



<http://dx.doi.org/10.11646/zootaxa.3956.1.4>

<http://zoobank.org/urn:lsid:zoobank.org:pub:67D5EDC0-753C-4976-A215-B80900593403>

Taxonomic studies on *Dolichothrips* (Thysanoptera: Phlaeothripinae), pollinators of *Macaranga* trees in Southeast Asia (Euphorbiaceae)

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Abstract

Five new species associated with the inflorescences of *Macaranga* trees are described in the Asian genus *Dolichothrips* Karny. Four of these, *chikakoae*, *eriae*, *fialae* and *utae*, are from the Malaysian region where they are involved in the pollination of these trees. The fifth, *franae*, is described from the Hawaiian Islands but is probably introduced from Southeast Asia, and this species appears also to be a pollinator of its host plant. In contrast, little is known of the biology of the many species of *Dolichothrips* from India. However, *D. indicus* (Hood) is here interpreted as a variable, polyphagous and widespread species around the tropics, with *D. nesius* Stannard and *D. pumilus* Priesner placed as new synonyms. *D. reuteri* (Karny) from Australia, is also not restricted to *Macaranga*, and *D. flavipes* (Moulton) from Taiwan is here considered a new synonym of *reuteri*. An identification key is provided to 15 species of this genus, but this excludes five species for which specimens were not available. *D. citricururus* Moulton, described from Ethiopia, is transferred to *Apelaunothrips* Karny.

Key words: *Macaranga*, pollination, *Dolichothrips*, new species, Malaysia, Hawaii

Introduction

Species of the Thysanoptera genus *Dolichothrips* are known to be pollinators of trees in the Euphorbiaceae genus *Macaranga* in Southeast Asia (Fiala *et al.* 2011), although the initial study on this subject (Moog *et al.* 2002) referred to the pollinators as members of the related Haplothripini genus *Neoheegeria*. Not until the studies of Mound and Minaei (2007) and Minaei and Mound (2008) was there any clarity in the diagnosis either of this tribe or of the common genera of mainly flower-living Phlaeothripinae species that it comprises. *Haplothrips* is the largest of these genera, and is found in flowers worldwide. In contrast, *Neoheegeria* is essentially Palaearctic in association with the flowers of Lamiaceae (Minaei *et al.* 2007), and *Dolichothrips* is from the tropical areas of eastern Asia and is commonly found in the flowers of *Macaranga* and *Mallotus* species. *Macaranga* is a genus, mainly of trees, that occurs from Africa to Japan and Australia, but with most of the 250 or more species in SE Asia (Whitmore 2008). The data presented here comprise the first attempt to understand the diversity within this genus of thrips.

Pollination studies inform us about one aspect of insect/plant relationships, in that seed-set, and hence survival of the plants is dependent on the insects. However, pollination studies rarely provide information on the extent to which survival of a pollinating insect is dependent on the plant pollinated. Any assumption that a specific pollinator of a plant species is dependent on that plant for survival is clearly premature in the absence of collateral information. For example, Williams *et al.* (2001) demonstrated that an Australian Monimiaceae tree, *Wilkiea huegliana*, is pollinated only by *Thrips setipennis*, despite that insect being highly polyphagous and breeding in the flowers of many different plant species. A rather similar situation seems to exist with at least some species of *Dolichothrips*. In Hawaii, *Dolichothrips indicus* is common in the terminal buds of two unrelated plants, *Macaranga tanarius* and the small Malvaceae tree, *Hibiscus tiliaceus*. Similarly around the coasts of northern Australia, *Dolichothrips reuteri* is common in the buds of these same two plant species. Unfortunately, no

pollination studies have been published on *Macaranga* anywhere other than those indicated above from SE Asia, and only limited attempts have been made in SE Asia to discover if the *Dolichothrips* pollinators of *Macaranga* also occur on other plant species. There is thus a significant asymmetry in our understanding of the association between the thrips and the plants.

A preliminary hypothesis in the *Macaranga* pollination studies would have been that some level of specificity might be expected between particular plant species and particular thrips species. The taxonomic studies on the pollinators reported here indicate that there is little specificity at the level of plant species. Despite this, the host plant associations recorded below confirm the evidence presented by Fiala *et al.* (2011) of specificity by these thrips to particular taxonomic sections within the genus *Macaranga*. In the Malaysian region the most frequently collected species, described below as *fialae* **sp.n.**, is clearly associated with the species of sections *Winklerianae* and *Pachystemon* (particularly *bancana* and *hypoleuca* groups within *Pachystemon*) as well as the closely related *bicolor* and *conifera* groups (see “Dol. Sp.1” in Table 1 in Fiala *et al.* 2011), and has been taken only rarely and in low abundance from species of section *Pruinosae*, such as *M. gigantea*. In contrast, three other Malaysian region species newly described below, *chikakoae* **sp.n.**, *eriae* **sp.n.**, and *utae* **sp.n.**, are all mainly associated with species of section *Pruinosae* and only rarely taken from species of section *Pachystemon*. A curious negative relationship is that the *Dolichothrips* species that have been found on the widespread invasive species, *M. tanarius*, have usually not been found on other species of *Macaranga* in these Southeast Asian studies. In this connection, a single female from an unidentified *Macaranga* in Malaysia has been studied, and this specimen cannot at present be distinguished from *franae* **sp.n.**, described below from the Hawaiian Islands where it lives on the introduced species *M. tanarius*.

The genus *Dolichothrips* is species-rich in SE Asia. However, the taxonomic literature dealing with the genus is superficial, with species defined inadequately and descriptions sometimes involving observational errors. The original material of some described species cannot be traced, and there is a lack of significant biological observations concerning most species. Two such species, *nesius* from Guam and *pumilus* from Taiwan, are here placed as synonyms of *indicus*, and this species is considered to be a widespread species around the world in association with various plants, including *Macaranga*, *Mallotus* and *Hibiscus*. The study presented here has the limited objective of providing a preliminary taxonomic guide to *Dolichothrips* species in order to facilitate further biological studies. Five described species for which we were not able to see original specimens, and one species that is transferred to another genus, are listed in Appendix I.

Acknowledgements, abbreviations and depositaries

We are particularly grateful to Brigitte Fiala from Germany for much help and advice in the preparation of this paper, also to Ute Meyer (Moog) for involving us initially in the pollination studies on *Macaranga*. Fran Calvert encouraged these studies through many questions, and actively obtained *Dolichothrips* specimens from the Hawaiian Islands. We are also grateful to Akiko Sakai, Chikako Ishida and Eri Yamasaki of Kyoto University, Kyoto, for the many specimens they collected in the Malaysian region. Kaomud Tyagi of Kolkata kindly provided us with information, quoted below, concerning *Dolichothrips indicus*. Studies such as this are fully dependent on the museum curators who kindly arrange loans of many specimens: Andrea Hastenpflug-Vesmanis of the Senckenberg Museum (SMF), Frankfurt; Paul Brown of the Natural History Museum (BMNH), London; James Boone and Keith Araraki of the Bernice P. Bishop Museum (BPBM), Honolulu.

Abbreviations: The following are used in the descriptions: po—postocular setae; pronotal setae: am—anteromarginals, aa—anteroangulars, ml—midlaterals, epim—epimerals, pa—posteroangulars; tergite IX setae S1—pair nearest to midline, setae S2—major setae lateral to S1 setae, iS—minor setal pair situated between S1 and S2.

Depositaries: The collections in which the holotypes of the new species are deposited are indicated for each new species; paratypes where available will be in the Australian National Insect Collection, CSIRO, Canberra (ANIC), and the Laboratory of Entomology, Tokyo.

***Dolichothrips* Karny**

Dolichothrips Karny, 1912: 299. Type species *Dolichothrips longicollis* Karny 1912, by monotypy.

Membrothrips Bhatti, 1978: 226. Type species *Neoheegeria indica* Hood, 1919, by monotypy. Synonymised by Mound & Minaei, 2007: 2937.

A full diagnosis of this genus is provided by Okajima (2006) and also by Dang *et al.* (2014). All species that have been examined have three sense cones on the third antennal segment, the published claims that *crassusensus* and *indicus* have only two sense cones on this segment being incorrect. Bhatti (1978) proposed restricting *Dolichothrips* to species with extra sigmoid wing-retaining setae on the abdominal tergites (Figs 26, 27), thus excluding *indicus* and related species (Figs 23, 29). However, the new species *franae* described below from Hawaii sometimes has an extra pair of weakly sigmoid setae on tergite III (Fig. 24), and the new species *chikakoe* described below from Sarawak has weakly curved extra setae on tergites II–VI (Fig. 18). Moreover, *reuteri* often has additional setae that are straight but rarely sigmoid, and the presence of similar additional straight setae is variable within populations of *indicus* (Figs 21–23). Bhatti also emphasised the short and weakly sclerotised pseudovirga of *indicus*, and concluded that this was fundamentally different from the more rigidly sclerotised pseudovirga of species that he retained in *Dolichothrips*. However, the weakly sclerotised pseudovirga of *indicus* does not seem to differ in structure fundamentally from the foreshortened pseudovirga of *reuteri* (Fig. 33). It seems equally valid to interpret the structure of *indicus* as being at the extreme end of a range of pseudovirga structural variation, with *macarangai* having a longer but particularly slender structure (Fig. 32), and even *longicollis* (Fig. 31) and *fialae* (Fig. 30) lacking the robust pseudovirga of typical Haplothripini such as species of the genus *Haplothrips* (see Minaei & Mound 2008).

