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Ambaeolothrips: a new genus of Neotropical Aeolothripidae (Thysanoptera), with observations on the type-species from mango trees in Mexico

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Abstract

Ambaeolothrips **gen. n.** is diagnosed for three Neotropical species: the type species *romanruizi* Ruiz-De la Cruz *et al*. **comb. n.** from Mexico, *microstriatus* Hood **comb. n.** from Panama, and *pampeanus* **sp. n.** from southern Brazil. Variation is discussed among character states that are used in the generic classification of the family Aeolothripidae, including segmentation of the antennae and maxillary palps, sculpture of the metanotum and presence of sternal discal setae. New field observations on the biology of *romanruizi* indicate that this species is phytophagous in flowers and on leaves, with no evidence of predation on the larvae of other thrips.

Key words: new genus, new species, generic classification, character-state variation, predation

Introduction

In describing *Aeolothrips romanruizi* as a new species, based on 15 females from mango in Oaxaca, Mexico, Ruiz-De la Cruz *et al.* (2013) referred to this thrips as "predatory", although with no supporting behavioural observations. This is not an unusual situation, because taxonomic publications on Thysanoptera commonly refer to Aeolothripidae as predators. In this family, species in a few genera such as *Franklinothrips* are certainly predators (Hoddle 2003), but one of the few studies on the diet of any other aeolothripid, by Bournier *et al*. (1979) on *Aeolothrips intermedius* in France, indicated that to achieve sexual maturity adults need to feed on flowers. Recently, we collected several hundred adult *A. romanruizi*, including four males, from the flowers of mango in Chiapas, southern Mexico. The presence of such large numbers provided an opportunity to reconsider two topics: the significance of this insect as a predator, and its systematic relationships within the family.

The Aeolothripidae is a family of worldwide distribution that currently includes 204 species in 23 genera (ThripsWiki 2016). However, 60% of these species are placed in either the Holarctic genus *Aeolothrips* or the Australian genus *Desmothrips*. Four other genera, known only from parts of the American continent, include a further 30 species, with the worldwide tropical genus *Franklinothrips* comprising 16 species. The remaining genera are all small, with 10 of them each including only one or two species. The aeolothripid fauna of the Neotropics is probably not well-sampled, and *Euceratothrips* is the only aeolothripid genus endemic to this region, and that is known only from a single male taken in Peru. Neotropical species are known in the New World genera *Erythrothrips*, *Dactuliothrips* and *Stomatothrips*, the pantropical genus *Franklinothrips*, and also *Gelothrips* that is recorded from South America and India to Australia. To these genera is here added *Ambaeolothrips* as a new genus based on three Neotropical species.

Phylogenetic relationships among the aeolothripid genera have never been fully explored. Historically, suprageneric groups have been named both for *Mymarothrips* and *Franklinothrips*, as well as for taxa that share

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with *Orothrips* the presence of multi-segmented maxillary palps (Priesner 1949). There is little support for such a classification, and a study of six major aeolothripid genera and one genus each of the families Merothripidae and Melanthripidae remains the only formal attempt to examine evolutionary relationships in this family (Marullo & Mound 1995). In diagnosing a new genus here for three Neotropical species, observations are provided on the main character state differences used to distinguish the 23 genera of Aeolothripidae. These observations are based primarily on specimens in the Australian National Insect Collection. Variation in these characters among species is such that it continues to be difficult to deduce phylogenetic relationships with any certainty.

Character state variation among Aeolothripidae genera. *Antennal segments*. Species of *Aeolothrips* commonly have antennal segments V–IX forming a more or less discrete terminal unit, and this character state is shared with the members of the new genus, *Ambaeolothrips*. In some *Aeolothrips* species (also of *Indothrips*) segment V is shorter than the total of VI–IX (Fig. 1), and this apical unit is then distinct. However, in many *Aeolothrips* species, such as *fasciatus* (Fig. 2), segment V is as long as, or longer than, VI–IX with the margins of V almost straight, and in some, such as *bicolor* (Fig. 3) and *nasturtii* (Fig. 4) segment VI is considerably longer than wide and even slightly constricted at the base. There is thus no simple distinction between the condition of antennae among species of *Aeolothrips* and the condition in species of *Desmothrips*, in which segment VI is more clearly constricted at the base (Fig. 5). In most other members of this family the apex of segment V, or even of VI, is clearly constricted, and the distal segments are thus more distinct from each other. Similarly variable between species are the length and form of the sensoria on segments III and IV, ranging from short and straight to long, convoluted and with internal markings, even among species within a single genus such as *Desmothrips* (Pereyra & Mound 2010). One remarkable difference in antennal sensoria is the duplication of the sensorium on segment III in species of *Cycadothrips*, *Dactuliothrips* and *Orothrips*, but there is no further evidence that this duplication indicates a relationship between these genera.

