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The genus *Heterothrips* (Thysanoptera) in Brazil, with an identification key and seven new species

VERONICA PEREYRA[1] & ADRIANO CAVALLERI[2]

[1]*CONICET-Instituto Superior de Entomologia 'Dr. Abraham Willink', Tucumán, Argentina. E-mail: vpereyra@csnat.unt.edu.ar*
[2]*Departamento de Zoologia, Instituto de Biociências,Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves 9500, 91501-970 Porto Alegre, Brazil. E-mail: cavalleri_adriano@yahoo.com.br*

Abstract

Seven new species of *Heterothrips* are described from Brazil, and a key presented to the 20 species now known from this country. *Heterothrips semiflavus* De Santis is synonymized with *H. bicolor* Hood. The new species are illustrated and notes on their biology included.

Key words: Systematics, Heterothripidae, host specificity, Terebrantia

Introduction

Heterothrips Hood is the largest genus in the family Heterothripidae, currently comprising about 70 species. Although restricted to the Americas, these thrips are found widely between north-eastern U.S.A. and Argentina (Mound 2011). With the exception of species in the genus *Aulacothrips* that are ectoparasitic on Hemiptera, all members of Heterothripidae feed exclusively on flowers (Mound & Marullo 1996; Cavalleri *et al.* 2010).

The species in this genus are relatively conservative in morphology, but little is known about their life history, which limits the knowledge of their intraspecific variation. As a result, some of the described species are likely to be recognised as synonyms in the future (Del-Claro *et al.* 1997). Moulton (1932) recognized two informal groups within the genus and provided a key to the known South American species. The abdominal tergites of species in his "group I" bear a posteromarginal fringe of independent microtrichia (Fig. 1), whereas the species of "group II" feature microtrichia that arise on the posterior margin of the abdominal tergites from a well-developed craspedum (Fig. 2). More recently, Mound & Marullo (1996) provided a key to 57 species in the genus and described two new species together with three new species synonyms. These authors also treated the subgenus *Lenkothrips* as a full genus to include the Brazilian species *sensitivus* De Santis.

The geographical distribution among *Heterothrips* species is quite particular and, aside from *watsoni*, the species composition of North and South America is completely different (Bailey & Cott 1954). From Brazil, 13 species were listed by Monteiro (2002), almost all described by Moulton (1932) or Hood (1954), although most species were based on few specimens with little biological information. For example, almost half of Brazilian species were described without any indication of the plant from which they were collected. In addition, recent studies from the Neotropics suggest a highly diverse and unexplored *Heterothrips* fauna (Cavalleri *et al.* 2006; Retana-Salazar 2009; De Borbón 2010).

Host-plant relationships. *Heterothrips* species are considered as showing a high degree of host specificity, but there are few studies on their life histories (Mound & Marullo 1996). Some species are found frequently living in sympatry, and on numerous plant species that are usually closely related (Figs 3, 5–10). As a result, recognition of true host-plant associations can be achieved only by repetitive collecting and identification of larval stages. In the Neotropics, many plant families such as Fabaceae, Myrtaceae, Malpighiaceae, Rubiaceae and Solanaceae seem to support a high diversity of species (Figs 5–10). Personal observations in Brazilian savannah indicate that *Heterothrips* adults are highly mobile, visiting flowers of many species, particularly of Malpighiaceae. The floral structure

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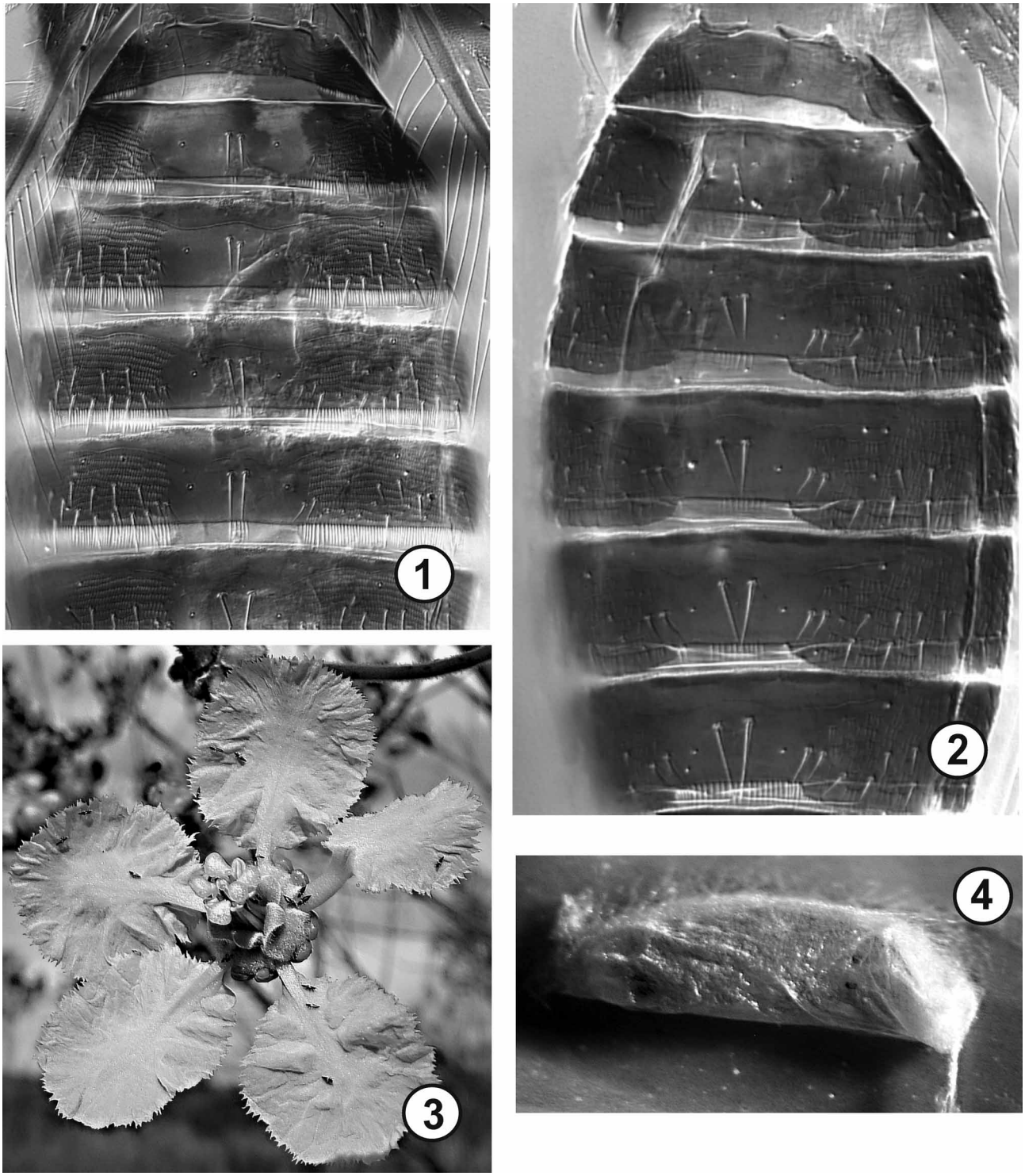
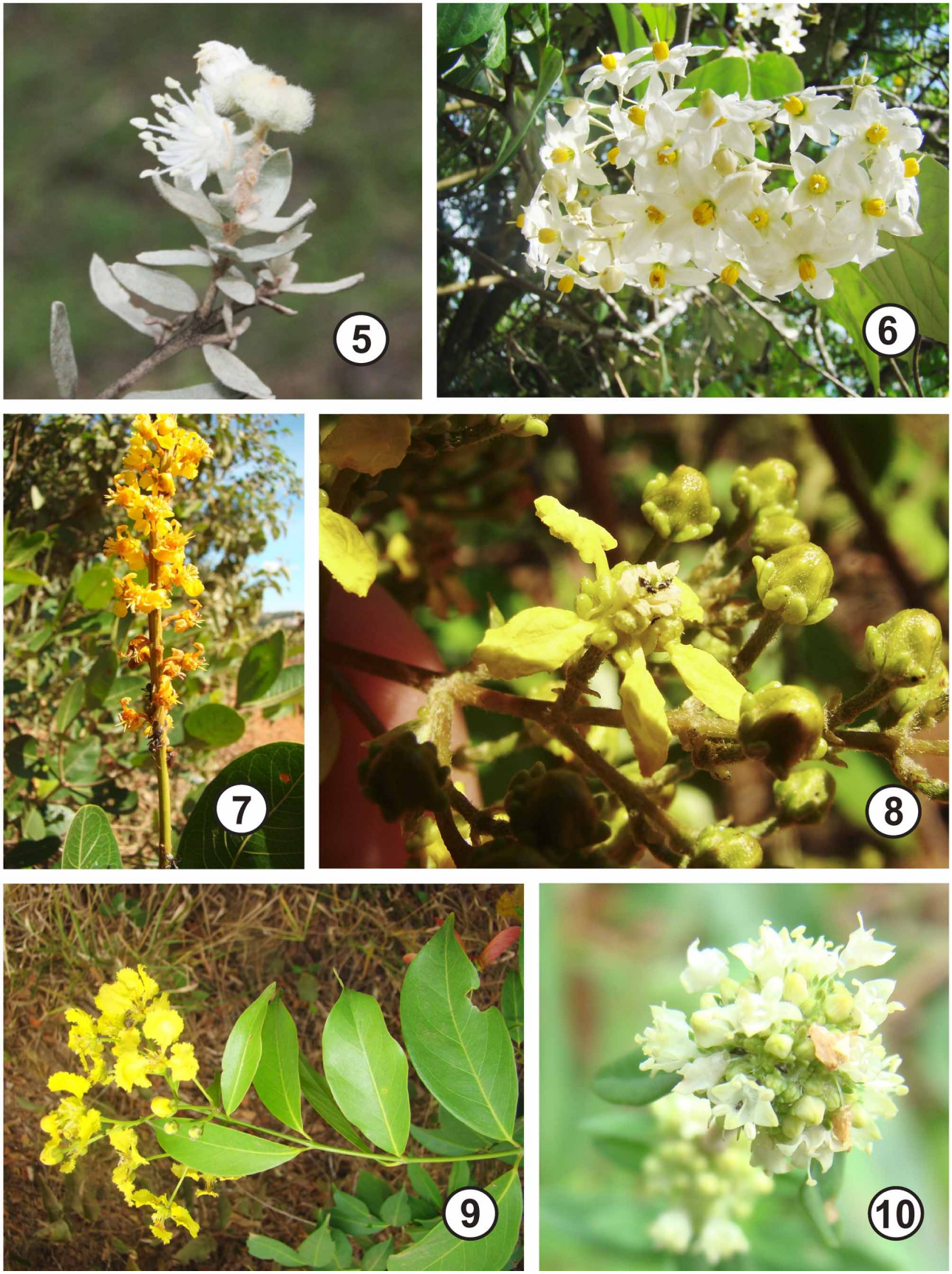
of these plants seems to offer protection against predators and extreme weather conditions (Del-Claro 1998). In addition, many Malpighiaceae species in Brazilian Cerrado show sequential flowering, allowing thrips and other insects to move to freshly flowering plants throughout the year (Alves-Silva 2010).

In this paper, we describe seven new *Heterothrips* species, and provide a key to the 20 species now recorded from Brazil. Information about geographical distributions and ecology is also presented, when available.



FIGURES. 1–4. Brazilian *Heterothrips*. **1.** *H. paulistarum* **sp.n.**, abdominal tergites I–VI, with posteromarginal independent microtrichia; **2.** *H. savanicus* **sp.n.**, abdominal tergites I–VI, with posteromarginal craspeda; **3.** *Peixotoa* sp. flowers with *Heterothrips* adults; **4.** *Heterothrips* pupa.



FIGURES 5–10. Host plants of Brazilian *Heterothrips* species: **5.** *Croton gnaphalii* (Euphorbiaceae); **6.** *Solanum sanctaecatharinae* (Solanaceae); **7.** *Byrsonima intermedia* (Malpighiaceae); **8.** *Niedenzuella glabra* (Malpighiaceae); **9.** *Diplopterys pubipetala* (Malpighiaceae); **10.** *Borreria verticillata* (Rubiaceae).