Key to species of *Dolichothrips*

1. Posterior pair of legs uniformly yellow 2
- Posterior pair of legs with at least femora dark brown 3
2. Fore femora largely brown, mid femora with small brown mark medially; antennal segment III yellow, but IV–VIII dark brown *crassusensus*
- All three pairs of legs uniformly yellow; antennal segments mainly yellow *ochripes* and *confusus*
3. Antennal segments V–VIII brown, IV variably yellow-brown; mesonotal posteromedian cleft more than 0.6 as long as median length of this sclerite (Fig. 12); tergite II with an extra pair of sigmoid wing-retaining setae anterolaterally, close to the anterolateral campaniform sensilla (Fig. 20); tergite IX setae S1 clearly shorter than tube *fialae* **sp.n.**
- Antennal segments IV–VI yellow; mesonotal posteromedian cleft less than 0.4 as long as median length of this sclerite (Figs 10–11); tergite II without an extra pair of sigmoid wing-retaining setae close to the anterolateral campaniform sensilla (Figs 18, 25); tergite IX setae S1 at least as long as tube 4
4. Pronotum fully covered with prominent sculpture lines (Figs 1, 3, 6) 5
- Pronotum usually with no sculpture medially but with sculpture lines present near posterior and lateral margins (Figs 4–5) . . 7
5. Antennal segment VIII as yellow as VII except for light shading at apex; mesonotal lateral setae weakly capitate, 25 microns long (Fig. 14) *franae* **sp.n.**
- Antennal segment VIII brown, much darker than VII; mesonotal lateral setae finely acute, 10 microns long 6
6. Postocular setae of female 65–85 microns long (Fig. 3); fore femur inner ventral margin with well-defined row of tubercles (Fig. 17) *eriae* **sp.n.**
- Postocular setae of female 110–135 microns long; fore femur inner margin of female only weakly rugose . . . *chikakoe* **sp.n.**
7. Mesonotal lateral setae capitate, 35–50 microns long (Fig. 13); tergites II–V each with an extra pair of sigmoid setae close to the anterior of the two major pairs of wing-retaining setae (Figs 26–27) 8
- Mesonotal lateral setae finely acute to blunt, 12–30 microns long; tergites II–V without an extra pair of sigmoid setae close to anterior pair of wing-retaining setae, sometimes with pair of small straight setae adjoining first wing-retaining setae (Figs 23, 29) 14
8. Mid and hind tibiae yellow, or at least extensively yellow 9
- Mid and hind tibiae brown 10
9. Pronotal anteromarginal setae 50 microns long, twice as long as maximum width of antennal segment II *citripes*
- Pronotal anteromarginal setal length no more than 35 microns, usually no longer than maximum width of antennal segment II *macarangai*
10. Pronotum lateral thirds with longitudinal sculpture lines; pronotal midlateral setae usually smaller than anteromarginal setae, sometimes absent (Fig. 5); hind tibiae relatively stout, no more than 5 times as long as wide *longicollis*
- Pronotum lateral thirds without longitudinal sculpture lines; pronotal midlateral setae well-developed, as long as anteroangulars; hind tibiae slender, at least 6 times as long as wide 11

11. Mid and hind tibiae yellow at apex *varipes*
 - Mid and hind tibiae uniformly brown including apex 12
 12. Pronotum apparently without any sculpture *zyziphi*
 - Pronotum with narrow band of reticulation on posterior sixth 13
 13. Pronotal posteroangular setae bluntly pointed, almost 4 times as long as width of antennal segment II; postocular setae longer than dorsal length of eyes; antennal segment VII uniformly brown *fumipennis*
 - Pronotal posteroangular setae capitate, scarcely twice as long as width of second antennal segment; postocular setae shorter than dorsal length of eyes; antennal segment VII brown only on apical third to half *utae* sp.n
 14. Mid and hind tibiae clear yellow. *reuteri*
 - Mid and hind tibiae brown, with apex variably yellow. *indicus*

***Dolichothrips chikakoae* sp.n.**

(Figs 1, 10, 18)

Female macroptera: Body and legs dark brown, fore tibiae and all tarsi yellow; antennal segments III–VII yellow, VIII light brown; postocular and pronotal posteroangular setae light brown and finely acute, remaining major setae on pronotum dark brown with broadly blunt apices; fore wing sub-basal setae, and lateral abdominal setae dark brown, tergite IX setae light brown; fore wing clear, weakly shaded on clavus and around sub-basal setae.

Head longer than wide, sharply narrowed to base; without sculpture between ocelli, but rest of vertex transversely striate (Fig. 1); po setae finely acute, longer than dorsal eye length, arising laterally; maxillary stylets retracted almost to postocular setae, weakly V-shaped in position, about one third of head width apart medially with prominent maxillary bridge; mouth cone long and pointed, extending between prosternal basantra; maxillary palps about 7 times as long as wide. Antennae 8-segmented; segment III with 3 slender sense cones about as long as segment width, IV with 4 sense cones; VIII narrowed to base.

Pronotum sculptured across entire surface, with longitudinal, darker median ridge; major setae relatively short and bluntly capitate, but pa setae long and finely acute; notopleural sutures complete. Fore femora swollen, inner margin slightly rugose without clearly-defined tubercles; fore tarsal tooth stout, more than half as long as tarsal width. Prosternal basantra long and well-developed; ferna large; mesopresternum of two triangles weakly joined medially, mesoepisternal anterior margin broadly rounded; metathoracic sternopleural sutures not developed. Mesonotum with median longitudinal division scarcely one third as long as this sclerite, lateral setae minute and acute. Metanotum medially with sculpture forming narrow longitudinal parallel reticulation, median setae acute (Fig. 10). Fore wings almost parallel sided, sub-basal setae S1 and S2 with blunt to weakly capitate apices, S3 pointed; with about 10 duplicated cilia.

Pelta broadly triangular with weak sculpture, campaniform sensilla present; tergites II–VII each with an additional pair of curved or weakly sigmoid setae present or absent anterolateral to wing retaining setae (Fig. 18); tergite IX setae pointed, longer than tube; anal setae longer than tube. Sternites with median pair of marginal setae long and slender, arising sub-marginally; about 12 small discal setae in irregular transverse row across each sternite.

Measurements (holotype female in microns). Body length 2500. Head, length 250; width across cheeks 180; po setae 135. Pronotum, length 225; median width 280; major setae, am 45, aa 40, ml 45, epim 50, pa 115. Mesonotal lateral setae 12. Fore wing, length 1000; sub-basal setae 70, 70, 90. Tergite IV lateral setae 100, 55. Tergite IX setae S1 260, S2 230. Tube length 190; longest anal setae 350. Antennal segments III–VIII length 75, 70, 60, 55, 55, 35.

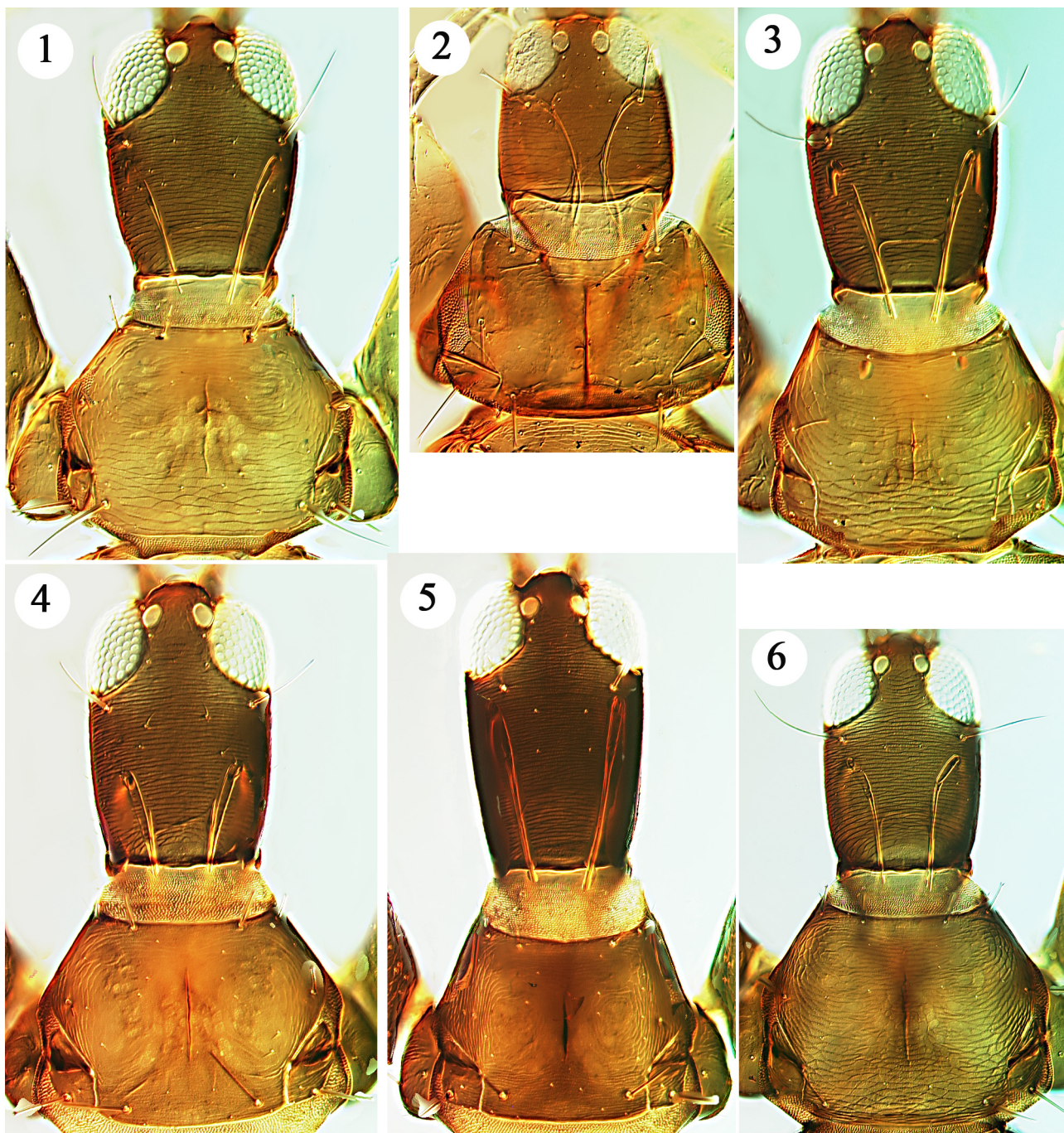
Male macroptera: Similar to female but smaller; tergite IX setae S2 short and stout, longer than iS setae; sternite VIII with no pore plate.