Maxillary palps. Subdivision of the second maxillary palp segment was at one time used to diagnose a Tribe, Orothripini. However, this subdivision is not constant within some genera, and is even variable between sexes within species (Mound 1967). Moreover, the length of the second segment is also variable among members of this family. Species of *Dactuliothrips* have this segment scarcely longer than wide, and the length varies amongst *Aeolothrips* species with a few, such as *fasciatus*, showing transverse markings on the segment. *Gelothrips* species have this segment elongate with distinctive transverse markings, and *Desmothrips* includes species exhibiting a transition from this condition to a segment with up to six clear subdivisions. In contrast, species of *Andrewarthaia*, an Australian genus presumably derived from *Desmothrips*, have the second segment entire but with transverse lines. *Erythrothrips* and *Stomatothrips* species have the second maxillary palp segment clearly subdivided into six parts, but *Aduncothrips* species have only four divisions with the basal part almost as long as the length of the three distal parts, and in *Streothrips* species the second segment is entire.

Metanotal sculpture. Most species in this family have the metanotum with equiangular reticulation, including those in *Aeolothrips*, *Andrewarthaia*, *Desmidothrips*, *Desmothrips*, and *Orothrips*, but *Desmothrips* and *Desmidothrips* species differ from those in the other genera in having markings within the reticles. In contrast, species of *Audiothrips*, *Corynothripoides*, *Franklinothrips*, *Indothrips*, and *Mymarothrips* have no sculpture medially on the metanotum. Species in two genera have highly distinctive metanotal sculpture: in *Allelothrips* the metanotum has longitudinal striae medially forming a distinctive triangle (Mound 1968), and in *Stomatothrips* there are transverse striae on the anterior half of the metanotum (Fig. 9). In *Rhipidothripiella* and *Rhipidothrips* the species have the metanotum with weak longitudinal reticulate lines that sometimes bear microtrichia, and *Dactuliothrips* species have transverse reticulations that also bear microtrichia in some species. The species of *Cycadothrips* also have longitudinal lines that are often irregularly concentric around a postero-median point of the metanotum. The three species in the new genus diagnosed below all have the metanotum with distinctive curving lines on the metanotum that are arched around the mid-point of the anterior margin (Figs 21–23), and species in three other genera have similar arcuate metanotal sculpture: *Aduncothrips* (Fig. 10), *Lamprothrips* (Fig. 12) and *Streothrips* (see Ng & Eow 2012). However, an intermediate condition between this and the typical *Aeolothrips* reticulate metanotum occurs in *Erythridothrips*, *Erythrothrips* (Fig. 11) and *Gelothrips* (Fig. 13). This is also true of a few North American species of *Aeolothrips*, including *nitidus* (Fig. 14), and to a lesser extent *vittipennis* (see Hoddle *et al*. 2012), in which the metanotal reticles form curved concentric bands around the anterior margin.