Material and methods

The new taxa were collected between 1999 and 2011 in several Brazilian localities and plant species, as listed below. All thrips were macerated in a 5% solution of NaOH, and dehydrated in a series of alcohols, for slide mounting in Canada balsam (Mound & Marullo 1996).

Type material was studied of species deposited at United States National Museum of Natural History (USNM), USA; California Academy of Sciences (CAS), USA; Museo de Ciencias Naturales de La Plata (MLP), Argentina; and Escola Superior de Agricultura Luiz de Queiróz (ESALQ), Brazil. Holotypes of the species described herein are placed at Departamento de Zoologia, Universidade Federal do Rio Grande do Sul (UFRGS), Brazil and paratypes are also available at Instituto Fundación Miguel Lillo (IFML), Argentina. Full nomenclatural and bibliographical information of Thysanoptera species is provided by Mound (2011).

Heterothrips Hood

Heterothrips Hood, 1908. Type-species *H. arisaemae* Hood.

Diagnosis. Antennae 9-segmented, segments III–IV with circumpolar sensoria at apex, with one or more rows of sensorial pores; III with two basal constrictions. Head wider than long, without long setae; ocellar setae I present or absent. Pronotum with no long setae (Fig. 14); metanotum covered with microtrichia, usually with concentric sculpture but sometimes almost forming a triangle medially (Fig. 12). Fore wing slender, wider at base, both veins with complete rows of setae (Fig. 20). Abdominal tergites laterally covered with microtrichia, with posteromarginal fringe of independent microtrichia (Fig. 1), or with craspedate lobes bearing microtrichia; II–VIII with median pair of setae well developed, arising close together (Figs 2, 17, 19); sternites sometimes bearing few discal setae. Male usually with oval or transverse pore plates on abdominal sternites (Figs 54, 67); some species with a pair of dorsolateral finger-like projections on tergite IX (Figs 81, 107).

Key to females of *Heterothrips* species from Brazil

1. Abdominal tergites, at least laterally, with posteromarginal craspeda bearing a fringe of microtrichia (Figs 2, 17, 19) 2
-. Abdominal tergites without craspeda, but with a fringe of independent posteromarginal microtrichia (Fig. 1) 6
2. Abdominal tergal craspeda lobed and interrupted medially on II–VI, but with independent microtrichia medially (Figs 17, 19) 3
-. Abdominal tergal craspeda entire and continuous across II–VI (Figs 44–45) 5
3. Antennal segment III with pedicel elongate, about 2.5 times as long as wide (Fig. 15–16); abdominal sternites III–VII with 2 or 3 pairs of discal setae (Fig. 18) . . . . . *pedicellatus* **sp.n.**
-. Antennal segment III with pedicel less than 2.0 times longer than wide; abdominal sternites III–VII without discal setae 4
4. Fore wing uniformly brown or strongly shaded (Fig. 21); posteromarginal craspeda not lobed nor bearing short teeth (Figs 22–23); all femora extensively pale . . . . . *savanicus* **sp.n.**
-. Fore wing brown but with a sub-basal pale area (Fig. 29); posteromarginal craspeda with irregular lobes bearing short teeth (Figs 31–32); all femora largely brown. . . . . *obscurus* **sp.n.**
5. Median area of abdominal tergites with few lines of reticulation bearing sparse and fine microtrichia (Figs 44, 47); mid and hind tibiae mostly dark . . . . . *australis* **sp.n.**
-. Median area of abdominal tergites without reticulation or microtrichia (Fig. 45); mid and hind tibiae pale (Fig. 41) *marginatus*
6. Abdominal tergite VI posteromarginal fringe of microtrichia widely interrupted (Fig. 52). . . . . *flavitibia*
-. Abdominal tergite VI posteromarginal fringe continuous. 7
7. Body uniformly brown, abdomen sometimes paler in teneral specimens; antennal segment I brown; ocellar setae I absent or present 8
-. Body coloration different, largely yellow or sharply bicolored; antennal segment I pale or slightly shaded brown; ocellar setae I always absent 17
8. Antennal segment III basal stem divided into 5 or 6 parts (Fig. 53); head about as wide as long . . . . . *angusticeps*
-. Antennal segment III basal stem not so divided; head at least 1.3 times as wide as long 9
9. Fore wing largely pale, usually with a small dark area at extreme apex. 10
-. Fore wing largely dark or strongly shaded, usually with a sub-basal pale area 11
10. Antennal segments III–IV with two rows of sensorial pores (Fig. 57); metapleura with several rows of fine microtrichia . . . . . *peixotoa*
-. Antennal segments III–IV with a single row of sensorial pores (Figs 62–63); metapleura without rows of microtrichia. . . . . .

. . . . . *albipennis* **sp.n.**

11. Fore wing uniformly dark (Fig. 70); postocular setal pair III longer than posterior ocellus (Fig. 69); antennal segments III–IV pale (Fig. 72) . . . . . *spinosus*
-. Fore wing with a sub-basal pale area; postocular setal pair III not longer than posterior ocellus; antennal segments III–IV color different, IV slightly shaded 12
12. Abdominal sternites III–VII without discal setae (Fig. 79); ocellar setae I absent . . . . . *paulistarum* **sp.n.**
-. Abdominal sternites III–VII with about 3 pairs of discal setae; ocellar setae I present 13
13. Pronotum smooth, without conspicuous sculpture (Fig. 85); abdominal tergite IX about 1.5 times as long as X (Fig. 82) . . . . . *varitibia*
-. Pronotum clearly sculptured; abdominal tergites IX and X subequal in length 14
14. Antennal segment IV less than 1.5 times as long as wide; pronotum with reticulate sculpture (Fig. 87) *sanctaecatharinae* **sp.n.**
-. Antennal segment IV more than 1.8 times as long as wide; pronotum closely striate 15
15. Antennal segment III about 2.5 times as long as wide; antennal segment V yellow in basal third (Fig. 90) . . . . . *condei*
-. Antennal segment III more than 2.7 times as long as wide; antennal segment V uniformly brown 16
16. Antennal segment IV extensively brown (Fig. 94); mid and hind tibiae largely brown with base and apical third yellow or only apical third yellow (Fig. 93); abdominal sternites III–VI with discal setae arising in a continuous row across median area . . . . . *striatus*
-. Antennal segment III–IV pale with dark apex (Fig. 98); mid and hind tibiae extensively yellow, slightly shaded medially; abdominal sternites III–VI with discal setae present only on lateral thirds . . . . . *brasiliensis*
17. Fore wing not white basally; body mostly pale; antennal segment III less than 2.0 times as long as wide . . . . . *flavidus*
-. Fore wing clearly paler sub-basally; body bicolored; antennal segment III 2.5 or more times as long as wide. 18
18. Body sharply bicolored (Fig. 102), abdominal tergites III–VIII yellow; pronotum brown, without conspicuous reticulation (Fig. 105). . . . . *bicolor*
-. Body extensively yellow (Fig. 108); abdominal tergites III–VI yellow laterally with brown markings medially (Fig. 109); pronotum yellow, with cross-striate reticulation . . . . . *decoratus*

Heterothrips albipennis sp. n.

Female winged. Body brown; femora extensively brown (Fig. 66); fore tibia largely yellow with light brown markings, mid & hind tibia brown medially and yellow at base and apex; tarsi pale; antennal segment I–II and V–IX brown, II paler apically; III yellowish; IV shaded brown (Fig. 62); fore wing pale but weakly shaded brown apically (Fig. 64).

Head wider than long, with no long setae, ocellar region with only two pairs of setae (Fig. 59). Antennae 9-segmented, segment III composed of four parts, segment IV entire and shorter than III (Figs 62–63), both segments with one row of aligned sensoria at apex. Pronotum broadly reticulate, with no long setae and bearing about 25 discal setae (Fig. 60); mesonotum with transversely elongate reticles; metanotum with concentric lines of sculpture, not forming a triangle and covered with microtrichia (Fig. 61). Fore wing with two rows of conspicuous and hyaline setae.

Abdominal tergites I–VIII with independent fringe of microtrichia posteriorly; well developed laterally on I–V but bearing only few teeth medially; lateral thirds covered with irregular lines of sculpture bearing fine microtrichia (Fig. 65). Sternites without craspeda, with 8 pairs of posteromarginal setae; discal setae absent on I–VI.

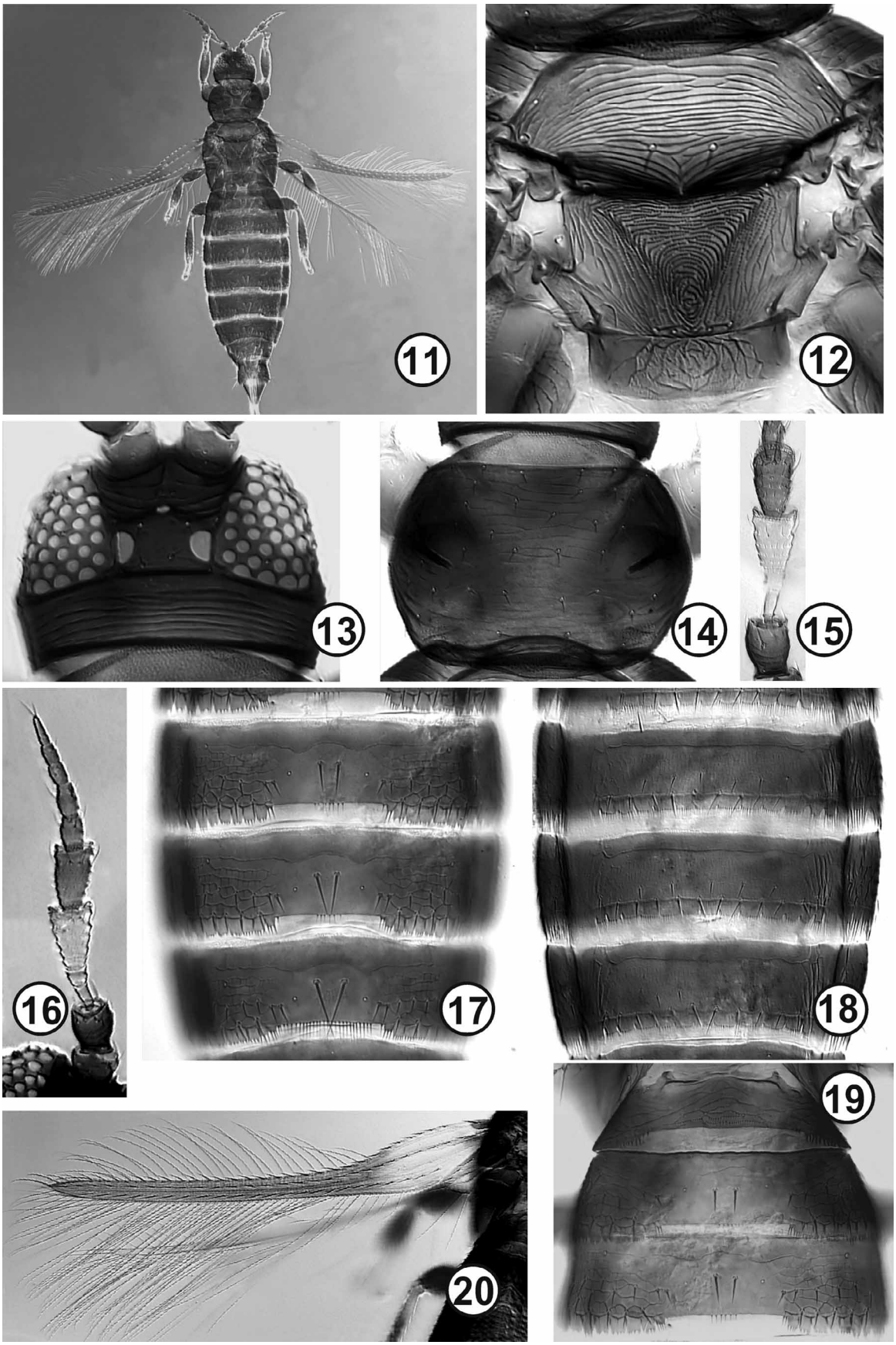
Measurements (holotype female in microns). Body length 1450 (distended). Head, length 102; width 167. Pronotum, length 140; width 232. Fore wing length 750; median width 47; Abdominal tergites IX and X length 85, 83. Antennal segments I–IX length (width), 13 (30), 35 (25), 67 (25), 40 (22), 35 (20), 35 (18), 22 (12), 12 (10), 12 (8).