Measurements (paratype male in microns). Body length 2000. Head, length 220; width across cheeks 160; po setae 95. Pronotum, length 175; median width 225; major setae, am 30, aa 35 ml ?, epim 50, pa 85. Mesonotal lateral setae 12. Fore wing length 820. Tergite IX setae S1 220, S2 35. Tube length 160. Antennal segments III–VIII length 70, 65, 55, 50, 45, 30.

Specimens examined. EAST MALAYSIA, SARAWAK, Lambir Hills National Park, holotype female. from *Macaranga gigantea* flowering male bud, 2.vi.2006 (Chikako Ishida), in BMNH.

Paratypes: 1 male taken with holotype; same locality and collector, 1 female from female flower of *Macaranga hosei* (= *pseudopruinosa*), 4.vii.2006. SABAH, from *Macaranga tanarius*: Kota Kinabalu, 1 female, 2.vi.2008, 2 females, 22.ix.2008; Pulau Mamutik, 3 females, 2 males.

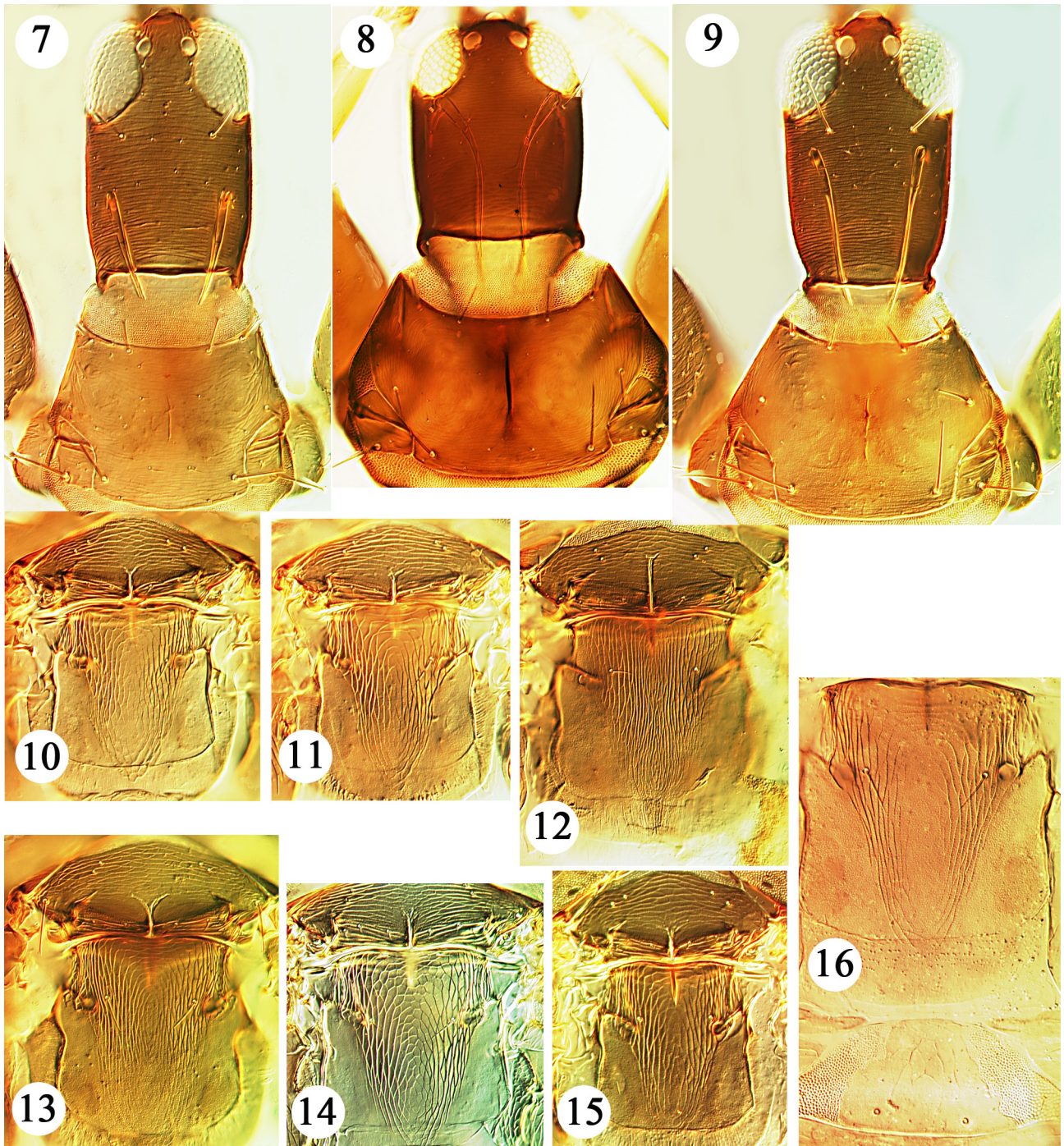
Non-paratype: WEST MALAYSIA, Frasers Hill, 1 female from *Macaranga gigantea*, 30.vi.1999 (Ute Moog 99/150).



FIGURES 1–6. *Dolichothrips* species, head & pronotum. (1) *chikakoe* sp.n.; (2) *crassusensus*; (3) *eriae* sp.n.; (4) *reuteri*; (5) *longicollis*; (6) *franae* sp.n.

Comments. The holotype female and paratype female are mounted very cleanly in a dorso-ventral position, such that the inner, ventral margins of the fore femora are not easily seen. However, these margins appear to have a row of weakly defined rugosities, although these are not clear enough to be illustrated and are not present either on the male paratype or on the paratypes from Sabah. In contrast, the non-paratype female has the single available fore leg slightly rotated, such that the inner, lower margin of the fore femur is exposed and clearly bears a row of rugosities or indistinct tubercles. It differs from the three specimens of the type series in being larger, the postocular setae 150 microns long, and the posteroangular setae on the pronotum short and dark and similar to the epimeral setae. As indicated in the key above, *chikakoe* differs from the others in this genus in the unusually long

postocular setae, but like *eriae* and the species related to *indicus* it has unusually short, pointed mesonotal lateral setae.



FIGURES 7–16. *Dolichothrips* species. Head & pronotum 7–9: (7) *macarangai*; (8) *fialae* sp.n.; (9) *utae* sp.n. Mesonotum and metanotum 10–15: (10) *chikakoae* sp.n.; (11) *eriae* sp.n.; (12) *fialae* sp.n.; (13) *utae* sp.n.; (14) *franae* sp.n.; (15) *reuteri*; (16) *indicus* mesonotum and pelta.

***Dolichothrips citripes* (Bagnall)**

Neoheegeria citripes Bagnall, 1921: 360.

Dolichothrips (Dolicholepta) gracilipes Ramakrishna & Margabandhu, 1939: 46. Synonymised by Mound 1968: 88.

Described from India, this species is similar in appearance to *macarangai*, but has much longer pronotal anteromarginal setae. It was described from two specimens taken in India near Delhi from *Abutilon indicum* (misspelled on the slides and in the original publication as “Alentillon”). The synonymic species, *gracilipes*, is also known to be associated with *Abutilon*. The male has tergite IX setae S2 unusually small and scarcely half as long as the iS setae, and as in *macarangai* the mesonotal lateral setae are long and capitate.

Specimens examined. INDIA: Pusa, paralectotype male on “Alentillon indicum”, 12.x.1909 (Misra); Madras, 1 female from *Abutilon*, 27.iv.1963 (Ananthkrishnan), in BMNH.