Discal setae on abdominal sternites. The presence, absence, number, and position of these setae varies among the members of this family. *Aeolothrips* species usually have no sternal discal setae, and there are four pairs of

marginal setae on sternites IV–VI. However, the lateral two pairs commonly arise slightly submarginally, and this condition is found in the species of the new genus below (Fig. 24), as well as in the species of *Streothrips* and *Orothrips*. In several species of *Aeolothrips*, such as *nitidus* and *vittipennis*, these two setal lateral pairs are so distant from the posterior margin that they look like discal setae, and this condition is also typical of *Franklinothrips* species. In contrast to the condition in these genera, discal setae are present in species of *Erythrothrips*, as a transverse row across each sternite, and although a similar transverse row is found in *Desmothrips* species the number of setae is highly variable with none present medially in some species (Mound 1967). On sternite VII of *Gelothrips* and *Lamprothrips* species all of the marginal setae arise submarginally, but a group of discal setae is present laterally. The only species in *Aduncothrips* is particularly unusual in that some of the sternal discal setae arise anterolaterally on the sternal antecostal ridge. The species of *Rhipidothrips, Rhipidothripiella* and *Stomatothrips* exhibit a further variation, in that the number of sternal marginal setae is reduced to three (sometimes even to two on anterior sternites) although there are numerous discal setae.

Fore wing pigmentation. The typical aeolothripid condition is for the fore wings to have two transverse dark bands (Fig. 17), although in *Aeolothrips* species the apex of the wing is pale, whereas in *Desmothrips*, *Gelothrips* and *Orothrips* the apex is dark. Despite this, many species in this family have longitudinal dark markings (Fig. 18), either alone or in combination with one or two transverse bands, and this variation occurs within genera including *Aeolothrips*, *Ambaeolothrips*, *Desmothrips*, and *Franklinothrips*.

Ambaeolothrips gen. n.

Diagnosis. Body colour either dark brown or abdomen bicoloured; fore wing with transverse and/or longitudinal dark bands. Antennae 9-segmented, V–IX form a unit that is little longer than IV (Figs 6–8), sensoria on III–IV broadly linear and 0.5 or more as long as their segment, on IV curving around apex. Head with numerous setae arranged in a pair of irregular transverse rows behind eyes; eyes prolonged ventrally; maxillary palp segment II not subdivided but with weak constrictions indicated by transverse rows of microtrichia. Fore tarsus with typical aeolothripid curved claw ventrally. Pronotum with no long setae, surface without sculpture lines. Meso and metanota very closely striate, with minute markings between striae (Figs 21–23). Tergite I with transverse reticulation (Fig. 21), remaining tergites with very faint narrow transverse reticulate lines; X with trichobothria no larger than bases of major setae. Sternite II often with only one pair of marginal setae, III with 3 or 4 pairs, V–VI with 4 pairs, VII with 4 pairs and 2 pairs of accessory setae submedially close to the margin (Fig. 24); II–VII with no discal setae, and no setae near antecostal ridge. Male (where known) tergite I with paired longitudinal ridges, tergites without tubercles, IX without claspers or stout setae.

Type species: *Aeolothrips romanruizi* Ruiz-De la Cruz *et al*.

Relationships. In the key to New World genera of Aeolothripidae (Mound & Marullo 1996) this new genus will run to *Aeolothrips*. The three species are similar to members of that genus in lacking sternal discal setae, and in the form of the maxillary palps and antennal segments, but differ in the closely striate sculpture of the meso and metanotum, with striae arched around the anterior margin on the metanotum. This form of curved linear sculpture on the metanotum is shared only with species in the three genera *Aduncothrips* (Fig. 10), *Lamprothrips* (Fig. 12) and *Streothrips*. The single species placed in *Lamprothrips*, from Australia, does not have the mesonotum closely striate (Fig. 12), in contrast to the species in the other two genera (Fig. 10). Moreover the sternites in *Lamprothrips* have exceptionally short marginal setae, there are a few discal setae laterally on sternites V–VII, and antennal segment VI is more than half as long as segment V. *Aduncothrips* comprises a single described species, from Asia, and this has the pronotum smooth as in *Ambaeolothrips* species, but on sternites III–VII there are two or more pairs of discal setae arising on or close to the antecostal ridge, and the maxillary palps have multiple segments. Moreover, the cephalic setae are unusually weak and small, scarcely longer than the distance between two sculpture lines, and the sensoria on antennal segments III and IV are long and slender with internal markings, on IV curving fully around the apex but also extending almost to the base of this segment. The three Asian species that comprise the genus *Streothrips* share with the species of *Ambaeolothrips* the absence of any sternal discal setae, and the presence of undivided maxillary palps, but they have the pronotum as closely striate as the meso and metanotum, and antennal segment VI is slightly longer than wide (Ng & Eow 2012). Two further genera have species in which the metanotal sculpture approaches that of *Ambaeolothrips*. In some *Erythrothrips* species the

