

Remarks. *Platystethynium glabrum*, originally described from only one specimen and later recorded and illustrated from Taiwan by Triapitsyn (2018) and India by Sankaraman *et al.* (2020), is placed here in synonymy under *P. onomarchicidum*. Jin & Li (2016) recognized that *P. glabrum* was "obviously closely related to *P. onomarchicidum*." The diagnostic features they presented do not work, either because they appear to be common to all *P*. (*Platystethynium*) species or they are wrongly described, e.g., the ocelli do not form a right angled triangle, as also stated (wrongly) by Ogloblin (1946), and there are a very few short setae among the eye facets. Triapitsyn (2018) also noted several incorrect statements in the *P*. *glabrum* description. The ratios given are not so different from those of *P. onomarchicidum* specimens that they could be considered sufficient to recognize two (or more) species instead of one, variable species. The propodeum in *P. glabrum* is stated to be relatively shorter than in *P. onomarchicidum* (0.49× instead of 0.57× the frenum length) and the ovipositor of *P. glabrum* originates at the level of tergum 4, as illustrated by Jin & Li and Sankaraman *et al.* (2020). Specimens of *P. onomarchicidum* in the CNC have the ovipositor originating at the level of tergum 2, 3 or 4 and the ovipositor length is ~0.64–0.75× the gaster length (0.84× gaster length in *P. glabrum*). The ovipositor length in two paratypes is 2.81 and 3.11× metatibia length, and in two non-type specimens is 2.61–2.78× metatibia length. Triapitsyn (2018) recorded the ovipositor length as 1.8× metatibia length in a specimen he identified as *P. glabrum* from Taiwan. In an otherwise similar specimen of *Platystethynium* (*Platystethynium*) sp. from Thailand he reported the ovipositor length as 2.3× metatibia length. He also measured non-type specimens from the same series as the types of *P. onomarchicidum* and recorded the ovipositor as about 3.0× metatibia length. He supposed that the ovipositor in *P. onomarchicidum* could be subject of significant intraspecific variability, but because material at his disposal was limited he did not place *P. glabrum* in synonymy under *P. onomarchicidum*. Jin & Li (2016) did not use the ratio of ovipositor length/metatibia length but it can be calculated from the scale bars and images of the holotype of *P. glabrum*, i.e., the ovipositor length is 2.37× as long



FIGURES 18–21. *Platystethynium* (*Platypatasson*) *fransseni* (Ogloblin) from Papua New Guinea. 18, left antenna, with scape dorsal; 19, right antenna, with scape dorsolateral; 20, antennae, lateral; 21, wings. Scale bars: 18–20 = 50 µm; 21 = 100 µm.

FIGURES 22–24. *Platystethynium* (*Platypatasson*) *fransseni* (Ogloblin), paratype female. 22, head, dorsal; 23, antenna, lateral; 24. Wings. Scale bars: 22, 23 = 100 μm; 24 = 200 μm.



FIGURES 25, 26. *Platystethynium* (*Platypatasson*) *fransseni* (Ogloblin), paratype female. 25, mesosoma, dorsal; 26a, metasoma, dorsal; 26b, genitalia (seen through metasoma). Scale bars = 100 µm.

as metatibia length. The greatest variation among all the above specimens is in ovipositor length, with the two non-type specimens about midway between the ratio given for the paratypes of *P. onomarchicidum* and the holotype of *P. glabrum*. Jin & Li (2016) gave the scape length/width of *P. glabrum* as ~2.64 and compared it to the scape length/width ratio from Ogloblin (1946) but his ratio is wrong, as one can determine if one measures his illustration of the scape; it is 2.69× not 1.85× as long as wide, which is almost identical to that of *P. glabrum*. A paratype (CNC) of *P. onomarchicidum* was measured to confirm the ratio. No other differences between *P. glabrum* and *P. onomarchicidum* are known so the above synonymy is confidently made.

Host. The only know host so far is *Onomarchus uninotatus* (Serville) (Tettigoniidae: Pseudophyllinae), an Oriental species with a range extending from India to Australia, so it is not surprising that *P. onomarchicidum* is also widespread and shows some intraspecific variation.