***Dolichothrips confusus* Ananthkrishnan, 1968: 52.**

This species from India is mentioned below under *ochripes*.

***Dolichothrips crassusensus* Reyes, 1994: 376.**

(Figs 2, 19)

Known only from a single female, the original description of this species was in error in stating that there are only two sense cones on the third segment, when in fact there are three. It is a curiously bicoloured species, with the head and thorax brown (Fig. 2), but the abdomen yellow with a brown tube. The hind legs are clear yellow, the mid legs have the femora weakly shaded medially, and the fore femora brown except at the apex. Antennal segments IV–VIII are uniformly brown, but segment III is clear yellow. The mesonotum has a short postero-median cleft, the metanotum has equiangular reticulation, the abdominal tergites have no additional wing retaining setae (Fig. 19), and setal pair S1 on tergite IX are softly pointed and shorter than the tube.

Specimens examined. THE PHILIPPINES, Luzon, holotype female, 6.vi.1987, in ANIC.

***Dolichothrips eriae* sp.n.**

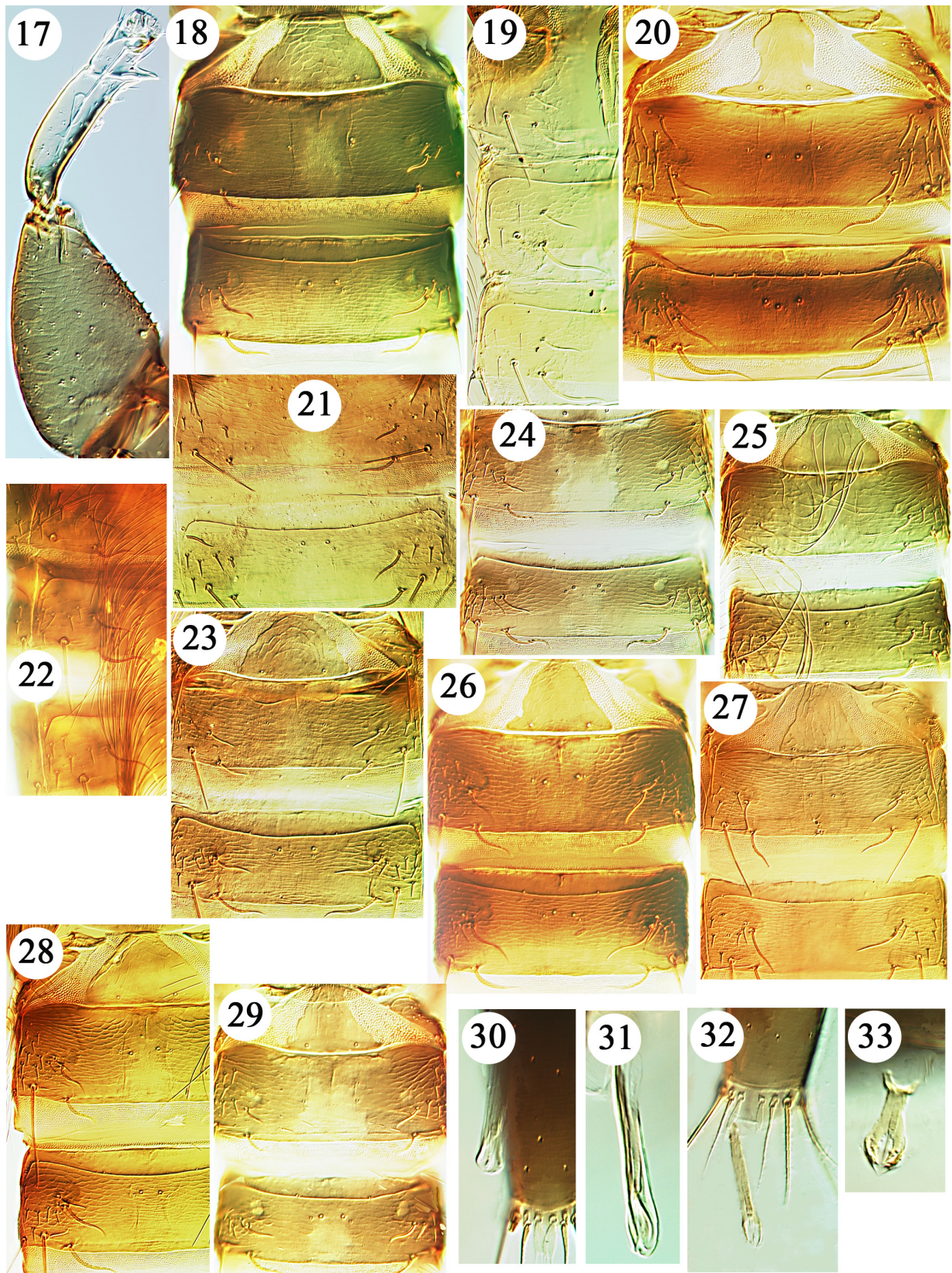
(Figs 3, 11, 17, 25)

Female macroptera: Body and legs brown, femora and tibiae brown but fore tibiae fading to yellow at apex and mid tibiae with extreme apex yellow; tarsi yellow; antennal segments III–VI yellow, VII weakly shaded at apex, VIII light brown; major setae light brown, tergite IX setae pale; fore wing clear, weakly shaded on clavus and around sub-basal setae.

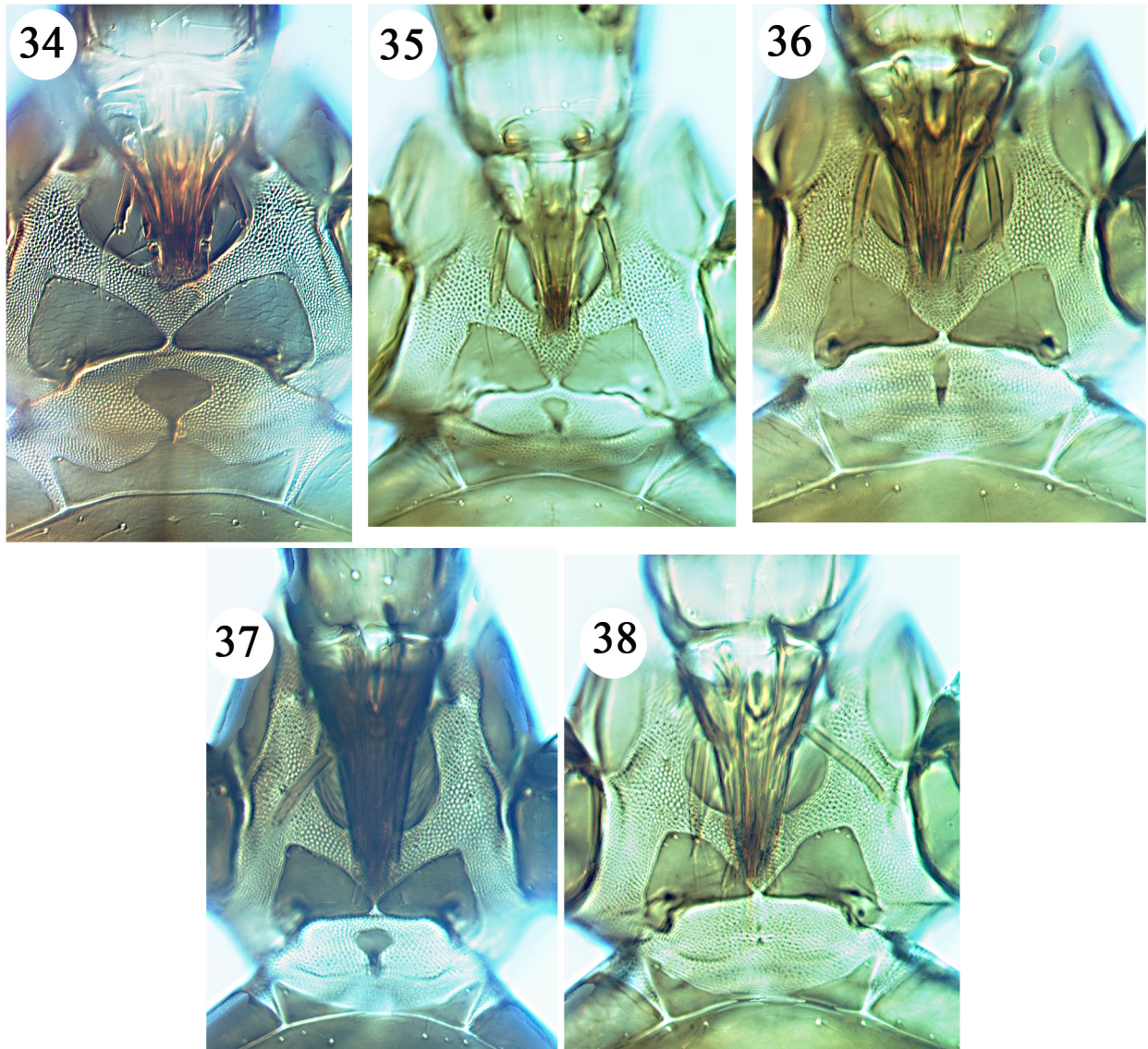
Head longer than wide, constricted at base; without sculpture between ocelli, but rest of vertex transversely striate (Fig. 3); po setae finely acute, almost as long as dorsal eye length, arising laterally; maxillary stylets retracted almost to postocular setae, weakly V-shaped in position, about one third of head width apart medially with prominent maxillary bridge; mouth cone long and pointed, extending between prosternal basantra; maxillary palps about 7 times as long as wide. Antennae 8-segmented; segment III with 3 slender sense cones about as long as segment width, IV with 4 sense cones; VIII narrowed to base.