metanotal sculpture forms a series of curving rows of reticles (Fig. 11), although *durango* from Mexico has the metanotum more evenly reticulate as in typical *Aeolothrips* species. The species of *Erythrothrips* differ from members of the new genus in having numerous sternal discal setae, and the maxillary palps with multiple small segments. The other genus in South America with the metanotal reticulation forming curving bands is *Gelothrips* (Fig. 13), but in contrast to the new genus antennal segments VI and VII are distinct from each other with each almost as long as segment V, and the sternites bear discal setae laterally. At present, the species of *Ambaeolothrips* appear to share most character states with species in two genera. The first is *Aeolothrips*, particularly species sculptured like *nitidus* (Fig. 14), the second is the Asian genus *Streothrips*.

Key to species of *Ambaeolothrips*

1. Fore wing with two distinct transverse dark bands, apex of clavus pale (Fig. 17); metanotum without a pair of campaniform sensilla (Fig. 21) . . . . . *romanruizi*
-. Fore wing with only one transverse dark band, clavus uniformly dark (Figs 16, 18); metanotum with paired campaniform sensilla medially (Figs 22, 23) 2
2. Fore wing with dark bands along anterior and posterior margins toward wing apex, deeply shaded between costa and first vein (Fig. 18), posterior margin dark opposite apex of clavus; female with antennal segment II dark, also abdominal segments uniformly dark brown (Fig. 20) . . . . . *pampeanus* **sp. n**.
-. Fore wing without long dark bands, not deeply shaded between first vein and costa (Fig. 16), posterior margin pale opposite apex of clavus; male with antennal segment II pale (Fig. 6), also abdominal segments III–VIII pale in contrast to dark segments I–II and IX–X (Fig. 15) . . . . . *microstriatus*

Ambaeolothrips romanruizi Ruiz-De la Cruz *et al*. comb. n.

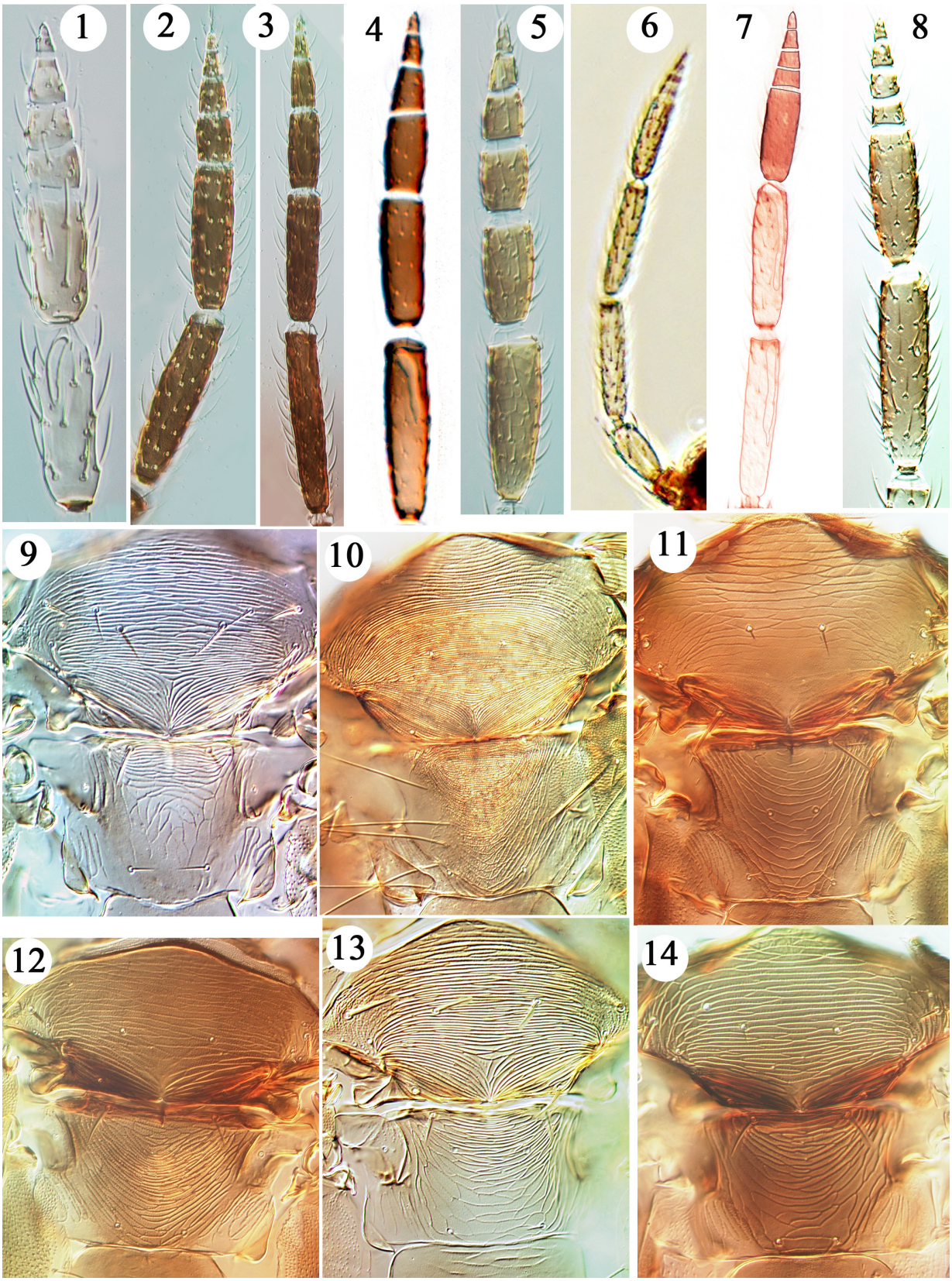
(Figs 8, 17, 19, 21, 24)