Material examined. **LAOS**: Houa Phan, Phou Pane Mt., 1480-1510 m, 20°13'09"–19°N 103°59'54"–104°00'03"E, 1-16.vi.2009, V. Kubáň (2 ♀, CNC). **PHILIPPINES**: Cavite, Indang, Petronio coffee farm, 14°09.20'N 120°54.40'E, 1508', 2.iv.2011, H. Ngo, Malaise trap (1 ♀, CNC). **TAIWAN**: Pintung, Kenting Nat. Park, 200-230 m, 17-23.v.1991, C.K. Starr & M. Wu, secondary forest, Malaise trap (2 ♀, CNC). **THAILAND**: Chiang Mai, Amphur Mae, 250 m, 15.42°N 98.49°E, 1-31.i.1998, R. Snelling, forest, Malaise trap (1 ♀, CNC); Nakhon Nayok, Khao Yai Nat. Park, evergreen trail near training centre, 14°24.482'N 101°22.388'E, 755 m, 26.ii-5.iii.2007, Malaise trap, W. Sukho; Uthai & Tak, Huai Kha Khaeng [Wildlife Sanctuary], 400 m, iii.1986, M.G. Allen (1 ♀, CNC).

Distribution. India, Indonesia, Laos, Philippines, Taiwan, Thailand. Rameshkumar *et al.* (2015) reported an unidentified *Platystethynium* from Meghalaya, northeastern India. Their habitus image is definitely that of *P. onomarchicidum* so India is included in the list of countries.

Key to Eastern Hemisphere *Platystethynium* species. Females.

1 Clava 3-segmented [*Platystethynium* (*Platystethynium*)]; fu_5 distinctly larger than fu_4 or fu_6 and with 1 mps 2
- Clava 2-segmented [*Platystethynium* (*Platypatasson*)]; fu_5 same size as fu_4 or fu_6 and without mps 3
2(1) Fu_3 with 1 mps . . . . *P. triclavatum* (Donev & Huber)
- Fu_3 without mps . . . . *P. onomarchicidum* Ogloblin
3(1) Vertex with V-shaped line extending from median ocellus to lateral apices of transverse trabecula and without a pair of short lateral setae about midway between median ocellus and transverse trabecula (Fig. 22); temple with 1 seta near posteroapical angle of eye (Fig. 22); pronotum with 2 short sublateral setae posteriorly; fore wing posterior margin with lobe behind parastigma forming an obtuse angle apically (Fig. 24); frenum about 1.3× as wide as long (Fig. 25); propodeum with V-shaped carinae submedially (Fig. 25) . . . . *P. fransseni* (Ogloblin)
- Vertex without V-shaped lines extending from median ocellus and without a pair of short lateral setae between median ocellus and transverse trabecula (Fig. 2a); temple with 2 setae near posteroapical angle of eye (Fig. 2a); pronotum with 1 long submedian seta posteriorly; fore wing posterior margin with lobe behind parastigma forming a right angle apically (Fig. 5); frenum about 2.2× as wide as long (Fig. 4); propodeum without V-shaped lines submedially (Fig. 4). *P. earlyi* Huber

Key to World *Platystethynium* species. Males.

This key is based on the few differences mentioned and illustrated (line drawings) by Subba Rao (1970) and the several differences described and illustrated (photographs) by Ortis *et al.* (2020). Males are still undescribed for *P. onomarchicidum*, *P. terebrator* and *P. vagatus*.

1 Flagellum 10-segmented (Figs 14, 15); fl_1 at most 1.0× as wide as long, and more than 1.0× as long as fl_2 2
- Flagellum 11-segmented; fl_1 about 2.5× as wide as long, and 0.5× as long as fl_2 (Subba Rao 1970, fig. 15) . . . . *P. fransseni* (Ogloblin)
2(1) Fl_1 almost 1.4× as long as wide, and almost 1.1× as long fl_2; remaining flagellomeres except apical flagellomere wider than long . . . . *P. earlyi* Huber
- Fl_1 at most 1.0× as long as wide, and at least 1.2× as long fl_2 (Ortis *et al*. 2020, fig. 8A, B); remaining flagellomeres longer than wide . . . . *P. triclavatum* (Donev & Huber)