Male winged. Similar to female in coloration but smaller; sternites VII–VIII each with a large transverse pore plate at antecostal ridge (Fig. 67); VI sometimes with a very small circular pore plate.

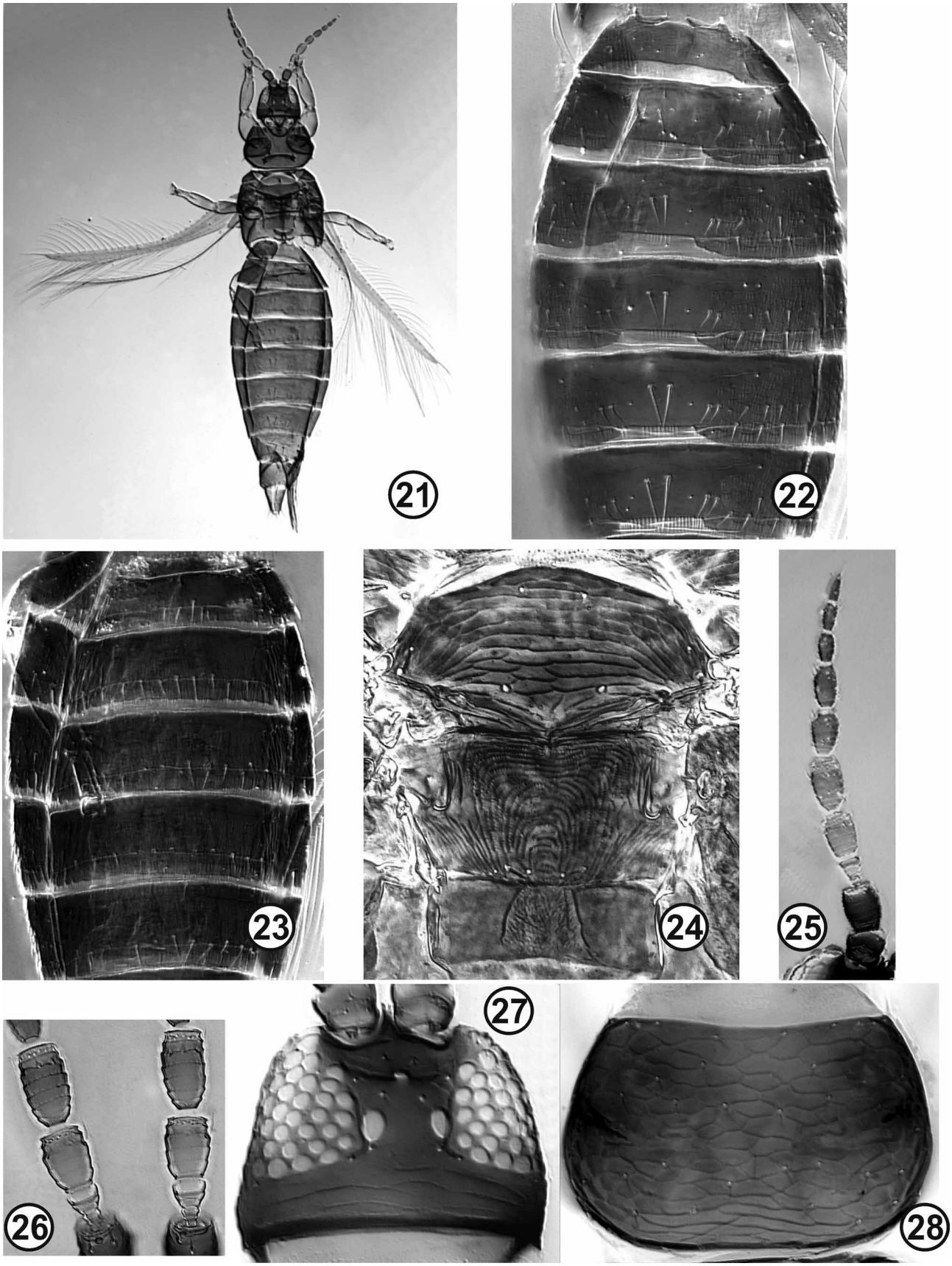
Measurements (paratype male in microns). Body length 1130 (distended). Head, length 100; width 150. Pronotum, length 137; width 215. Fore wing length 660; median width 45; Abdominal segments IX + X length 188; width 165.

Material examined. Holotype female, **Brazil, Rio Grande do Sul**, Viamão, (30º21’45”S, 51º01’55”W), 17.ix.2004, on *Croton gnaphalii* flowers (A. Cavalleri). Paratypes: 5 females, 11 males collected with holotype; 1 female with similar data but 20.vi.2003.

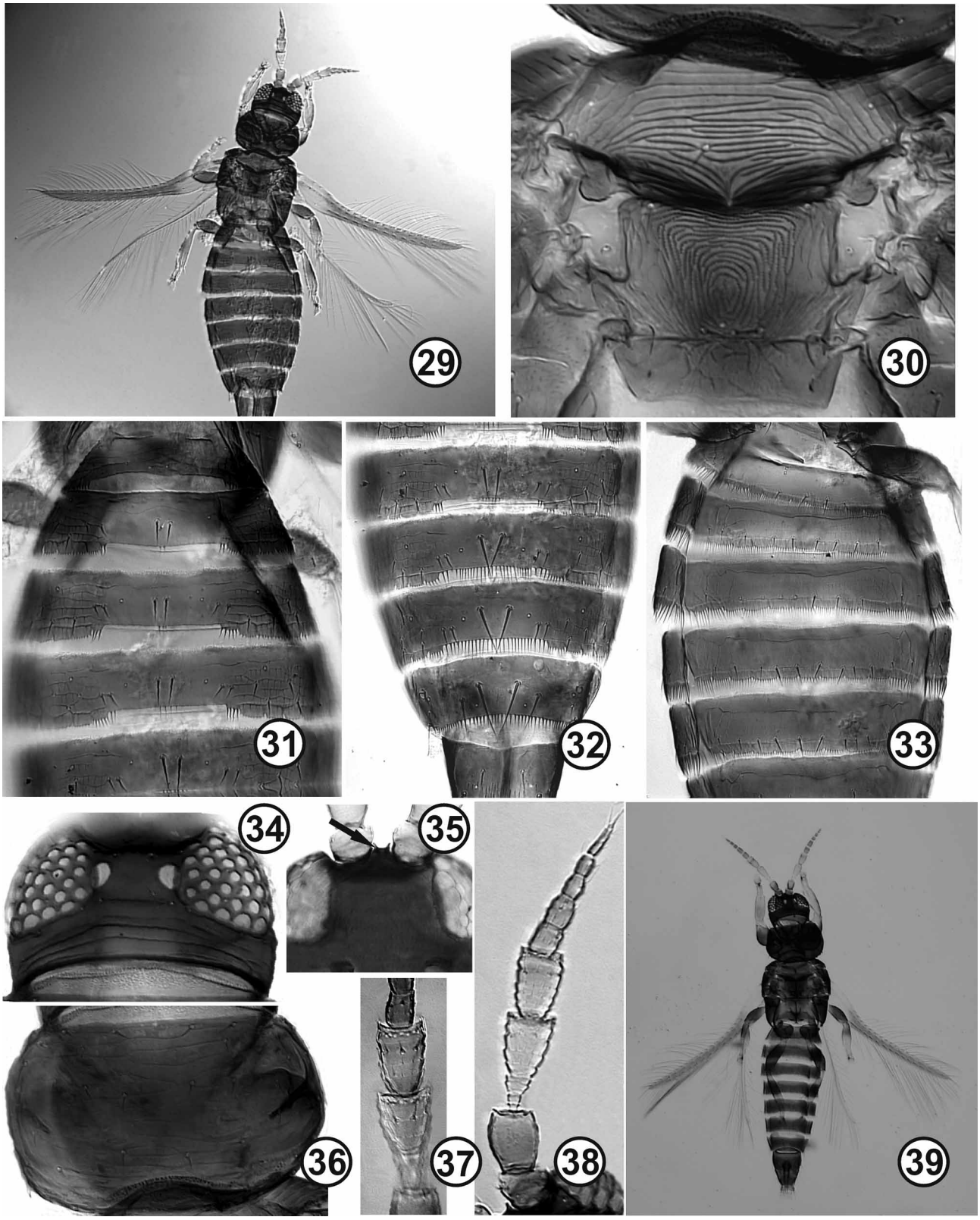
Comments. This species is closely related to *peixotoa* in having fore wings largely pale and lacking ocellar setae I on head. However, it can be distinguished easily by the single row of sensorial pores on antennal segments III–IV. Moreover, *albipennis* metapleura contrasts with *peixotoa* in lacking dense rows of microtrichia. This new species is commonly found in female flowers of *Croton gnaphalii* (Euphorbiaceae) during warm seasons.



FIGURES 11–20. Brazilian *Heterothrips*. *H. pedicellatus* **sp.n.** female **11–20: 11.** Dorsal view; **12.** Mesonotum and metanotum; **13.** Head; **14.** Pronotum; **15.** Antennal segments II–IV; **16. A**ntenna; **17.** Abdominal tergites IV–VI; **18.** Abdominal sternites IV–VI; **19.** Abdominal tergites I–III; **20.** Fore wing.



FIGURES 21–28. Brazilian *Heterothrips*. *H. savanicus* **sp.n.** female **21–28: 21.** Dorsal view; **22.** Abdominal tergites I–VI; **23.** Abdominal sternites II–VI; **24.** Mesonotum and metanotum; **25.** Antenna; **26.** Antennal segments III–IV; **27.** Head; **28.** Pronotum.



FIGURES 29–39. Brazilian *Heterothrips*. *H. obscurus* **sp.n** female **29–38: 29.** Dorsal view; **30.** Mesonotum and metanotum; **31.** Abdominal tergites I–V; **32.** Abdominal tergites V–VIII; **33.** Abdominal sternites II–VI; **34.** Head; **35.** Ventral view of the head (arrow indicates interantennal projection); **36.** Pronotum; **37.** Antennal segments III–IV; **38.** Antenna. *H. obscurus* **sp.n.** male: **39.** Dorsal view.

***Heterothrips angusticeps* Hood, 1954**

This species is remarkable in having the pale basal half of antennal segment III subdivided into several parts (Fig. 53). The sensoria on antennal segments III–IV consist of a single row of pores, and the fore wings are pale basally. The male is similar to the female in color, but abdominal sternites VII–VIII have transverse pore plates (Fig. 54). No information about the host plant is available, neither in the original description nor on the slide labels of the specimens studied.

Material examined. Holotype female, **Brazil**, **Santa Catarina**, Nova Teutônia, 17-18.xi.1949, (F. Plaumann) (USNM). Paratypes: 4 females, 1 male, collected with holotype (USNM).

***Heterothrips australis* sp. n.**

Female winged. Body brown, head darker (Fig. 40); femora largely brown; tibiae brown with pale apex; tarsi paler; antennal segment I–II and V–IX brown, III–IV pale brown (Fig. 42); fore wing brown but somewhat paler subbasally (Fig. 40).

Head wider than long, with no long setae (Fig. 49); ocellar region with three pairs of setae, pair III inside ocellar triangle, ocellar area broadly reticulated. Antennae 9-segmented, segment III slightly longer than IV, with two constrictions, one at the union between the short pedicel and the segment, the other near the base of the segment (Figs 42–43); III–IV each one with one single row of small sensorial pores. Pronotum broadly reticulate (Fig. 49) with about 30 long setae; mesonotum with transversely elongate reticles; metanotum with concentric lines of sculpture, not forming a triangle, covered with microtrichia (Fig. 46). Fore wing with two rows of minute brown setae.