Pronotum sculptured across entire surface (Fig. 3); major setae relatively short, apices capitate; notopleural sutures complete. Fore femora slightly swollen, inner margin with row of 6 or 7 small dark tubercles; fore tarsal tooth stout, almost half as long as tarsal width. Prosternal basantra well-developed; ferna large; mesopresternum of two triangles extending toward mid-line but not joining; mesoeusternal anterior margin broadly rounded; metathoracic sternopleural sutures not developed. Mesonotum with median longitudinal division scarcely one third as long as this sclerite, lateral setae minute and acute. Metanotum medially with sculpture forming narrow longitudinal parallel, concentric, reticulation, median setae acute (Fig. 11). Fore wings almost parallel sided, sub-basal setae S1 and S2 with weakly capitate apices, S3 pointed; with about 7 duplicated cilia.

Pelta broadly triangular with very weak sculpture, campaniform sensilla present; tergites II–VII without an additional pair of sigmoid setae anterolateral to wing retaining setae (Fig. 25); tergite IX setae finely acute, longer than tube; anal setae longer than tube. Sternites with median pair of marginal setae long and slender, arising sub-marginally; about 16 small discal setae in irregular transverse row across each sternite.



FIGURES 17–33. *Dolichothrips* species. (17) *eriae* sp.n. fore leg; (18) *chikakoae* sp.n. pelta, tergites II–III; (19) *crassusensus* tergites II–IV; (20) *fialae* sp.n. pelta, tergites II–III; (21) *indicus* (*nesius* holotype) tergites II–III; (22) *indicus* Syntype tergites II–IV; (23) *indicus* from Mo’orea, pelta, tergites II–III; (24) *franae* sp.n. tergites II–III. Pelta and tergites II–III 25–29: (25) *eriae* sp.n.; (26) *longicollis*; (27) *macarangai*; (28) *utae* sp.n.; (29) *reuteri*. Male pseudovirga 30–33: (30) *fialae* sp.n.; (31) *longicollis*; (32) *macarangai*; (33) *reuteri*.



FIGURES 34–38. *Dolichothrips* species mouth cone, prosternum and mesoprosternum (34) *fialae* sp.n.; (35) *franae* sp.n.; (36) *indicus*; (37) *longicollis*; (38) *reuteri*.

Measurements (holotype female in microns). Body length 1900. Head, length 220; width across cheeks 150; po setae 75. Pronotum, length 155; median width 210; major setae, am 30, aa 20, ml 30, epim 40, pa 40. Mesonotal lateral setae 12. Fore wing, length 720; sub-basal setae 35, 40, 65. Tergite IV lateral setae 70, 35. Tergite IX setae S1 180, S2 180. Tube length 150. Antennal segments III–VIII length 55, 55, 45, 50, 40, 25.

Specimens examined. EAST MALAYSIA, SARAWAK, Lambir Hills National Park, holotype female, from *Macaranga gigantea*, 22.ix.2011 (Eri Yamasaki), in BMNH.

Paratypes: from same locality as holotype; 3 females taken with holotype; 2 females from flowering male bud of *Macaranga gigantea*, 2.vi.2006, 1 female from female flower of *Macaranga gigantea*, 15.vi.2006, 3 females from male bud (or flower) of *Macaranga hosei* (= *pseudopruinosa*), 29.vi.2006, 1 female, from female flower of *Macaranga hosei* (= *pseudopruinosa*), 4.vii.2006, 1 female from male flower of *Macaranga hosei* (= *pseudopruinosa*), 10.vii.2006, (Chikako Ishida); SARAWAK, Jalan Borneo Hts, 2 females from *Macaranga gigantea*, 12.vi.2000 (Ute Moog 00/061). SABAH, Kota Kinabalu, 5 females from *Macaranga gigantea*, 27.vi.2008.

Comments. Within the genus *Dolichothrips* this species is remarkable for a row of tubercles on the fore femora that are similar to those found in the gall-invading species of the genus *Androthrips*. It is similar to *chikakoe* in having the pronotum strongly sculptured, and the mesonotum with minute lateral setae.

***Dolichothrips fialae* sp.n.**

(Figs 8, 12, 20, 30, 34)

Female macroptera: Body and legs dark brown, fore tarsi yellow; antennal segments mainly brown, II paler at apex, III yellow with apex lightly shaded, IV brownish yellow on basal third; major setae brown; fore wing clear but brown around sub-basal setae.

Head longer than wide (Fig. 8), slightly narrowing to base; reticulate between ocelli, transversely striate between eyes, transversely reticulate on posterior third; po setae softly pointed, shorter than dorsal eye length, arising rather laterally; maxillary stylets retracted to posterior margin of eyes, one third of head width apart medially with prominent maxillary bridge; mouth cone pointed, extending across prosternal basantra but scarcely reaching ferna (Fig. 34); maxillary palps about 5 times as long as wide. Antennae 8-segmented; segment III with 3 short sense cones, IV with 4 sense cones; VIII narrowed to base.

Pronotum almost smooth medially (Fig. 8), with faint reticulate sculpture on posterior and lateral thirds; major setae all broadly blunt to weakly capitate; notopleural sutures complete. Fore femora weakly swollen; fore tarsal tooth about half as long as tarsal width. Prosternum with basantra well-developed, close under mouth cone; ferna large, triangular; mesopresternum boat shaped; metathoracic sternopleural sutures not developed. Mesonotum with median longitudinal division extending from posterior margin to beyond the mid-point of this sclerite (Fig. 12), lateral setae well-developed with blunt apices. Metanotum with narrow longitudinal reticulation medially, the lines arranged into weak oval on posterior third, median setae acute. Fore wings weakly constricted medially to almost parallel sided, sub-basal setae S1 and S2 with blunt apices, S3 softly pointed; with about 12–14 duplicated cilia.

Pelta reticulate, bell-shaped with broad basal wings (Fig. 20); tergite II with 10–12 setae anterolateral to wing retaining setae, these additional setae vary from straight to sigmoid with at least one pair close to the anterolateral campaniform sensilla (Fig. 20); III–VI with one pair of small sigmoid setae anterolateral to the 2 pairs of major wing retaining setae; tergite IX setae pointed, pair S1 shorter than tube; anal setae longer than tube. Sternites with median pair of marginal setae slender, arising sub-marginally; about 12–15 small discal setae in a transverse row across each sternite.

Measurements (holotype female in microns). Body length 2400. Head, length 240; width across cheeks 185; po setae 60. Pronotum, length 160; median width 300; major setae, am 40, aa 30, ml 35, epim 70, pa 70. Mesonotal lateral setae 30. Fore wing, length 1000; sub-basal setae 60, 70, 90. Tergite IV lateral setae 130, 80. Tergite IX setae S1 125; S2 160. Tube, length 160; longest anal setae 200. Antennal segments III–VIII length 70, 60, 55, 50, 45, 30.

Male macroptera: Similar to female but smaller; pronotum with stout median longitudinal apodeme and fore tarsal tooth more robust; tergite IX setae S2 short and stout; sternite VIII with no pore plate; pseudovirga long, slender, weakly sclerotised and with apex little expanded.

Measurements (paratype male in microns). Body length 2200. Head, length 240; po setae 60. Pronotum, length 180; median width 310. Fore wing length 850. Tergite IX setae S1 115, S2 35. Tube length 150.

Specimens examined. MALAYSIA, SARAWAK, Lambir Hills National Park, holotype female, from *Macaranga trachyphylla*, 16.ix.2010 (Eri Yamasaki), in BMNH.

Paratypes: 8 females, 5 males, taken with holotype; same locality and collector – 1 female from *Macaranga gigantea*, 22.ix.2011, 4 females, 1 male from *Macaranga havilandii*, 14.viii.2010, 5 females, 3 males from *Macaranga winkleri*, 18.ix.2011, 4 females from *Macaranga*, no date; same locality – 3 females, 7 males from male bud of *Macaranga beccariana*, 2.vi.2006, 1 female from female flower of *Macaranga gigantea*, 15.vi.2006, 3 females from male bud (or flower) of *Macaranga hosei* (= *pseudopruinosa*), 29.vi.2006, 4 females, 3 males from male flower of *Macaranga winkleri*, 4.vii.2006, 5 females, 7 males from female flower of *Macaranga beccariana*, 18.x.2006, 6 females, 4 males from male flower of *Macaranga hypoleuca*, 28.x.2006, 9 females, 6 males from female flower of *Macaranga winkleri*, 12.i.2007 (Chikako Ishida). MALAYSIA, SABAH, Telupid, 2 females, 1 male from *Macaranga depressa*, 27.vi.2000 (Ute Moog 00/116). BRUNEI, Kuala Belalong, 1 female, 2 males from *Macaranga hullettii*, 7.vi.2000 (Ute Moog 00/051). WEST MALAYSIA, Frasers Hill, 1 female from *Macaranga hullettii*, 23.v.1999 (Ute Moog 99/090); Ulu Gombak, 2 females, 1 male from *Macaranga hypoleuca*, 23.iv.1998 (Ute Moog 98/200), 1 female from *Macaranga bancana* (= *triloba*), 24.iv.1998 (Ute Moog 98/220).