Aeolothrips romanruizi Ruiz-De la Cruz, Vásquez-López, Retana-Salazar, Mora-Aguilera & Johansen-Naime, 2013: 29.

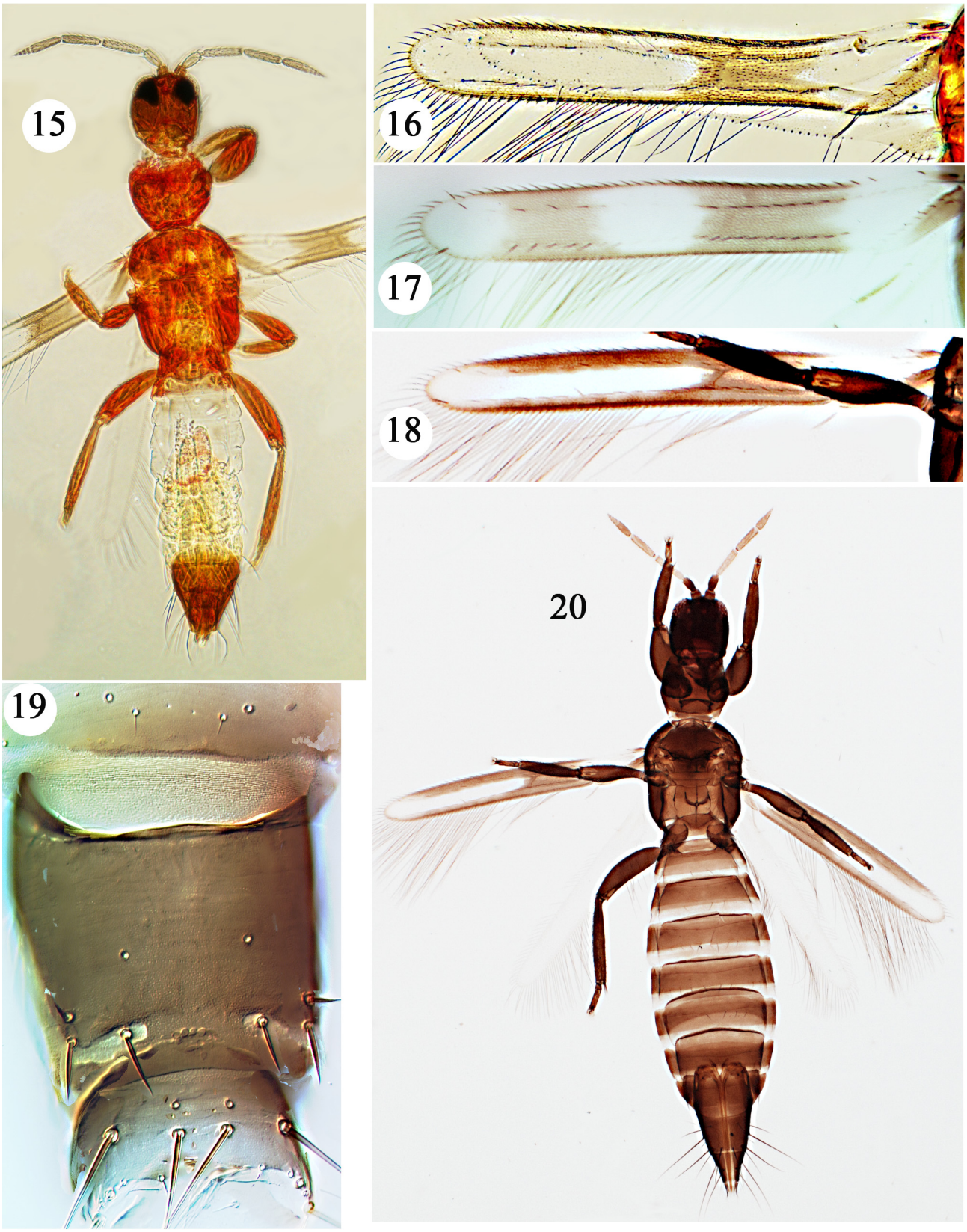
Described from 15 females taken from "mango crops" on unspecified dates in Oaxaca, Mexico, this species has been studied from various sites between Panama and southern Mexico, as discussed further below. The male is described here for the first time, based on specimens from Chiapas, and voucher specimens will be deposited in suitable museum collections.

Description of male. Body and legs dark brown, abdominal segments III–VIII light brown with lateral margins yellow; antennal segment II pale distally, III weakly shaded toward apex (not as clear yellow as in female); fore wing as in female, with two dark cross bands, anterior and posterior marginal veins dark around median pale area, apical ring vein dusky, clavus with distal half pale. Smaller than female, with abdomen slender; tergite I with paired longitudinal ridges and transverse sculpture lines; median tergites without tubercles; tergite IX with pair of narrow pale areas near posterior margin, one pair of stout setae arise submedially and two pairs laterally (Fig. 19). Sternite II with one pair of marginal setae, III–VII with three pairs.