Abdominal tergites II–VII with broad and continuous posterior craspedum, bearing a fringe of fine microtrichia. Abdominal tergites I–VIII with few lines of medial sculptures, bearing small microtrichia; lateral thirds of tergites I–VIII covered with fine microtrichia (Figs 44, 47). Sternites II–VI with a well developed posterior craspedum bearing microtrichia; with about six pairs of posteromarginal setae, and no discal setae (Fig. 48).

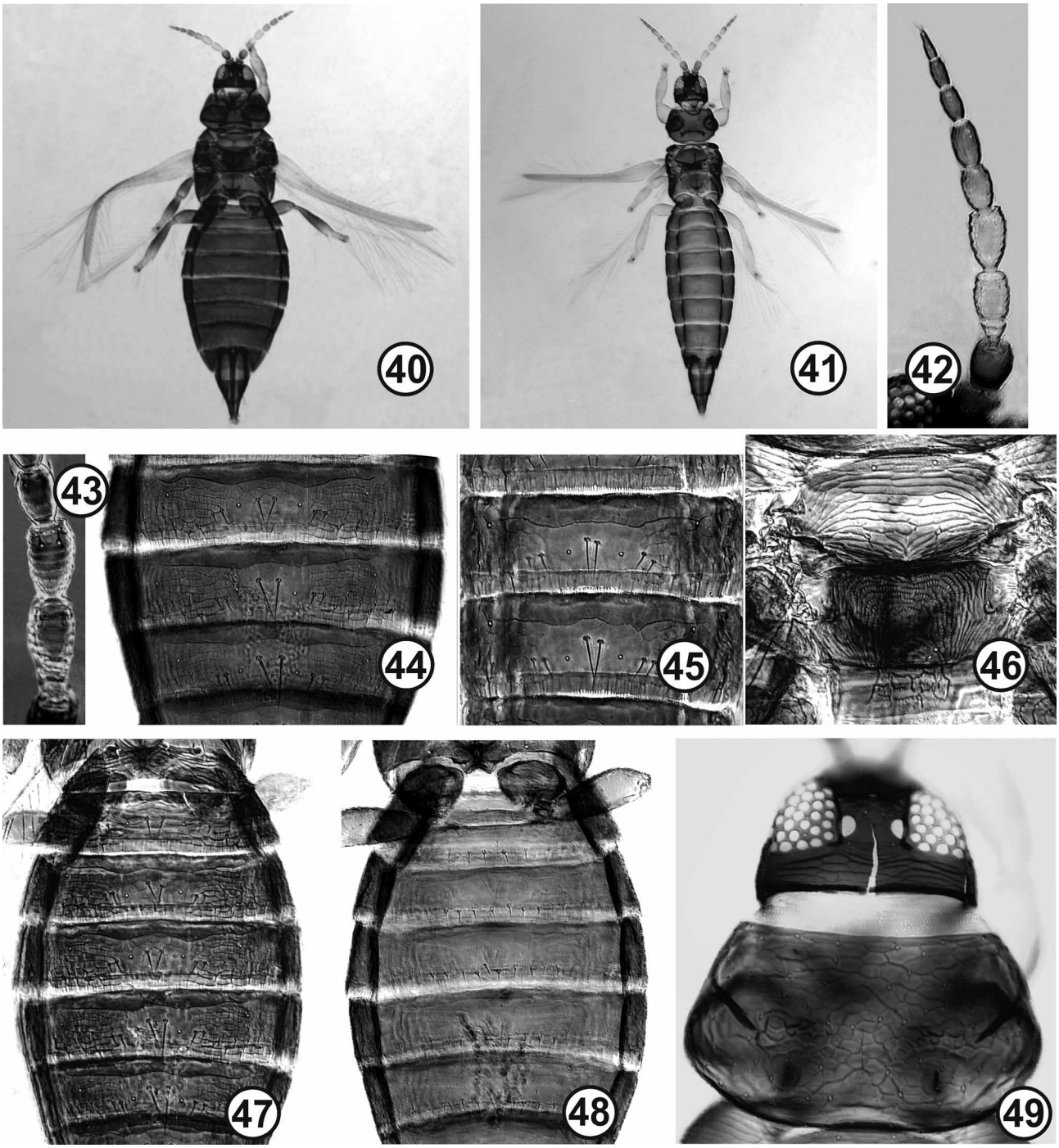
Measurements (holotype female in microns). Body length 1120 (distended). Head, length 92; width 125. Pronotum, length 115; width 177. Fore wing length 560; median width 32. Abdominal tergites IX and X length 77, 70. Antennal segments I–IX length (width), 23 (27), 33 (25), 45 (22), 35 (22), 28 (20), 27 (20), 17 (12), 17 (10), 17 (5).

Male winged. Smaller and paler than female; sternites III (or IV)–VIII each one with a small oval pore plate at antecostal ridge.

Measurements (paratype male in microns). Body length 840 (distended). Head, length 80; width 105. Pronotum, length 102; width 150. Fore wing length 450; median width 28. Abdominal segments IX + X length 118; width 80.

Material examined. Holotype female, **Brazil, Rio Grande do Sul**, Porto Alegre, (30º03’59”S, 51º07’15”W), 26.x.2011, on *Borreria vertillata* flowers (A. Cavalleri). Paratypes: 17 females, 1 male collected with holotype; 1 female with similar data but 14.ii.2011; **Rio Grande do Sul**, Viamão, 21.xi.1999 and 21.xi.2003, 10 females, 3 males on *Borreria vertillata* flowers (S.M. Pinent & A. Cavalleri); Viamão, 13.ii.2001, 4 females on *Eryngium nudicaule* flowers (A. Cavalleri); **Goiás**, Alto Paraíso de Goiás, 27.i.2011, 2 females on *Borreria* flowers (F.S. de Melo).

Comments. Larvae and adults are very abundant in *Borreria* inflorescences (Rubiaceae) and seem to co-exist with *Haplothrips* spp. This species is possibly related to *savanicus* which also breeds in flowers of herbaceous Rubiaceae. The shape of the antennal segments, as well the single row of minute sensorial pores on antennal segments III–IV, is quite similar between these species. However, differences can be observed in antennal coloration and the presence of continuous craspedal lobes on the posterior margin of the abdominal tergites, contrasting with the lateral entire craspeda of *savanicus*. The other Brazilian species with continuous craspedal lobes is marginatus, and differences between these two species include coloration and differences in the median area of the abdominal tergites: for *australis* it is reticulate with few microtrichia, whereas for *marginatus* there is no reticulation or microtrichia (Fig. 45).



FIGURES 40–49. Brazilian *Heterothrips*. *H. australis* **sp.n.** female **40, 42–44, 46–49: 40.** Dorsal view; **42.** Antenna; **43.** Antennal segments III–IV; **44.** Abdominal tergites IV–VI; **46.** Mesonotum and metanotum; **47.** Abdominal tergites I–VI; **48.** Abdominal sternites II–VI; **49.** Head and pronotum. *H. marginatus* female **41, 45**: **41.** Dorsal view; **45.** Abdominal tergites IV–V.

Heterothrips bicolor Hood, 1954

Heterothrips semiflavus De Santis, 1972: 431. **syn.n.**

This species has previously been known only from the holotype female from Southern Brazil, but has now been collected in large numbers in Rio Grande do Sul. It is remarkable in having the body sharply bicolored (Fig. 102), with all tibiae and abdominal segments III–VII yellow. Antennal segments I–II are yellow (Fig. 104), and the fore

wings are mostly pale, with a median brown area medially. The male is similar in coloration to the female (Fig. 103). Males have large transverse pore plates on sternites VII–VIII, and short dorsolateral processes on tergite IX (Fig. 107). No differences in reticulation pattern, wing color and abdominal microtrichia distribution could be found between this species and the single female from which *semiflavus* was described. This is a damaged specimen, without antennae, and the differences in leg and abdomen coloration are possibly because it is teneral, and thus paler than a mature adult.

Material examined. Holotype female, **Brazil**, **Santa Catarina**, Nova Teutônia, 26.xi.1949, (F. Plaumann) (USNM); **Rio Grande do Sul**, Porto Alegre (30º04'09"S, 51º07'12"W), 27.i.2011, 15 females, 1 male on *Trema micrantha* flowers (Ulmaceae) (A. Cavalleri); 1 female with similar data but on *Eugenia uniflora*; **São Paulo**, Mogi-Guaçu, 17.v.2010, 1 female on *Alchornea triplinervia* flowers. Holotype female of *H. semiflavus*, **Brazil**, **São Paulo**, Barueri, 21.v.1967, in nest of *Camponotus rufipes* (L. De Santis) (MLP).

Heterothrips brasiliensis Moulton, 1932

Known only from the type series, this species was described from specimens collected on *Beginia* sp. [sic], possibly a typographic mistake for *Begonia* sp. This dark brown thrips (Figs 97–100) is unusual in having a very long antennal segment III, about 3.5 times as long as wide (Fig. 98). Antennal segments III–IV are pale with the apex dark (Fig. 98), and the tibiae are extensively pale. Moreover, the discal setae on abdominal sternites III–VI are placed only laterally and males lack sternal pore plates.

Material examined. Holotype female, **Brazil**, **Espírito Santo**, Santa Theresa, 22.vii.1928, on *Beginia* sp. (O. Conde) (CAS). Paratypes: 5 females, 3 males collected with holotype on indeterminate vegetation (CAS and USNM).

Heterothrips condei Moulton, 1932

Described from an unknown host, this dark brown species (Fig. 89) has antennae with segment III pale with dark apex, IV dark or pale with dark apex and V yellow in basal third (Fig. 90). The pronotum and mesonotum have fine and closely spaced striate lines (Fig. 91) and the fore wing bears a sub-basal pale area. Females have sternal discal setae (Fig. 92), and males lack pore plates on abdominal sternites.

Material examined. Holotype female, **Brazil**, **Espírito Santo**, Santa Theresa, 09.xi.1923, on indeterminate vegetation (O. Conde) (CAS). Paratypes: 3 females, 2 males collected with holotype (CAS and USNM).

Heterothrips decoratus Hood, 1954

This species is characterized by the largely pale body (Fig. 108), including legs, with a dark median area on abdominal tergites III–VI (Fig. 109). Males have antennal segments I–IV yellow and transverse pore plates on abdominal sternites VII–VIII.

Material examined. Holotype female, **Brazil**, **Santa Catarina**, Nova Teutônia, 04.ii.1949, on *Luehea* sp. and dry undetermined branches (F. Plaumann) (USNM). Paratypes: 2 females, 1 male, collected with holotype (USNM).

Heterothrips flavidus Hood, 1954

Known only from two females, this species is unusual in having the body extensively pale but the fore wings uniformly brown. The antenna is relatively short (Fig. 101), and the pronotum is moderately closely striate with pale lines.

Material examined. Holotype female, **Brazil**, **Santa Catarina,** Nova Teutônia, 26.vi.1949, on unidentified vegetation (F. Plaumann) (USNM). Paratype female collected with holotype (USNM).

***Heterothrips flavitibia* Moulton, 1932**

This dark brown species (Fig. 50) is characterized by having antennal segments I–V largely pale (Fig. 51), and abdominal tergite VI with marginal fringe widely interrupted (Fig. 52). The pronotum has weakly defined reticulation, and the fore femur is well-developed. De Santis (1963) recorded this species from Argentina, but a re-examination of the Argentinean specimens by De Borbón (2010) suggested that these possibly represent an undescribed species.

Material examined. Paratype female, **Brazil**, **Espírito Santo**, Santa Theresa, 22.vii.1928, on *Serjania* or *Paullinia* sp. (O. Conde) (CAS); **Minas Gerais**, 1 female, 06.iv.1933 (Hambleton) (CAS).