Comments. This species appears to be the major pollinator of many *Macaranga* species in the Malaysian region (Fiala *et al.* 2011). In colour and structure it is unusual within the genus *Dolichothrips*, as indicated in the key to species. The mouth cone (Fig. 34) is slightly shorter than that of *longicollis* (Fig. 37) and *macarangai* but

similar in length to several other species in the genus. However, in contrast to other species in this genus the mesopresternum is transverse and complete. Despite being a large and robust, dark species, the pronotum is remarkably smooth medially, in contrast to two other species from *Macaranga* in the same geographic region (*eriae* and *chikakoe*) as well as *franae* from the Hawaiian Islands.

***Dolichothrips franae* sp.n.**

(Figs 6, 14, 24, 35)

Female macroptera: Body and legs dark brown, fore tibiae yellow with brown shading at base, all tarsi yellow; antennal segment II brown with apex yellow, III–VIII yellow, VIII with variable faint shading on apical third or fifth; major setae brown to dark brown, tergite IX setae pale; fore wing clear, weakly shaded around sub-basal setae, clavus brown.

Head longer than wide (Fig. 6), narrowed at base; without sculpture between ocelli, rest of vertex with narrow transverse reticulation; po setae finely acute, longer than dorsal eye length, arising laterally; maxillary stylets retracted almost to postocular setae, parallel and about one third of head width apart medially with prominent maxillary bridge; mouth cone long and pointed, extending between prosternal basantra (Fig. 35); maxillary palps about 8 times as long as wide. Antennae 8-segmented; segment III with 3 slender sense cones about as long as segment width, IV with 4 sense cones; VIII weakly narrowed to base.

Pronotum sculptured across entire surface (Fig. 6); major setae capitate; notopleural sutures complete. Fore femora swollen; fore tarsal tooth stout, about half as long as tarsal width. Prosternal basantra long and well-developed; ferna large; mesopresternum of two triangles extending to midline but not joining, mesoeusternal anterior margin broadly rounded; metathoracic sternopleural sutures not developed. Mesonotum with median longitudinal division about one third as long as this sclerite (Fig. 14), lateral setae short and capitate. Metanotum medially with sculpture forming narrow longitudinal parallel, almost concentric, reticulation, median setae acute. Fore wings weakly constricted medially, sub-basal setae S1 and S2 with capitate apices, S3 blunt; with 8–11 duplicated cilia.

Pelta broadly triangular with almost no sculpture, campaniform sensilla present; tergites II–VII usually without an additional pair of sigmoid setae anterolateral to wing retaining setae (Fig. 24); tergite IX setae pointed, longer than tube; anal setae longer than tube. Sternites with median pair of marginal setae long and slender, arising sub-marginally; about 12 small discal setae in irregular transverse row across each sternite.

Measurements (holotype female in microns). Body length 2400. Head, length 250; width across cheeks 175; po setae 100. Pronotum, length 225; median width 290; major setae, am 35, aa 40, ml 45, epim 55, pa 60. Mesonotal lateral setae 25. Fore wing, length 1000; sub-basal setae 50, 55, 70. Tergite IV lateral setae 85, 55. Tergite IX setae S1 250, S2 240. Tube length 200; longest anal setae 250. Antennal segments III–VIII length 70, 75, 65, 60, 60, 35.

Specimens examined. HAWAII, OAHU, Waiamanaloa, Luna Farm, holotype female, from *Macaranga tanarius*, 11.xi.2014 (F. Calvert), in BPBM.

Paratypes: 32 slide mounted females taken with holotype [this sample included over 100 females together with larvae that were left in ethanol]; same locality and host, 10 females, 11.iii.2010, 1 female with same data except Luna Road, 5 females with same data except not Luna Road or Farm. HAWAII, KAUAI, Wailua, 17 females from *Macaranga tanarius*, 9.iv.2010 (R. Hollingsworth).

Comments. Despite the large number of adults collected, no males of this species were found. It may represent a parthenogenetic strain that has been introduced from somewhere else in the western Pacific, as has its host plant, *M. tanarius*. In this connection, a single female has been studied from *Macaranga* at Gombak, Malaysia that cannot be distinguished from the specimens from Hawaii. Two other species from Malaysia, *chikakoe* and *eriae*, share the curious sculpture of the pronotum, but they have the mesonotal midlateral setae minute and finely pointed whereas these setae are slightly longer and weakly capitate or blunt in *franae*. Within the genus *Dolichothrips* this species is unique in having the terminal antennal segment effectively as yellow as the third to the seventh segments.

***Dolichothrips fumipennis* (Bagnall)**

Neoheegeria fumipennis Bagnall, 1921: 360.

This species is particularly difficult to define. It is known only from the damaged female holotype that was collected in India, in the eastern Himalayas. The pronotal posteroangular setae are exceptionally long, 110–115 microns, the anteromarginals slender and pointed, and the postocular setae long and finely pointed. A single antenna is detached and mounted under a separate coverslip, and seems to have segment VII as uniformly brown as VIII.

Measurements (holotype female in microns). Body length (not distended) 2300. Head, length 280; po setae 95. Pronotum, length 185; median width 300; major setae, am 35, aa 35, ml 65, epim 125, pa 110. Tergite IX setae S1 270. Tube length 230.

Specimens examined. INDIA, West Bengal, Kurseong, holotype female, 26.iii.1910, in BMNH.

***Dolichothrips indicus* (Hood)**

(Figs 16, 21, 22, 23, 36)

Neoheegeria indica Hood, 1919: 96.

Dolichothrips pumilus Priesner, 1935: 362. **Syn.n.**

Dolichothrips (Dolicholepta) rambhutanae Ananthakrishnan, 1960: 572.

Dolichothrips nesius Stannard, 1961:457. **Syn.n.**

Hood described *indicus* from specimens collected by Ramakrishna from shoots of *Ailanthus* (Simaroubaceae) at Coimbatore, southern India. Three females are listed below that were collected and identified by Ramakrishna as this species, and these are probably part of the original series. In describing this species Hood stated that the third antennal segment bears only two sense cones, and this statement was repeated by Stannard (1961). However, the Ramakrishna specimens listed here clearly have three sense cones on the third segment, and presumably these specimens include the “syntype” mentioned by Bhatti (1978) as having three sense cones. Moreover, this condition was confirmed on Hood’s holotype of *indica* by Greg Evans of USDA APHIS, Beltsville, who successfully photographed in different focal planes all three sense cones.

Hood described the postocular setae of *indicus* as “dilated at tip”, however this dilation is weak and less than the width of the seta near its base. The mid and hind tibiae are brown with the apex yellow, but the length of this yellow band is shorter than the distal width of a tibia. In contrast, the male listed below from *Mallotus* and identified as *indicus* by Ananthakrishnan has the postocular setae blunt at the apex. This male has the mid and hind tibiae similar in colour to the type series, and setae S2 on tergite IX are stout and longer than the iS setae. The female listed below from Rambhutan was labelled by Ananthakrishnan as *rambhutanae*, but this has finely pointed postocular setae, and the dark brown mid and hind tibiae are scarcely paler at the apex. In discussions about this variation, Dr Kaomud Tyagi of Kolkata commented (in litt. ii.2015) “I have checked eight specimens of *Dolichothrips indicus*, collected from *Jasminum sambac*, in which apices of postocular setae are blunt in six specimens but nearly pointed in two specimens. The colour of mid and hind tibia is brown with extreme apex yellow, this yellow area wider than long.”

Priesner described *pumilus* from Taiwan from an unspecified number of specimens. He did not designate any types, although someone subsequently has added a red holotype label to the slide listed below that bears the three original specimens. The mid and hind tibiae of these specimens are uniformly brown with the apex faintly paler but not clearly yellow. The female is without antennae, and has postocular setae that are bluntly pointed. One of the males has lost many of the major setae, including the postoculars, but has antennal segment VII almost uniformly dark brown. The second male has the postocular setae almost pointed, but antennal segment VII is largely yellow with brown shading in the apical third. Both males have the tergite IX setae S2 slightly shorter and stouter than the iS pair of setae.

Stannard, in describing *nesius*, referred to a female holotype deposited in the Bishop Museum, but he did not label as holotype either of the two specimens listed below from that museum. F. Bianchi placed a label on the reverse of both slides, and indicated that one female was probably the holotype, and that the other specimen was

the “male allotype”. However, this second specimen is actually a female. These two females were mounted into Hoyers Mountant, and by 2014 the mountant had dried out completely, crushing the specimens and obscuring all structural and colour characteristics. The putative holotype was remounted into fresh Hoyers Mountant, because it proved impossible to dissolve the old mountant and rescue the specimen. The mountant around the second female was dissolved after prolonged treatment in warm water, and the specimen was remounted into Canada balsam. It was thus possible to confirm the following character states: mid and hind tibiae with apices extensively yellow, the yellow area longer than the width of the tibial apex. The postocular setae of the holotype are broadly blunt at the apex, not pointed, but the postocular setae on the second female were lost during remounting. Stannard, in describing *nesius*, also mentioned that he had studied specimens from Sri Lanka.