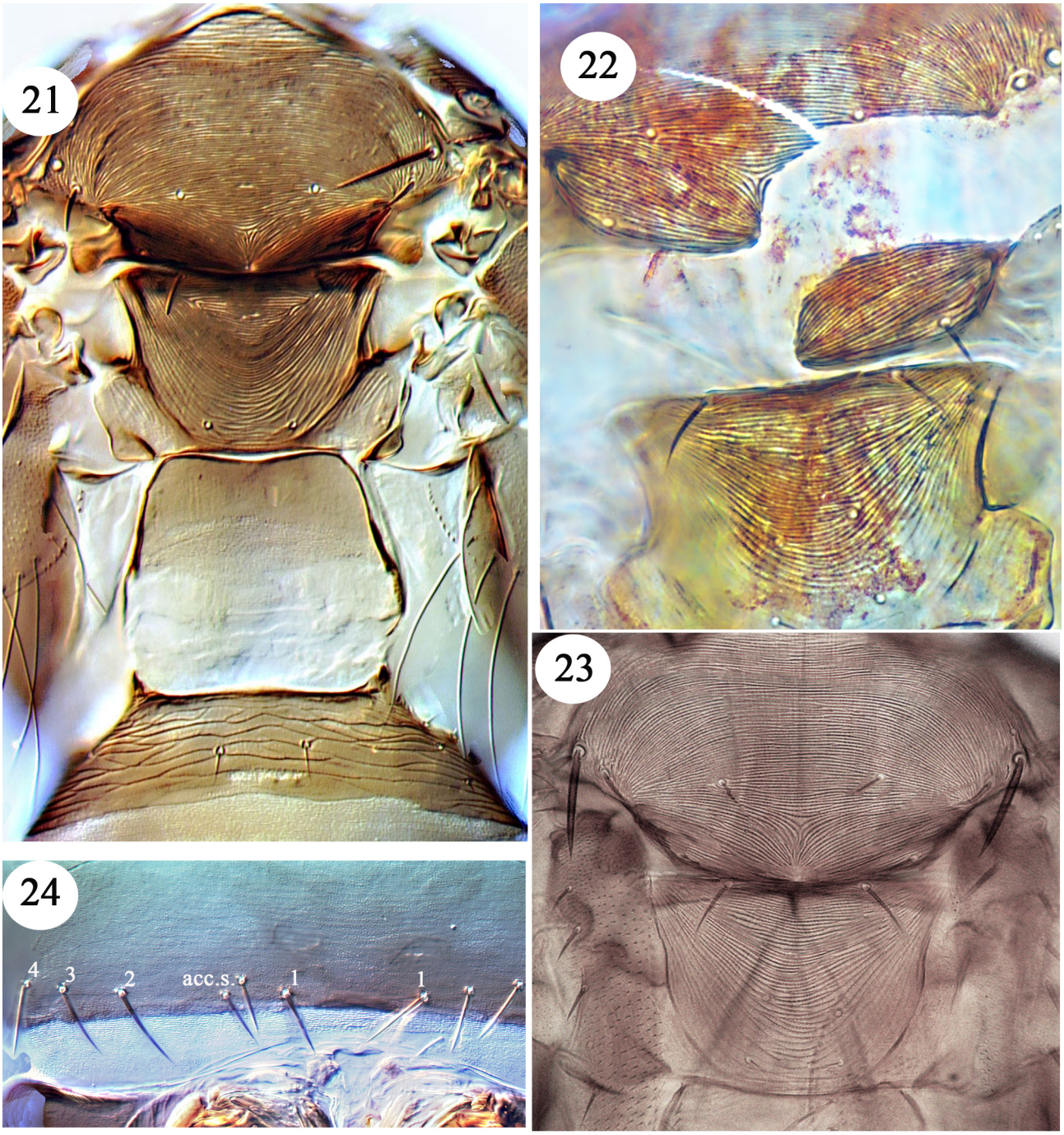
Biological observations on *romanruizi*. In January 2016, more than 500 females of this aeolothripid were collected from the flowers of mango trees in Chiapas, together with four of the previously unknown males. Females were also collected from mango at various localities in Chiapas between February and April, 2012, and again in March 2013. A few females were taken from mango and avocado in Veracruz, Mexico, and a single female was taken from mangrove in Panama in July 2011. In order to examine the feeding behaviour of this thrips, live females were collected in Chiapas from leaves and flowering panicles of mango. After a resting period in the laboratory, 15 females were placed individually into separate plastic cups together with a piece of mango leaf and about 25 larvae of mango-inhabiting *Frankliniella* and/or *Scirtothrips* species. Behaviour of the females was observed several times each day, but no predation on the available larval Thripidae was observed. The females apparently continued to feed on the mango leaves, and were observed to oviposit in these leaves. Clearly, there remains a possibility that this thrips is predatory under some circumstances, but our observations could not confirm the opinion of Ruiz de la Cruz *et al*. (2013) that "This predatory thrips may be important in controlling many species of phytophagous thrips that attack this crop."



FIGURES 1–14. Aeolothripidae species. Terminal antennal segments 1–8: **(1)** *Aeolothrips nitidus*; **(2)** *Ae. fasciatus*; **(3)** *Ae. bicolor*; **(4)** *Ae. nasturtii*; **(5)** *Desmothrips australis*; **(6)** *Ambaeolothrips microstriatus* segments I–IX; **(7)** *Am. pampeanus* segments III–IX; **(8)** *Am. romanruizi* segments IV–IX. Meso and metanota 9–14: **(9)** *Stomatothrips septenarius*; **(10)** *Aduncothrips* ?*asiaticus*; **(11)** *Erythrothrips arizonae*; **(12)** *Lamprothrips miltoni*; **(13)** *Gelothrips cinctus*; **(14)** *Aeolothrips nitidus*.