***Heterothrips marginatus* Hood, 1954**

This species is remarkable in having a well-developed craspedum on abdominal tergites II–VIII. The posterior margins of the craspedum have a row of small microtrichia (Fig. 45). The fore wing are uniformly dark (Fig. 41), and abdominal sternites lack of discal setae. Males have small transverse pore plates on abdominal sternites III–VIII. This species is also recorded from La Pampa, Argentina by De Santis (1959).

Material examined. Holotype female, **Brazil**, **Pará,** Belém, 24.vii.1951, on *Andropogon* sp. (J.D. Hood) (USNM). Paratypes: 2 females, 1 male, collected with holotype (USNM).

***Heterothrips obscurus* sp. n.**

Female winged. Body brown (Fig. 29); femora brown; fore tibia largely pale, slightly washed with brown basally, mid and hind tibia brown at base but pale apically; tarsi pale; antennal segment I–II and V–IX brown, III pale, IV brown at apical third (Fig. 38); fore wing brown with a large pale band near the base (Fig. 29).

Head wider than long, with no long setae (Fig. 34); ocellar region with three pairs of setae, pair III at anterior margin of ocellar triangle; interantennal projection with widely separated arms (Fig. 35). Antennae 9-segmented, segment III apparently divided into three parts, IV entire and shorter than segment III (Figs 37–38). Both segments with one unaligned row of conspicuous sensorial pores dorsally; segment IX unusually long and narrow basally (Figs 38). Pronotum reticulate-striate with no long setae (Fig. 36); mesonotum reticulate-striate, with sculpture lines not closely spaced medially; metanotum with sculpture forming concentric lines medially, covered with microtrichia and almost forming a triangle (Fig. 30). Fore wing with two rows of conspicuous brown setae. Abdominal tergites I–VII with fine and sparse microtrichia laterally, posterolateral margins with irregular craspedal lobes each bearing short and pointed teeth; II–V with few marginal microtrichia medially (Fig. 31); VI–VII with complete fringe of microtrichia medially; VIII with complete posteromarginal comb (Fig. 32). Sternites with 6 pairs of posteromarginal setae, I–VII without discal setae (Fig. 33).

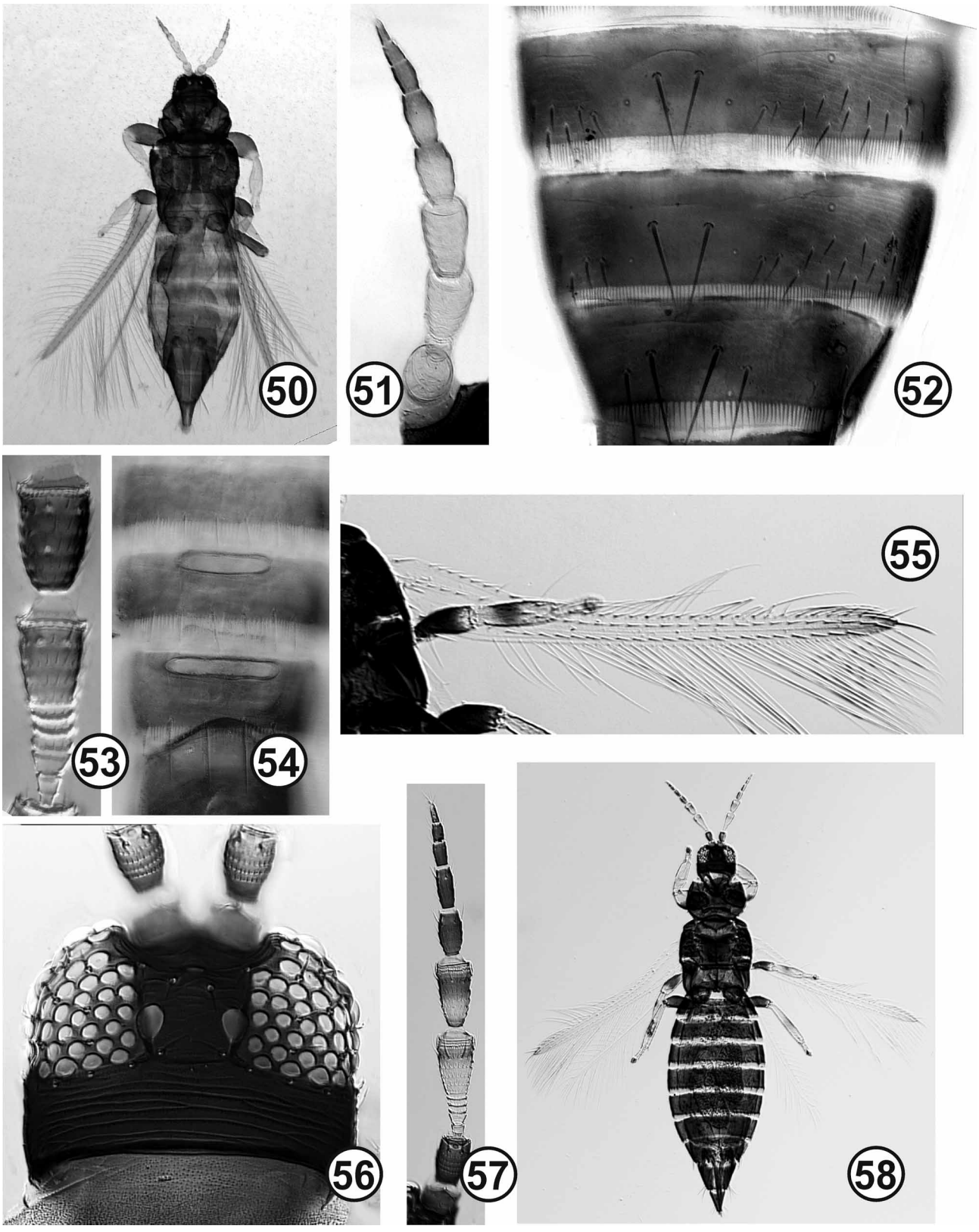
Measurements (holotype female in microns). Body length 1110 (distended). Head, length 71; width 131. Pronotum, length 204; width 169. Fore wing length 570; median width 32. Abdominal tergites IX and X length 77, 72. Antennal segments I–IX length (width), 20 (30), 35 (25), 68 (27), 45 (25), 23 (15), 23 (12), 15 (10), 15 (7), 23 (5).

Male winged. Smaller but similar in coloration (Fig. 39); abdominal segments II–VI with craspedum interrupted medially, with long and fine teeth; lateral thirds of I–VIII covered with numerous and irregular rows of microtrichia; intermediate abdominal sternites without discal setae, III–VIII with large transverse pore plates.

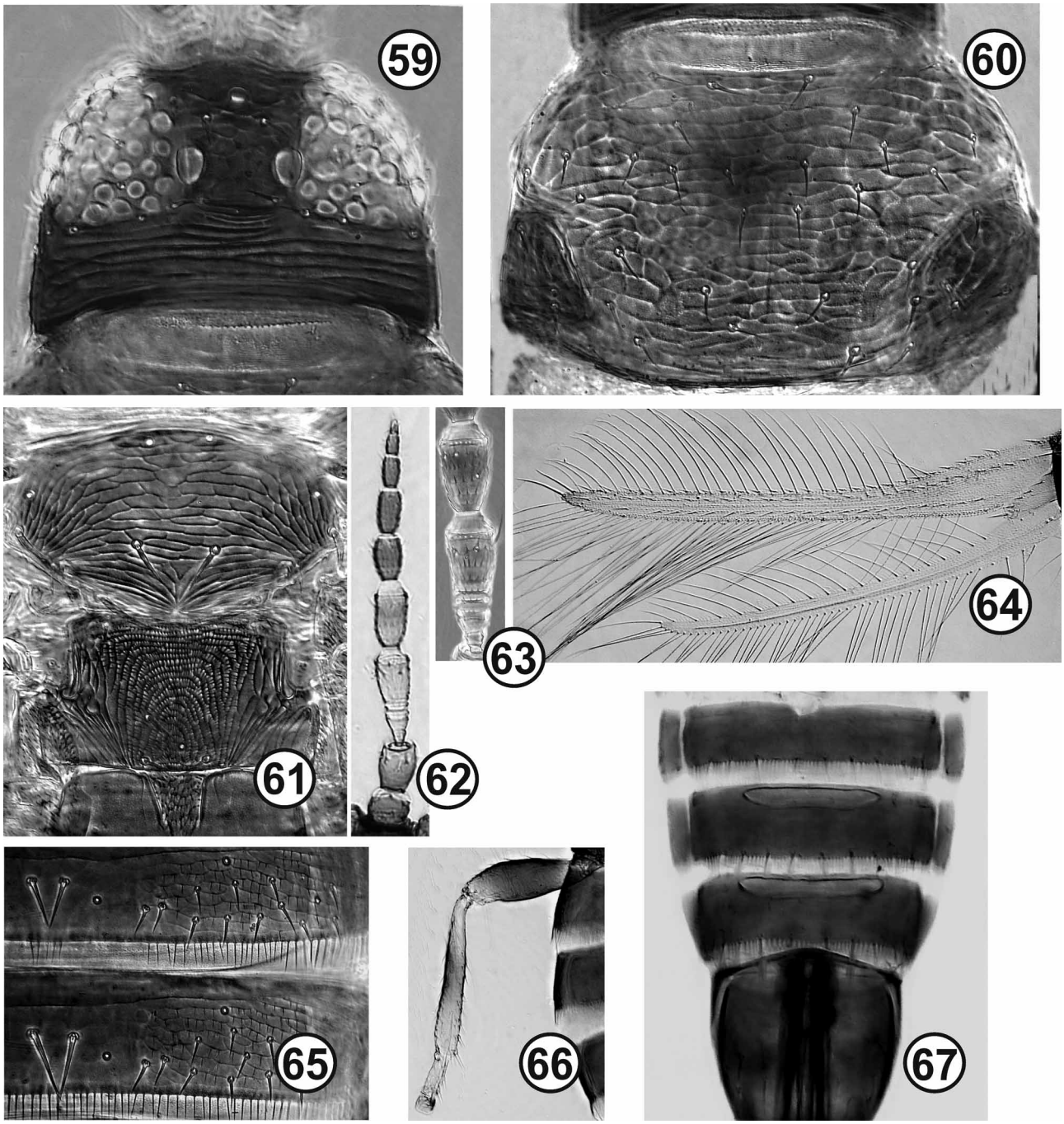
Measurements (paratype male in microns). Body length 900 (distended). Head, length 88; width 127. Pronotum, length 120; width 180. Fore wing length 510; median width 28; Abdominal segments IX + X length 117; width 90.

Material examined. Holotype female, **Brazil, São Paulo**, Campinas, Sincontron, (22º48’10”S, 47º03’14”W), 18.iii.2010, on *Byrsonima intermedia* flowers (Malpighiaceae) (A. Cavalleri). Paratypes: 1 female, 1 male, collected with holotype.

Comments. Despite the short pedicel on antennal segment III and the absence of discal setae on the abdominal sternites, this species is very similar to *pedicellatus*. The unusual shape of the interantennal projection and the medially interrupted craspedum on abdominal tergites reinforces the relationship between these two taxa.



FIGURES 50–58. Brazilian *Heterothrips*. *H. flavitibia* female **50–52: 50.** Dorsal view*;* **51.** Antenna; **52.** Abdominal tergites VI–VIII. *H. angusticipeps* **53–54: 53.** Female antennal segment III–IV; **54.** Male abdominal sternites VII–VIII pore plates. *H. peixotoa* female **55–58: 55.** Fore wing*;* **56.** Head; **57.** Antenna; **58.** Dorsal view.



FIGURES 59–67. Brazilian *Heterothrips*. *H. albipennis* **sp.n.** female **59–66: 59.** Head; **60.** Pronotum; **61.** Mesonotum and metanotum; **62.** Antenna; **63.** Antennal segment III–IV; **64.** Fore wing; **65.** Abdominal tergites V–VI; **66.** Hind leg. *H. albipennis* **sp.n.** male: **67.** Abdominal sternites VI–VIII.

Heterothrips paulistarum sp. n.

Female winged. Body brown (Fig. 73); femur brown; tibia pale with a brown band in the middle; tarsi pale; antennal segments I and IV–IX brown, II pale, III pale with brown apex (Figs 75–76); fore wing brown with pale band near the base including half of clavus.