From the above, it seems that, although some specimens of *indicus* from India have the postocular setae weakly dilated at the apex, the condition of these setae is variable among Indian populations. All other available specimens have the postocular setae blunt to pointed at the apex. The apical colour of the mid and hind tibiae is even more confusing. The type specimens of *nesius* have the most extensive yellow area, and the type specimens of *pumilus* have the least yellow. But specimens from other parts of the world suggest that there is almost continuous variation between these two extremes. Moreover, the chaetotaxy of the lateral areas of tergites II–IV varies considerably (Figs 21–23), not only between specimens from single localities, but also on the left and right sides of the same individual. Considering these patterns of variation the conclusion is that *indicus* is a variable, polyphagous and widespread species, with both *nesius* and *pumilus* best considered synonyms in the absence of more secure data.

This species shares with *reuteri* the unusual character state of having the mesonotal lateral setae short and acute, although this condition is also found in two species that have the pronotum strongly sculptured, *chikakoae* and *eriae*. The mid and hind tibiae of *reuteri*, and its synonym *flavipes*, are considered to be consistently entirely yellow. Thus the specimens from southern Japan mentioned by Okajima (2006) as having these tibiae variable in colour are here regarded as *indicus*, as are the specimens from French Polynesia identified as *flavipes* in Hoddle *et al.* (2008).

Specimens examined. INDIA: 3 females (from type series?) from *Ailanthus* shoots, Ramakrishna coll. 29(a); 4 females without data, labelled by R.S.Bagnall; Madras, 1 female from *Cassia*, 9.vi.67 (TNA54); Sirumalai, 1 male from *Mallotus*, 27.vii.67 (TNA54); Kallar, from inflorescence of Rambhutan, 9.v.1959, in BMNH.

GUAM, Mt Lamlam, ?holotype female of *nesius* and one paratype female, from young leaves of *Melastoma marianum*, Feb. 1958, N. Krauss, in Bernice P. Bishop Museum, Honolulu.

TAIWAN, Nisui, 1 female, 2 male syntypes of *pumilus*, from *Diospyrus discolor*, 1.xi.1928, R.Takahashi, in SMF.

HAWAIIAN ISLANDS, coll. F. Calvert: **HAWAII,** Keeau, 11 females from *Macaranga tanarius*, 20.v.2014; Kona, 4 females from *Macaranga tanarius*, 20.vi.2014; Hilo, 8 females from *Hibiscus tiliaceus*, 20.v.2014, 4 females from *Mangifera indica*, 20.v.2014, 2 females from *Murraya koeigii*, 21.vi.2014, 3 females from *Acalypha hispida*, 29.i.2010. **OAHU,** Waiamanalo, 8 females from *Macaranga tanarius*, 11.iii.2010, in ANIC. **NEW CALEDONIA,** Bouraille and La Foa, 2 females, 1 male from *Hibiscus tiliaceus*, i.2012, in ANIC. **FRENCH POLYNESIA,** Moorea, Rurutu, Tahiti, 5 females from *Persea*, *Hibiscus* and *Musa*, ix.2004, in ANIC. **JAPAN,** Okinawa Island, 18 females from *Macaranga tanarius*, 12.iv.2012, in ANIC. **BARBADOS,** 3 females from cotton, 14.i.2007, in ANIC. **BRAZIL,** Maranhão, São Luis, 3 females from *Acacia*, 22.vii.2011.

***Dolichothrips longicollis* Karny, 1912: 299.**

(Figs 5, 26, 31, 37)

Based on a single male from the flowers of *Macaranga tanarius* near Semarang, in central Java, this species appeared to be unique in the genus in the absence of the major midlateral setae on the pronotum (Fig. 5). However, although a few specimens have been studied that lack this pair of setae, including the specimens listed below from Bali, these setae vary in length from 10 to 30 microns among specimens from both Malaysia and Borneo. The mouth cone (Fig. 37) and the pronotum are longer than in most other members of the genus, and the sculpture lines laterally on the pronotum form a distinctive series of almost concentric lines (Fig. 5). However, the setae on tergite IX of males are similar to those of *macarangai*.

Specimens examined. WEST MALAYSIA, Kuala Lumpur: Ampang, 1 female from *Macaranga* leaves, 4.iii.2007; Ulu Gombak, from *Macaranga tanarius*, 1 female, 29.iv.1998, 1 female, 4 males, 27.ii.2013; Kuala Selangor, 4 females, 3 males from *Macaranga tanarius*, ii. 2013. EAST MALAYSIA, SABAH, Kota Kinabalu, 2 females from *Macaranga tanarius*, 2.vi.2008; Sepilok, 6 females from *Macaranga tanarius*, ix.2013. INDONESIA, Bali, Buleleng, 3 females, 2 males from *Macaranga* flowers, 17.viii.2006, in ANIC.

***Dolichothrips macarangai* (Moulton)**

(Figs 7, 27, 32)

Neoheegeria macarangai Moulton, 1928: 319.

Described from Taiwan, where it seems to be quite common, a single male of this species was recorded from the Ryukyu Islands of southern Japan (Okajima 2006). It is similar in appearance to *citripes*, but as indicated in the key above the pronotal anteromarginal setae are considerably shorter than in that species. Both species have the setal pair SI on tergite IX dark brown, but in the few available specimens from Thailand the fore wing sub-basal setae S3 are paler than in specimens from Taiwan. The four males studied all have setae S2 on tergite IX scarcely 10 microns long, and much shorter than the iS setae.

Specimens examined. TAIWAN, Kentin, 1 female, 1 male, 13.iv.1993; Nantou, 1 female, 4.v.1993, in ANIC; Wufeng, 1 male, 23.vii.1993, in BMNH. THAILAND, Bangkok, Kasetsart University, 2 females, 2 males on *Polyalthia longifolia*, 3.vii.2013, in ANIC.

***Dolichothrips ochripes* Karny, 1926: 213.**

Both *ochripes* and *confusus* are described from India, but no specimens have been studied. Ananthkrishnan and Sen (1980) state of *ochripes* "All femora and tibiae ochraceous" whereas they state of *confusus* "All legs uniformly yellow". However, Bhatti (1978) refers to *ochripes* as having "uniformly yellow legs", and so it remains impossible to distinguish satisfactorily between these two from published information.

***Dolichothrips reuteri* (Karny)**

(Figs 4, 15, 29, 33, 38)

Liothrips reuteri Karny, 1920: 40; 1921: 47.

Liothrips karnyi Bagnall, 1924: 631. Unnecessary replacement name.

Neoheegeria flavipes Moulton, 1928: 317. **Syn.n.**

Neither the original 4-line description of *reuteri*, nor the extensive 1921 description, mention how many specimens were involved, but the species seems to have been based on a single female collected just south of Brisbane (Cedar Creek) in Queensland, Australia. This specimen has been compared to many specimens taken commonly in eastern Queensland, between the New South Wales border and the Torres Strait Islands, also around Darwin. Both sexes have been found in large numbers in the hairy apical buds of both *Macaranga tanarius* and *Hibiscus tiliaceus*. A few specimens have also been studied from Malaysia at Kuala Lumpur, and from Singapore, and also from the Solomon Islands. Moulton described *flavipes* from a series of both sexes taken from *Euphorbia* in Taiwan, and two females from the type series have been studied. Okajima (2006) interpreted *flavipes* as having the mid and hind tibiae variable in colour. However, the common species recorded on *Mallotus* from the Ryukyu Islands is here considered to be *indicus*, because the yellow area on the tibiae is never extensive. In structure, *reuteri* is closely similar to *indicus*, with similar thorax (Figs 4, 15), tergites (Fig. 29) and mouth cone (Fig. 38). On tergite IX of males, setae S2 are moderately stout and about 25 microns long, and about the same length as the iS setae. Most specimens of *reuteri* throughout its range have long slender almost pointed postocular setae, but a few specimens from around Darwin and also Kuala Lumpur have these setae shorter and distinctly capitate.

Specimens examined. AUSTRALIA, Queensland: Cedar Creek, holotype female, in the Swedish Museum of Natural History, Stockholm.

TAIWAN, Taihoku, xi.1926, from *Euphorbia*, holotype female of *flavipes* in California Academy of Sciences, San Francisco, paratype female in BMNH, London.