Discussion

In Mymaridae, when both sexes are known and correctly associated, females are almost always more numerous than males, or at least are collected more often. For some genera males are still unknown or, if described, not yet correctly associated with the corresponding females. In species of two genera, *Platystethynium* and *Litus* Haliday, the unknown males were only discovered when both sexes emerged together from a single parasitized egg of their respective hosts. In these, the sex ratio is extremely female biased. Although in *P. triclavatum* the data are not clear it would appear that at least a few more females than males emerged or were dissected from a single host egg (Ortis *et al.* 2020). The fact that males of *Platystethynium* are micropterous explains why no males had ever been collected by any of the frequently used collecting methods such as Malaise traps or pan traps. The corresponding females are relatively common and, for one or more species, are widely distributed.

In *Litus*, males resemble the females in being fully winged (Viggiani 1973). Evidently, they are capable of flight, having occasionally been collected by using passive collecting techniques, e.g., Malaise traps. In *Litus cynipseus* Haliday females were far more numerous than males: 184 and 8, reared respectively, from one host egg, and 41 and 1, respectively, from another host egg of the same genus. The host was identified at the time as *Staphylinus* sp. but was likely an *Ocypus* sp. (Coleoptera: Staphylinidae).

The extremely aberrant males of *Dicopomorpha echmepterygis* Mockford, which are blind, apterous and have greatly reduced antennae and tarsi (Huber *et al*. 2020) evidently do not and probably cannot live freely, at least for long, outside a host egg; they have only ever been reared. One female was found with several minute, wingless males attached to her wings and body (Mockford 1997). Mockford did not actually observe both males and females emerging from a single egg but, given the host egg size and the size of female and male *D*. *echmepterygis* and from Mockford's data, a few more males than females may have emerged from each host egg. In this species, the sex ratio (male biased) is evidently opposite to that of most Mymaridae, including species of *Litus* and *Platystethynium*.

Interestingly, the host orders for the above three genera are different: Orthoptera, Psocoptera, and Coleoptera. It is assumed that all these cases involve gregarious parasitism but likely not superparasitism or multiple parasitism, though see Jackson (1966) for examples of the latter. For species of *Litus* and *Platystethynium*, the host eggs are huge relative to the size of the parasitoids so large numbers of individuals develop in a single egg. For species of *Dicopomorpha*, the host egg is relatively small so few individuals could potentially develop in a single egg. But in *D*. *echmepterygis* the males are so minute that several could easily develop in the same host egg, together with at least one female.

In addition to the above examples, *Eustochus* (*Caraphractus*) *cinctus* (Walker) from eggs of various species of Dytiscidae (Coleoptera) is another example of extreme gregarious behavior in Mymaridae. Jackson (1958) reared 48 females and 8 males from a single *Dytiscus marginalis* L. egg.

If the insect host eggs parasitized by Mymaridae are relatively large compared to size of the adult fairyflies that parasitize them, then many wasp individuals must develop in a single host egg. This is because if the parasitoid larvae do not consume the entire host egg contents, i.e., yolk remnants, it rots and the rotting agent, e.g., a bacterium or virus, will spread to the parasitoid larvae, prepupae or pupae and kills them. In contrast, if the fairyfly adult is about the same size as the host egg then only one will develop in each egg simply because there is only enough food to support complete development and the entire egg contents are consumed. However, as Jackson (1958) showed for *C*. *cinctus*, if too much food remains for the larvae to consume the adults are very large with distended abdomens and only one or two may be sufficiently vigorous to emerge. However, these physogastric specimens die without breeding.

It would be worth searching for relatively large insect eggs, particularly of Orthoptera (especially Ensifera) and Coleoptera, to try and rear additional, very gregarious, species of Mymaridae, some perhaps with unusual males. Regardless of how many specimens emerge from a single host egg, additional host records for any species of Mymaridae would be useful to understand more clearly, for example, if there are patterns regarding hosts, host egg size and sex ratios as well as to associate correctly males and females. Unfortunately, searching for host eggs or oviposition scars that indicate the presence of host egg(s) laid in or on vegetation is tedious and time consuming. Host eggs laid in soil may be extracted fairly efficiently from soil samples by floatation in salt water and placed on moist filter paper in Petri dishes for observation until something emerges (Aeschlimann 1975).

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