Head wider than long, with no long setae (Fig. 77); ocellar region with three pairs of setae, pair III inside the ocellar triangle. Antennae 9-segmented, segment III long with two constrictions, one at union between the pedicel and segment, the other near the base of the segment, IV entire and shorter than III (Figs 75–76), both segments with

two rows of circumpolar sensorial pores at apex. Pronotum reticulate-striate with no long setae (Fig. 78); mesonotum striate; metanotum covered with microtrichia and with concentric lines of sculpture, almost forming a triangle (Fig. 80); metapleura covered with several rows of minute microtrichia. Fore wing with two rows of conspicuous brown setae.

Abdominal tergites I–VIII with microtrichia laterally; I–V with lateral posteromarginal microtrichia; II–V with few median teeth. Tergites VI–VIII with continuous fringe of microtrichia (Fig. 1). Sternites II–VII with continuous row of marginal microtrichia; and about 7 pairs of posteromarginal setae; no discal setae on abdominal sternites (Fig. 79).

Measurements (holotype female in microns). Body length 1500 (distended). Head, length 122; width 162. Pronotum, length 170; width 242. Fore wing length 840; median width 38. Abdominal tergites IX and X length 98 and 105, respectively. Antennal segments I–IX length (width), 17 (32), 35 (27), 90 (30), 52 (27), 37 (17), 32 (15), 17 (10), 12 (7), 17 (5).

Male winged. Smaller than female; body sharply bicolored, abdominal segments III–VII clear yellow (Fig. 74). Tergite IX with a pair of stout dorsolateral finger-like projections (Fig. 81). Sternites VII–VIII with large transverse pore plates.

Measurements (paratype male in microns). Body length 1130 (distended). Head, length 120; width 140. Pronotum, length 152; width 210. Fore wing length 690; median width 37. Abdominal segments IX + X length (including anterior margin of sternite IX) 220; width 150.

Material examined. Holotype female, **Brazil, São Paulo**, Mogi-Guaçu, 30.ix.2011, on *Diplopterys pubipetala* flowers (A. Cavalleri). Paratypes: 1 female, 4 males collected with holotype; **São Paulo**, Campinas, iii.2010, 16 females, 4 males on *Niedenzuella glabra* flowers (A. Cavalleri).

Comments. Collected from two different members of the Malpighiaceae, this species shows variation in antennal segment II coloration, ranging from pale to light brown. As in *peixotoa*, this species lacks ocellar setae I on the head and antennal segments III–IV bear two rows of well-developed sensorial pores. Both species also have an independent fringe of microtrichia on the posterior margin of the abdominal tergites, and the metapleura are covered with fine and delicate microtrichia. However, *paulistarum* has the fore wings extensively brown, with a distinct sub-basal pale area. Males are similar to *bicolor* in coloration and structure, but the paired dorsal processes on abdominal tergite IX are more developed, as in the North American species *analis* and *vitis*. These finger-like projections are presumably associated with copulatory behavior.

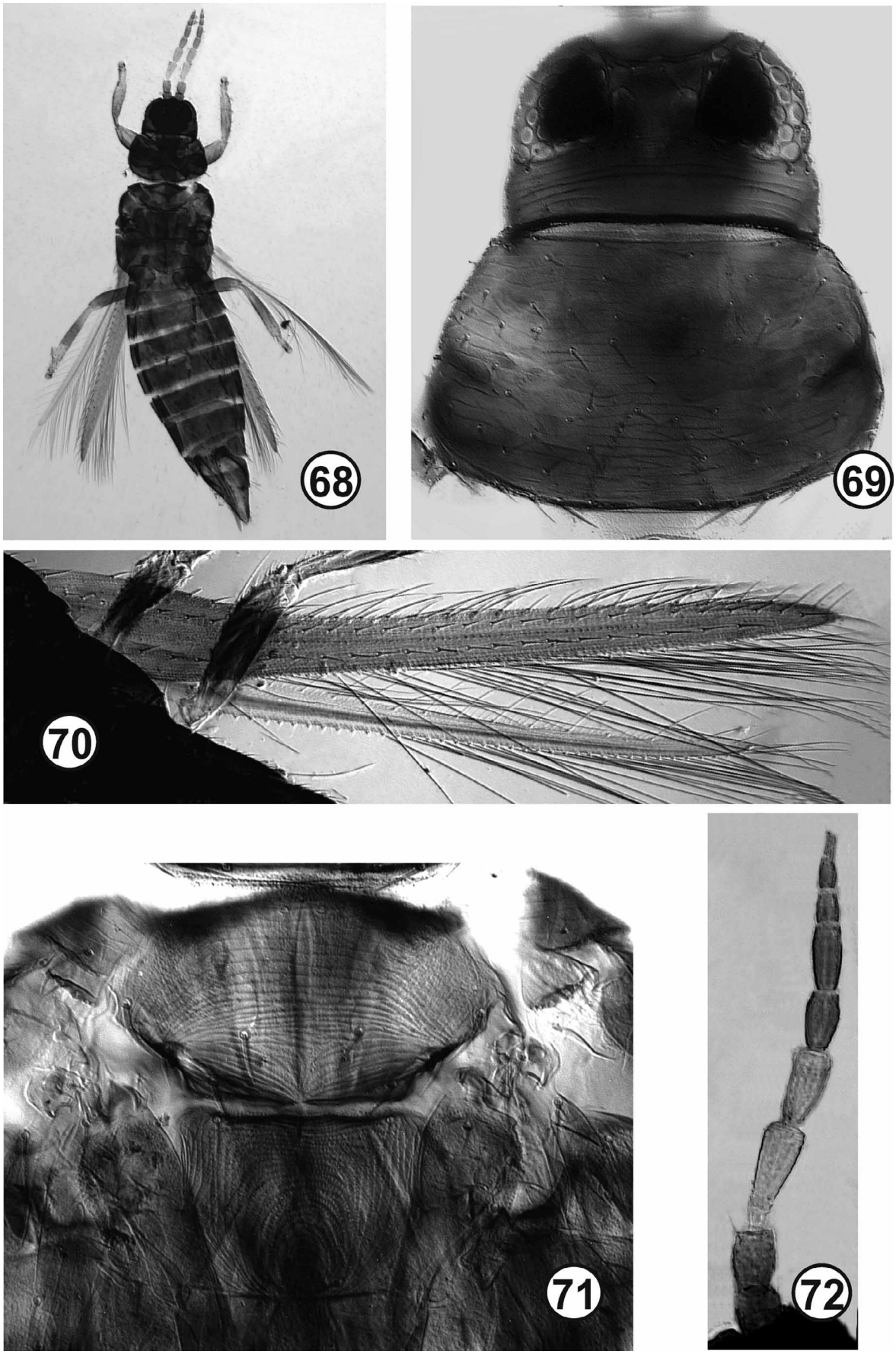
Heterothrips pedicellatus sp. n.

Female winged. Body brown (Fig. 11); femora brown; tibiae brown with pale apex; tarsi pale; antennal segments I–II and IV–IX brown, III pale (Fig. 16); fore wing brown with a pale band near the base (Fig. 20).

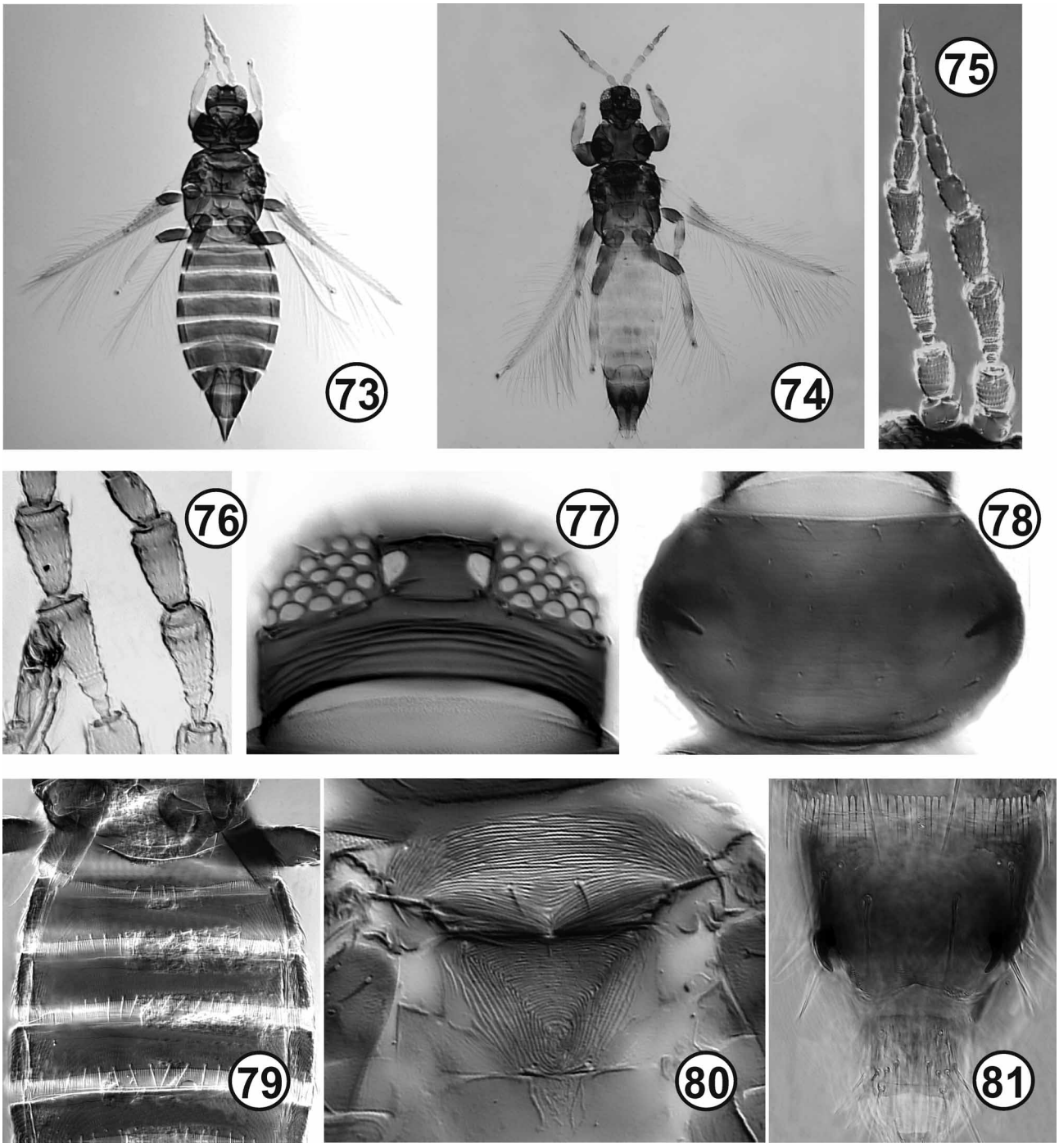
Head wider than long, with no long setae; ocellar region with three pairs of setae, pair III arising on anterior margin of ocellar triangle (Fig. 13); interantennal projection with widely separated arms. Antennae 9-segmented, segment III long with an elongate pedicel and two constrictions, one at the union between the pedicel and segment, the other near the base of segment; segment IV entire and shorter than III (Figs 15–16), both with two rows of sensorial pores. Pronotum reticulate-striate with no long setae (Fig. 14); mesonotum reticulate-striate; metanotum with concentric sculpture around basal midpoint, covered with microtrichia (Fig. 12). Fore wing with two rows of conspicuous brown setae (Fig. 20).

Abdominal tergites I–VII with sparse microtrichia on lateral thirds and posterior margin with craspedal lobes laterally, each rectangular lobe bearing a fringe of fine, irregular microtrichia (Figs 17, 19). Tergites II–V posterior margin with few microtrichia medially, VI–VII with a complete feinge of microtrichial medially, with no gap between this and the lobes. Tergite VIII with continuous posteromarginal microtrichia. Sternites II–VI posterior margins with well-developed craspedal lobes bearing microtrichia (Fig. 18) and with 7 pairs of posteromarginal setae; few discal setae present.