AUSTRALIA, Queensland: Brisbane, Long Pocket, 2 females, 2 males from *Macaranga tanarius* buds, 6.iii.2006; Surfers Paradise, 6 females, 4 males from *Macaranga tanarius* fls, 31.viii.2009; Paluma, 1 female from dead lvs, 15.vii.1995; Cape Tribulation, 4 females, 5 males from *Macaranga tanarius* fls, 7.vii.1995, 2 females from *Melastoma* lvs, 8.x.2012; Atherton, 7 females, 4 males from *Cissus* lvs, 1.viii.2004; Torres Strait Islands—Badu, Boigu, Darnley, Thursday Yam—15 females, 14 males from *Macaranga tanarius* fls, 18-20.xi.2009. **New South Wales**, Crystal Creek, Murwillumbah, 16 females, 6 males from *Macaranga tanarius* young lvs, 23.xii.2006. **Northern Territory**, Darwin, Lee Point, 10 females, 8 males from *Hibiscus tiliaceus* leaf bracts, 30.xii.1995; Litchfield, National Park, 3 females, 3 males from *Macaranga tanarius* lvs, 31.xii.1995, 1 female, 1 male from *Antidesma ghesembilla* curled lvs, 31.xii.1995; Humpty Doo, 2 females, 1 male from *Antidesma ghesembilla* lvs, 24.xii.1996. **MALAYSIA**, Kuala Lumpur, University Botanic Gardens, 3 females, 1 male from *Piper* lvs, 8.vii.2006. **SINGAPORE**, Botanic Gardens, 1 female, 1 male from *Melastoma*, 28.viii.2001. **SOLOMON ISLANDS**, Malaita, 4 females 4 males from *Hibiscus tiliaceus* lvs, 15.xii.1975.

***Dolichothrips utae* sp.n.**

(Figs 9, 13, 28)

Male macroptera: Body and legs dark brown, mid and hind tarsi also apex of fore tibiae paler, fore tarsi yellow; antennal segment III yellow, IV–VI yellow with apex weakly shaded light brown, VII brown on apical half, VIII uniformly brown; major setae brown to dark brown; fore wing clear, very weakly shaded at base.

Head longer than wide, narrowed to base (Fig. 9), without sculpture between ocelli, but rest of vertex transversely striate; po setae bluntly pointed, shorter than dorsal eye length, arising almost behind inner margins of eyes; maxillary stylets retracted almost to postocular setae, weakly V-shaped in position, more than one third of head width apart medially with prominent maxillary bridge; mouth cone long and pointed, extending across prosternal basantra; maxillary palps more than 7 times as long as wide. Antennae 8-segmented; segment III with 3 short sense cones, IV with 4 sense cones; VIII narrowed to base.

Pronotum smooth, with narrow band of reticulation along posterior margin; major setae all bluntly capitate; notopleural sutures complete. Fore femora slender; fore tarsal tooth small, less than one fifth as long as tarsal width. Prosternum with basantra well-developed, close under mouth cone; ferna large, triangular; mesopresternum of two triangles, with mesoeusternal anterior margin almost acute medially; metathoracic sternopleural sutures not developed. Mesonotum with median longitudinal division scarcely one third as long as this sclerite, lateral setae well-developed with blunt apices (Fig. 13). Metanotum medially with sculpture weak, forming narrow longitudinal parallel reticulation laterally, median setae acute. Fore wings almost parallel sided, sub-basal setae S1 and S2 with blunt to weakly capitate apices, S3 bluntly pointed; with about 12 duplicated cilia.

Pelta broadly triangular to D-shaped with weak sculpture, campaniform sensilla present (Fig. 28); tergites II–VII each with an additional pair of sigmoid setae anterolateral to wing retaining setae, also 2 or more pairs of straighter setae pointing toward mid-line (Fig. 28); tergite IX setae pointed, S1 longer than tube, but S2 minute. Sternites with median pair of marginal setae slender, arising sub-marginally; about 16 small discal setae in irregular transverse row across each sternite; sternite VIII without a pore plate.

Measurements (holotype male in microns). Body length 2400. Head, length 270; width across cheeks 160; po setae 60. Pronotum, length 170; median width 250; major setae, am 35, aa 30, ml 35, epim 70, pa 70. Mesonotal lateral setae 45. Fore wing, length 950; sub-basal setae 70, 75, 85. Tergite IV lateral setae 90, 65. Tergite IX setae S1 210, S2 18. Tube length 165; longest anal setae 200. Antennal segments III–VIII length 75, 80, 65, 60, 50, 30.

Female macroptera: Similar to male but larger; pronotum with small median longitudinal apodeme; fore tarsal tooth almost half as long as tarsal width; tergite IX setae S2 as long as S1.

Measurements (paratype female in microns). Body length 2700. Head, length 270; po setae 60. Pronotum, length 190; median width 280; major setae, am 35, aa 35, ml 50, epim 70, pa 70. Fore wing length 1000. Tergite IV lateral setae 130, 100. Tergite IX setae S1 230, S2 230. Tube length 165; longest anal setae 240. Antennal segments III–VIII length 75, 70, 60, 50, 30.

Specimens examined. WEST MALAYSIA, Frasers Hill, holotype male, from *Macaranga gigantea*, 30.vi.1999 (Ute Moog 99/150), in BMNH.

Paratypes: 3 females, 1 male, taken with holotype; EAST MALAYSIA, SARAWAK, Lambir Hills National Park, 1 female and 2 males from female flower of *Macaranga gigantea*, 15.vi.2006, 1 female from female flower of *Macaranga hosei* (=pseudopruinosa), 25.vi.2006, 1 female from male bud (or flower) of *Macaranga hosei* (=pseudopruinosa), 29.vi.2006, 1 male from female flower of *Macaranga hosei* (=pseudopruinosa), 4.vii.2006, 1 male from male flower of *Macaranga hosei* (=pseudopruinosa), 10.vii.2006 (Chikako Ishida); SARAWAK, Jalan Borneo Hts, 1 female, 1 male from *Macaranga gigantea*, 12.vi.2000 (Ute Moog 00/061). SABAH, Kota Kinabalu, 2 females, 3 males from *Macaranga gigantea*, 22.ix.2008. WEST MALAYSIA, Perak, Sepangan, 6 females, 1 male from *Macaranga gigantea*, 4.iv.2012.

Non-paratype: WEST MALAYSIA, Ulu Gombak, 1 damaged female from *Macaranga hosei*, 29.iv.1998.

Comments. This species was taken from *Macaranga* flowers rather less frequently than *fialae*, and is unusual in having particularly short setae S2 on tergite IX of males. The abdominal chaetotaxy is similar to that of the unique female from northern India on which *fumipennis* is based. However, that species has longer and more finely pointed postocular setae, and also longer pronotal setae.

***Dolichothrips varipes* Bagnall, 1921: 359.**

Described from an unspecified number of individuals collected by Ramakrishna in India, this species has been reported subsequently from Egypt, Sudan, Ethiopia and Cape Verde Islands (zur Strassen 1992). Syntypes of both sexes have been studied together with the recorded specimens from Sudan and Cape Verde Islands. The host association is uncertain, but this thrips has been recorded, together with larvae, from *Abutilon* (Malvaceae) and from *Grewia* (Tiliaceae). The mesonotal lateral setae are capitate and about 40 microns long, tergites II–VII each have an extra pair of curved setae anterior to the first pair of sigmoid wing-retaining setae, and tergite IX setae S2 of males are acute and about 15 microns long and considerably shorter than the iS setae. The yellow area at the apex of the mid and hind tibiae varies from as long as the width of a tibia to at least twice as long as this width.

***Dolichothrips zyziphi* (Bagnall)**

Neoheegeria zyziphi Bagnall, 1924: 629.

This species remains known only from the damaged and distorted type series, comprising three females and two males (Mound 1968: 89), apparently collected at Paresnath, West Bengal. The lectotype male has the fore femora swollen and slightly angulate, and the pronotum is also swollen but with no sculpture lines visible. The mesonotal lateral setae are capitate and about 50 microns long, and tergites II–VII each have an extra pair of curved setae anterior to the first pair of sigmoid wing-retaining setae.

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APPENDIX I. Species not studied or removed from *Dolichothrips*

Apelaunothrips citricrurus (Moulton) **comb.n.**

Described in *Dolichothrips* from Ethiopia (Moulton 1949:486), the holotype of this species has been examined in BMNH. It is here recognised as a species of *Apelaunothrips* because of the relatively stout maxillary stylets (Mound 2013).

Dolichothrips amygdali Pelikan, 1984: 123.

This species was described from Mongolia as having only two sense cones on the third antennal segment, and the maxillary bridge was stated to be absent. The holotype female is probably deposited in the Hungarian Natural History Museum, Budapest.

Dolichothrips assimilis Priesner & Seshadri, 1952: 405.

Although distinguished as having only two sense cones on the third antennal segment, the original material of this species is not available among the slides of the Priesner collection at SMF.

Dolichothrips fuscipes Moulton, 1947: 174.

Described from New Guinea as having 26–29 duplicated cilia on the fore wing, this figure is far higher than for any other species in the genus. The type specimens are in the California Academy of Sciences.

Dolichothrips malhavii Ananthkrishnan, 1961: 266.

The depositary is not known of the syntypes of this species from India, but specimens labelled with this name are listed in the collections of the Indian Agricultural Research Institute, Delhi. It was described as having yellow tibiae, but was distinguished as having red internal pigments.

Dolichothrips montanus Ananthkrishnan, 1964: 223.

The depositary is not known of the syntypes on which this species was based. Described from India, it was stated to have the mid and hind tibiae brown.