FIGURES 15–20. *Ambaeolothrips*. **(15)** *microstriatus* male. Fore wings 16–18: **(16)** *microstriatus*, **(17)** *romanruizi*, **(18)** *pampeanus*. **(19)** *romanruizi* male tergite IX. **(20)** *pampeanus* female.



FIGURES 21–24. *Ambaeolothrips*. Meso and metanotum 21–23: **(21)** *romanruizi*; **(22)** *microstriatus*; **(23)** *pampeanus*. **(24)** *romanruizi* female sternite VII (left side), marginal setae 1–4; paired accessory setae (acc.s.)

Ambaeolothrips microstriatus (Hood) comb. n.

(Figs 6, 15, 16, 22)

Aeolothrips microstriatus Hood, 1935: 103

Without seeing the specimen, and with no explanatory comment, Bhatti (1999) listed this species in the genus *Streothrips*. It remains known from a single male in the United States National Museum of Natural History, Beltsville, Maryland (Fig. 15). This was collected from unidentified Asteraceae flowers in Panama in March, 1934, and is strongly bicoloured, in contrast to the uniformly brown males of *romanruizi*. Unfortunately, the terminal

abdominal segments are slightly telescoped into each other, and the chaetotaxy of tergite IX is thus difficult to observe and illustrate, although it appears to be similar to that of *romanruizi* (Fig. 19). The fore wing colour pattern resembles that of the new species described below from southern Brazil.

***Ambaeolothrips pampeanus* sp. n.**
(Figs 7, 18, 20, 23)

Female macroptera: Body extensively dark brown, abdominal segments I–VII slightly paler; antennal segments III–IX light brown. Fore wing with longitudinal dark bands along anterior and posterior margins toward wing apex (Fig. 18), clavus uniformly brown.

Head about as long as wide; about 8 pairs of postocular setae in irregular double row; one pair of short setae between posterior ocelli; mouth-cone short and scarcely extending between fore coxae. Antennal segments III and IV each with a linear sensorium, on III straight and extending to basal half of segment, on IV curving around apex and extending to basal third of segment (Fig. 7). Pronotum smooth, with no long setae; mesonotum closely striate; mesosternum entirely divided by furcal spinula; metanotum divided into two sclerites, anterior sclerite with arcuate and closely spaced striae, posterior sclerite smooth. Fore wing with two complete rows of small setae; clavus with a row of 7–8 setae and a single discal seta near base. Abdominal tergite I broad, covering the entire dorsal surface of segment; tergal median setae small and wide apart; tergite IX slightly longer than VIII; abdominal sternite III with 3 pairs of postero-marginal setae, IV–VII with 4 pairs.

Measurements (holotype female in microns). Body length 1600. Head length 182, width 205. Pronotum length 160; width 225. Fore wing length 935, median width 110. Antennal segments I–IX length: 27, 55, 110 (102 excluding pedicel), 103, 67, 10, 10, 8, 7.

Male: unknown

Material studied. Holotype female: **Brazil**, Rio Grande do Sul state, Porto Alegre, on grass leaves, 05.xii.2011 (Cavalleri A) [Universidade Federal do Rio Grande, São Lourenço do Sul, Brazil: UFRGS 1432].

Paratype: **Brazil**, Rio Grande do Sul state, Catuípe, 1 female on *Lonchocarpus campestris* [Fabaceae], 27.xi.2008 (Santos FL) [UFRGS 1433].

Comments. Known only from two females taken in southern Brazil, the fore wing colour pattern suggests that this species is particularly closely related to *microstriatus* from Panama, from which it can be distinguished using the key above. One referee in commenting on this manuscript indicated that the three available specimens could be interpreted as a single variable species. Although this is true, such intraspecific colour variation would be unusual in Aeolothripidae, as would the geographical distribution of an endemic thrips species almost the full length of South America.

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