Measurements (holotype female in microns). Body length 1430 (distended). Head, length 120; width 165. Pronotum, length 137; width 210. Fore wing length 730; median width 43. Abdominal tergites IX and X length 72 and 82, respectively. Antennal segments III–IX length (width), 83 (30), 47 (27), 22 (17), 27 (15), 15 (12), 15 (10), 21 (8).



FIGURES 68–72. Brazilian *Heterothrips*. *H. spinosus* female **68–72: 68.** Dorsal view; **69.** Head and pronotum; **70.** Fore wing; **71.** Mesonotum and metanotum; **72.** Antenna.



FIGURES 73–81. Brazilian *Heterothrips*. *H. paulistarum* **sp.n.** female **73, 75–80: 73.** Dorsal view; **75.** Antenna; **76.** Antennal segments III–IV; **77.** Head; **78.** Pronotum; **79.** Abdominal sternites II–VI; **80.** Mesonotum and metanotum. *H. paulistarum* **sp.n.** male **74, 81**: **74.** Dorsal view; **81.** Abdominal tergites IX–X.

Male winged. Similar to female in coloration but smaller; abdominal tergites II–VI with craspedum interrupted medially, with long and fine teeth; lateral thirds of tergites I–VIII covered with numerous irregular rows of microtrichia. Intermediate abdominal sternites without discal setae, sternites III–VIII with large transverse pore plates.

Measurements (paratype male in microns). Body length 1030 (distended). Head, length 100; width 155. Pronotum, length 137; width 220. Fore wing length 600; median width 37; Abdominal segments IX + X length 107; width 132.

Material examined. Holotype female, **Brazil, São Paulo**, Mogi-Guaçu, 30.ix.2011, on *Diplopterys pubipetala* flowers (A. Cavalleri). Paratypes: 11 females, 3 males collected with holotype; **Bahia**, Ibicoara, iv.2002, 1 female on "native plants" (O. Feiler); **São Paulo**, Campinas, 26.III.2010, 3 females on *Niedenzuella glabra* flowers (A. Cavalleri).

Comments. This new species has been collected with *paulistarum* from two species of Malpighiaceae. The elongated pedicel on antennal segment III is similar to that found in *prosopidis*, but the segment is much wider at the apex than the base, unlike in *prosopidis*. The abdominal tergites have similar lateral craspedal lobes, but the microtrichia are smaller in *pedicellatus* than in *prosopidis*. The general coloration is similar in these two species, as well as the form of the terminal abdominal segment. The metanotal sculpture of *pedicellatus* is similar to that found in *flavicornis* with a central triangular area, although they feature different reticulation patterns. Like the other Brazilian species *obscurus*, *pedicellatus* presents lateral craspedal lobes on the posterior margins of the abdominal tergites, although these two species differ in the antennal coloration and the length of antennal segment III pedicel (which is remarkably longer in *pedicellatus*). Moreover, the microtrichia on abdominal craspedum are slightly smaller in *pedicellatus* than in *obscurus*.

Heterothrips peixotoa Del-Claro, Marullo & Mound, 1997

This species is unusual in having largely pale fore wings (Fig. 58), with a small but distinctive brown area at the extreme apex (Fig. 55). The head lacks ocellar setae pair I (Fig. 56) and the abdominal tergites are covered with fine microtrichia laterally and bear a fringe of independent long microtrichia posteriorly. The males have large transverse pore plates on abdominal sternites VII–VIII. This species is found commonly on several Malpighiaceae species, and is widespread in the Brazilian savannah.

Material examined. Paratype female, **Brazil**, **Minas Gerais**, Uberlândia, 14.vii.1995, on *Peixotoa tomentosa* flowers (K. Del-Claro); **Bahia**, Ibicoara, iv.2002, 8 females, 11 males on "native plants" (O. Feiler); **São Paulo**, Mogi-Guaçu, 25.ix.2007, 1 female, 1 male on *Peixotoa* flowers (A. Cavalleri); 2 females with similar data but 14.v.2010; Mogi-Guaçu, 1.vi.2010, 1 female on *Banisteriopsis* flowers; same locality, 22.ix.2007, 1 female on *Cochlospermum regium* flowers; same locality, 30.ix.2011, 5 females on *Diplopterys pubipetala* flower.

Heterothrips sanctaecatharinae sp. n.

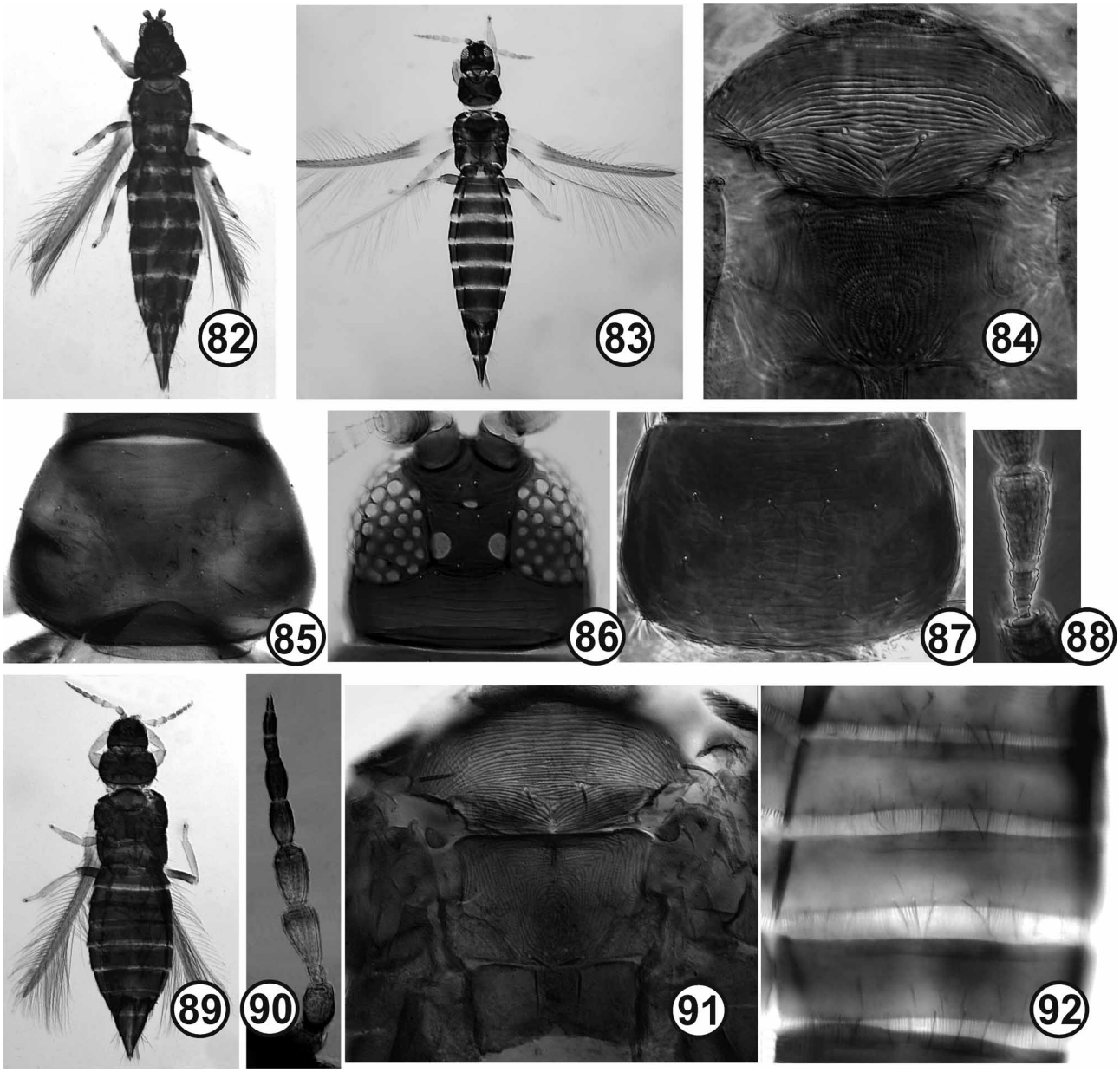
Female winged. Body brown (Fig. 83); fore and mid femora largely brown, washed with yellow at tips; hind femur uniformly brown; tibiae yellow but with a small shaded area medially on mid and hind tibiae; tarsi pale; antennal segment I–II and VI–IX uniformly brown, III pale, IV uniformly shaded brown, V brown at apical fourth. Fore wings largely brown but pale sub-basally (Fig. 83).

Head wider than long, with no long setae; ocellar region with three pairs of setae, pair III close to anterior margin of ocellar triangle (Fig. 86). Antennae 9-segmented, segment III subdivided into three parts (Fig. 88); IV entire and unusually short, about 1.4 times as long as wide, both segments with one row of small sensorial pores. Pronotum with few and widely separated lines of sculpture, with about 20 discal setae (Fig. 87); mesonotum reticulate-striate; metanotum with concentric sculpture lines medially, covered with microtrichia and not forming a triangle (Fig. 84). Fore wing with two rows of conspicuous brown setae.

Abdominal tergites I–VIII with several lateral rows of microtrichia, without craspeda but bearing an independent fringe of fine small posteromarginal microtrichia, interrupted medially on II–V. Sternites II–VI posterior margins with well developed and entire craspeda bearing microtrichia; 5 pairs of posteromarginal setae and discal setae present.

Measurements (holotype female in microns). Body length 1170 (distended). Head, length 107; width 135. Pronotum, length 112; width 167. Fore wing length 670; median width 37. Abdominal tergites IX and X length 68 and 80, respectively. Antennal segments III–IX length (width), 55 (23), 35 (25), 27 (20), 30 (18), 15 (12), 16 (10), 15 (10).

Male winged. Smaller than female; body brown, mid and hind tibiae more extensively brown. Intermediate abdominal sternites without discal setae, pore plates absent.



FIGURES 82–92. Brazilian *Heterothrips*. *H. varitibia* female **82, 85: 82.** Dorsal view; **85.** Pronotum. *H. sanctaecatharinae* **sp.n.** female **83–84, 86–88: 83.** Dorsal view; **84.** Mesonotum and metanotum; **86.** Head; **87.** Pronotum; **88.** Antennal segment III. *H. condei* female **89–92: 89.** Dorsal view; **90.** Antenna; **91.** Mesonotum and metanotum; **92.** Abdominal sternites IV–VI setae.

Measurements (paratype male in microns). Body length 920 (distended). Head, length 83; width 130. Pronotum, length 107; width 165. Fore wing length 600; median width 37; Abdominal segments IX + X (including anterior margin of sternite IX) length 110; width 163.

Material examined. Holotype female, **Brazil**, **Rio Grande do Sul**, Porto Alegre (30º04’09”S, 51º07’12”W), 26.x.2011, on *Solanum sanctaecatharinae* flowers (A. Cavalleri). Paratypes: 3 females, 5 males collected with holotype; 1 female, 2 males with similar data but 20.x.2011; 4 females, 2 males with similar data but 19.x.2011.

Comments. This new species is similar to *striatus* and *brasiliensis* in having bicolored fore wings, discal setae on abdominal sternites, and no sternal pore plates in males. However, *sanctaecatharinae* has an unusually short antennal segment IV and pronotum bears reticulate sculpture, rather than striate. The mesonotum is also not so closely striate, and the metanotal sculpture does not form a triangle. The adults are common inside flowers of *S. sanctaecatharinae*, beneath the large yellow stamens.

Heterothrips savanicus sp. n.

Female winged. Body brown (Fig. 21); fore legs pale brown washed with dark brown at base of femur and tibia, mid and hind femora and tibiae brown with pale apex; tarsi pale; antennal segment I–II and V–IX brown, III pale brown, IV pale brown at base, brown at apex; fore wing uniformly brown.

Head wider than long, with no long setae; ocellar region with three pairs of setae, pair III on anterior margin of ocellar triangle (Fig. 27). Antennae 9-segmented, segment III apparently divided into three parts, IV entire and shorter than III, both segments with one row of small sensorial pores (Figs 25–26). Pronotum broadly reticulate with no long setae (Fig. 28); mesonotum reticulate-striate; metanotum with concentric lines of sculpture, covered with microtrichia and not forming a triangle (Fig. 24). Fore wing with two rows of minute brown setae.

Abdominal tergites I–VIII laterally with several rows of microtrichia and with an entire craspedum bearing a fringe of small microtrichia on posterolateral margin; craspeda absent medially but with a fringe of microtrichia posteromedially (Fig. 22). Sternites II–VI posterior margins with well-developed entire craspedum bearing microtrichia, with about 6 pairs of posteromarginal setae and no discal setae present (Fig. 23).

Measurements (holotype female in microns). Body length 1140 (distended). Head, length 80; width 137. Pronotum, length 125; width 215. Fore wing length 720; median width 32. Abdominal tergites IX and X length 72 and 62, respectively. Antennal segments III–IX length (width), 55 (22), 40 (22), 32 (18), 32 (15), 20 (12), 20 (10), 20 (8).

Material examined. Holotype female, **Brazil**, **São Paulo**, Itirapina (22º16’11”S, 47º49’37”W), 14.iii.2010, on *Psyllocarpus*? *phyllocephalus* flowers (A. Cavalleri). Paratypes: 14 females collected with holotype.

Comments. This new species has undivided tergal craspeda while most of the described Brazilian species have a comb of microtrichia or craspedal lobes on the posterolateral margins of the tergites. Abdominal tergite VIII has a lateral craspeda and microtrichia posteromedially, rather than the usual independent regular row of microtrichia. Apparently related to *australis*, this species was found living in the small flowers of an herbaceous Rubiaceae together with *Haplothrips gowdeyi*.

Heterothrips spinosus Moulton, 1932

This dark brown thrips (Fig. 68) is remarkable in having largely dark fore wings, without the usual sub-basal pale area (Fig. 70). Moreover, postocular setae pair III is longer than in any other Brazilian species, and pronotum and mesonotum have reticulate-striate sculpture (Figs 69, 71). The female sternites bear discal setae, and males lack sternal pore plates.

Material examined. Paratypes: 6 females, 3 males, **Brazil**, **Rio de Janeiro**, Colônia Rio Bonito, 27.vi.1928, on *Solanum* sp. (O. Conde) (CAS and USNM).

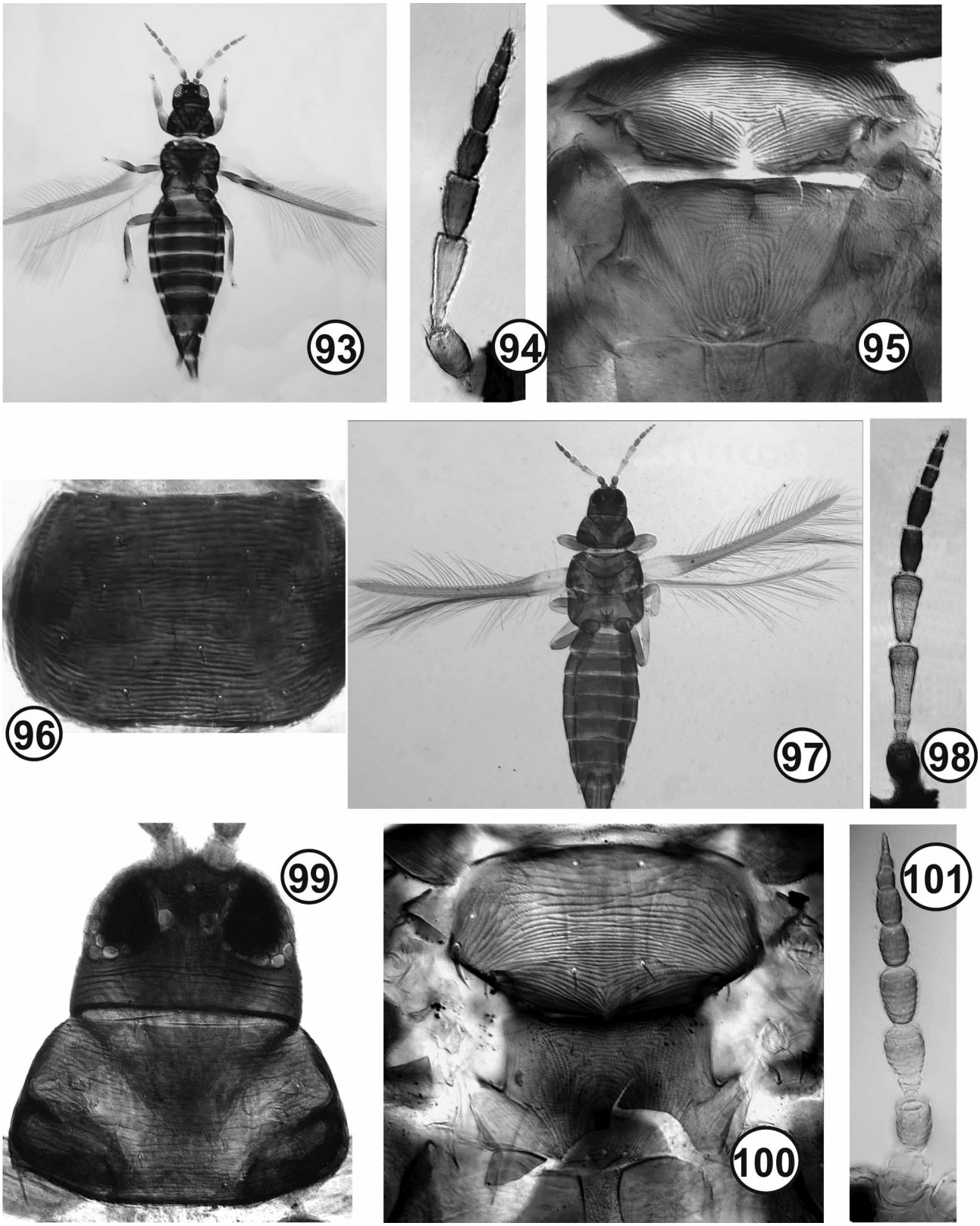
Heterothrips striatus Moulton, 1932

This dark brown species (Fig. 93) has the antennae and mid & hind tibiae extensively dark, and the mesonotum closely striate (Fig. 95). It is similar to *brasiliensis* in having antennal segment III relatively long (Fig. 94) and sternal discal setae on abdomen. The males lack sternal pore plates and are similar to females in coloration.

Material examined. Paratypes: 3 females, 5 males, **Brazil**, **Espírito Santo**, Santa Theresa, 9.xi.1928 (O. Conde) (CAS and USNM); **Rio Grande do Sul**, 30.x.2011, 30 females, 15 males on *Blepharocalyx salicifolius* (Myrtaceae) (A. Cavalleri); 7 females with similar data but on *Stachytarpheta cayennensis* flowers (Verbenaceae).

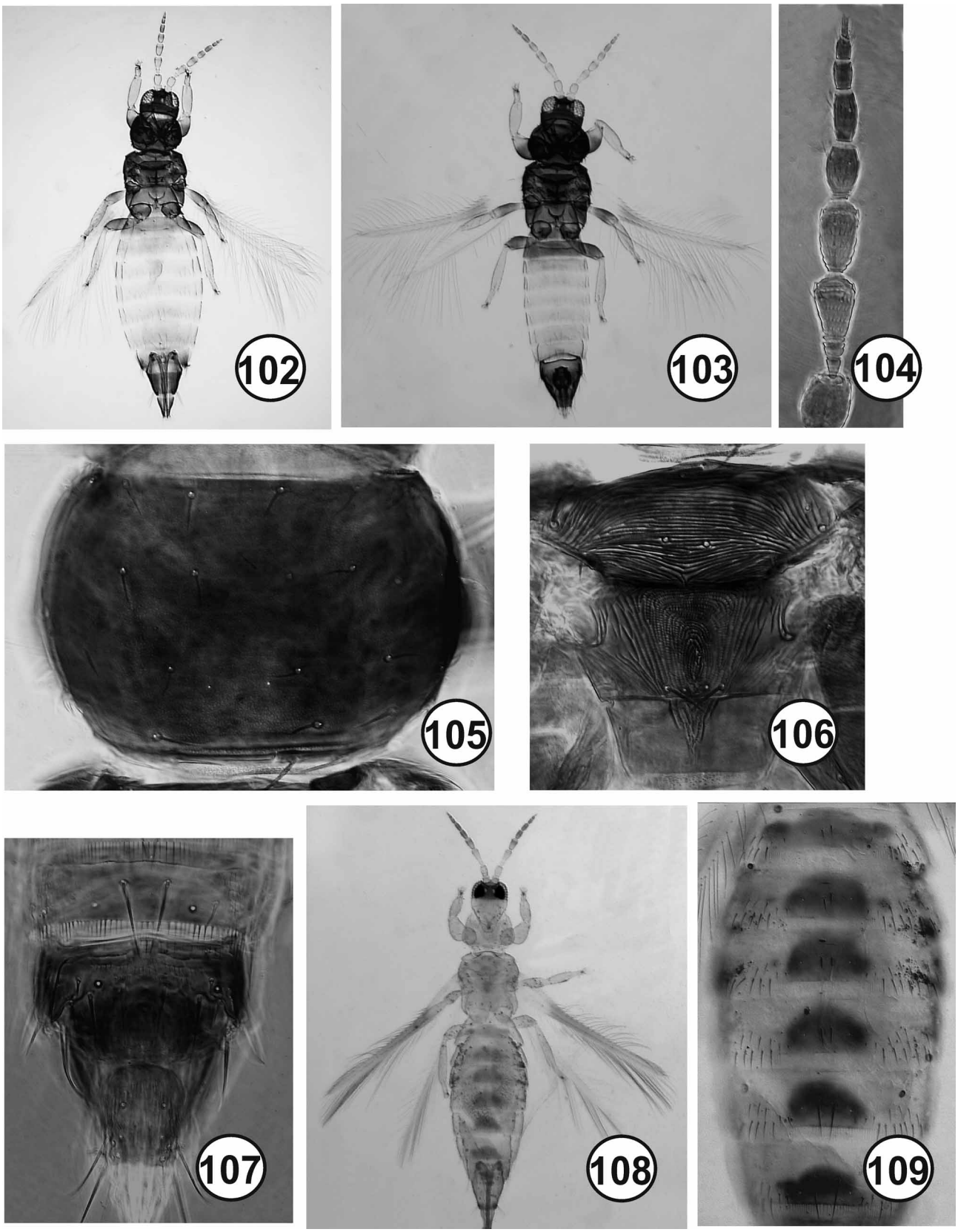
Heterothrips varitibia Moulton, 1932

This poorly studied species is known only from few specimens collected in São Paulo (Fig. 82). The pronotal sculpture is weak (Fig. 85), and abdominal tergite IX is remarkably longer than X (Fig. 82). Males are similar to females in coloration and lack pore plates on abdominal sternites.



FIGURES 93–101. Brazilian *Heterothrips*. *H. striatus* female **93–96: 93.** Dorsal view; **94.** Antenna; **95.** Mesonotum and metanotum; **96.** Pronotum. *H. brasiliensis* female **97–100: 97.** Dorsal view; **98.** Antenna; **99.** Head and pronotum; **100.** Mesonotum and metanotum. *H. flavidus* female: **101.** Antenna.

Material examined. Paratypes: 1 female, 4 males, **Brazil**, **São Paulo**, viii.1929, on "jurubeba" (herbaceous Solanaceae) (J.P. da Fonseca) (CAS and USNM).



FIGURES 102–109. Brazilian *Heterothrips*. *H. bicolor* female 102, 104–106: 102. Dorsal view; 104. Antenna; 105. Pronotum; 106. Mesonotum and metanotum. *H. bicolor* male 103, 107: 103. Dorsal view; 107. Abdominal tergites IX–X. *H. decoratus* female 108-109: 108. Dorsal view; 109. Abdominal tergites I–VI.

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