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Toward the identification of *Frankliniella* species in Brazil (Thysanoptera, Thripidae)

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Abstract

This paper provides an illustrated key to about 40 species of *Frankliniella* recorded from Brazil, together with notes about each species. Two new synonyms are established: *Frankliniella longispinosa* Moulton is a synonym of *Frankliniella varipes* Moulton; *Frankliniella rodeos* Moulton is a synonym of *Frankliniella gemina* Bagnall, all described originally from South America. One new species is described, *Frankliniella graminis* **sp.n.** is recorded from Poaceae in central and southeastern Brazil. Four species are newly recorded from Brazil: *Frankliniella frumenti* Moulton, *Frankliniella gossypiana* (Hood), *Frankliniella musaeperda* Hood and *Frankliniella platensis* De Santis.

Key words: Diversity, identification, Neotropics, pests, taxonomy, tospovirus

Introduction

With over 230 described species, *Frankliniella* is the third most species-rich genus in the insect Order Thysanoptera (Mound 2011). In contrast to the members of the other two large genera, *Liothrips* and *Thrips*, the species of *Frankliniella* are almost entirely from the Americas, with most of the species being confined to the Neotropics (Mound & Marullo 1996).

One species, *Fr. occidentalis*, has been introduced throughout the world and is a major pest of many crops (Kirk & Terry 2003), but several other members of the genus such as *fusca* and *schultzei*, are also pestiferous although usually in more restricted areas (see Hoddle *et al.* 2008). Recognising such pest species against the spectrum of native species is particularly difficult in South America, both for technical and biological reasons. By technical problems we mean the fact that so many species have been described inadequately, with no real host-plant data, and from very few specimens that are often mounted onto microscope slides in an unsatisfactory condition for critical observations. As in all branches of science, conclusions in taxonomy can be no more reliable than the data on which they are based. Statements concerning the presence or absence of a pair of setae, if based on examination of a single *specimen*, may not be valid for that *species* when further samples are examined. There have been no studies on any of these South American species to establish the variation within and between populations, such as that induced on colour and structure by different seasons and environmental conditions. By biological problems we refer to the fact that, in contrast to species of genus *Thrips*, many species of *Frankliniella* seem to have no single distinctive character. Thus the most common species, *Fr. occidentalis*, can be distinguished only by using a range of characters, although the widespread pest form often has a distinctive abdominal colour pattern.

The only available comprehensive key to the species of *Frankliniella* aimed to distinguish almost 150 named species (Moulton 1948), but this is now more than half century out of date, both in its method of production and in its biological concepts. Some of the species in that key were included only from published descriptions, a particularly unreliable procedure. Moreover, several basal steps in the key used inappropriate characters, including body colour and world distribution. Adults of several species are known to vary in body colour, and newly emerged adults are commonly much paler than mature adults (see Mound & Nakahara 1994); this results in problems when

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new species are described from such teneral individuals. Distribution as a recognition character is similarly unreliable, as it fails to allow for the fact that many species have been widely distributed by human activities (Hoddle *et al.* 2008).

More recently, Ortiz (1977) produced a key to 37 *Frankliniella* species from Peru, De Santis *et al.* (1980) a key to 19 species from Argentina, and Mound and Marullo (1996) a key to almost 80 *Frankliniella* species from Central America. Moreover, several accounts of Mexican species have been published (e.g. Johansen & Mojica-Guzman 2009). A full generic definition of *Frankliniella* was provided by Mound and Nakahara (1994), and Nakahara (1997) published a checklist of the 159 species then recognised. Currently, 230 *Frankliniella* species are listed by Mound (2012), and that web resource provides full nomenclatural and bibliographic details of all of the species discussed in this paper.

Monteiro (2002) listed 41 *Frankliniella* species from Brazil, of which 18 were described originally from this country. Published records of two North American species, *fusca* and *minuta*, lack any support in the form of specimens or suitable descriptive details. Almeida and Arruda (1962) recorded *fusca*, the tobacco or peanut thrips of eastern North America, attacking leaves of peanut in São Paulo. No voucher specimens are available, and this record is here considered likely to have been a misidentification of *Enneothrips flavens*, an abundant species that causes severe damage to the leaves of peanuts in Brazil. For this reason, *fusca* is not included in the key below. The record of *minuta* from Brazil is also possibly a misidentification, but this species is included in the key and further notes about this species are provided. Many Brazilian *Frankliniella* species remain known only from poorly mounted specimens, resulting from inadequate slide preparation techniques. Detailed observations are thus essentially limited on such specimens, with many character states obscured or not available.

The purpose of the present article is to provide an identification key to a restricted sub-set of South American species—that is, those recorded from Brazil. National boundaries do not provide a biologically satisfactory target group. However, given that revisionary taxonomy is limited by the practicalities of specimen availability, our aim is to facilitate biological studies in Brazil, whilst hoping that this work will provide a basis for more comprehensive studies in the future.

A further restriction of this paper is that it targets females only. This is partly because males of 25% of the species discussed here have not been collected. Males are less abundant than females (Mound & Marullo 1996), and sexual dimorphism among species of *Frankliniella* can cause problems in correctly associating field-collected males and females. For example, in some species the comb of microtrichia is well developed on tergite VIII of females but not in males, and there can be considerable differences in colour between the sexes.

The Brazilian thrips fauna is undoubtedly very rich, and many species remain to be more deeply investigated. However, without studies on host associations and the variation within and between populations, there can be little understanding of this biological diversity. Of particular concern is a group of small yellow *Frankliniella* that are commonly found in association with crops yet cannot be identified satisfactorily, even as one or several species. This group includes individuals that are variously named as *distinguenda*, *gemina*, *rodeos* and *zucchini*, but with no certainty that discrete biological entities are involved.

Methods and Abbreviations

Species of which the holotype or lectotype have been studied during the preparation of this key are indicated in the text by an asterisk (*) before the name. Primary types were also used in the preparation of the keys by Sakimura and O'Neill (1979), and Mound and Marullo (1996), and some decisions in this paper are based on these two keys together with specimens in the Australian National Insect Collection (ANIC), Canberra, and the Departamento de Zoologia, Universidade Federal do Rio Grande do Sul (UFRGS), Brazil. The holotype of the new species described below is placed at UFRGS, and paratypes will be available at the Australian National Insect Collection, Canberra, and Museo de Ciencias Naturales de La Plata (MLP), Argentina.

The following abbreviations are used: po —postocular seta; am —pronotal anteromarginal seta; aa —pronotal anteroangular seta; pa —pronotal posteroangular seta; pm —pronotal posteromarginal seta; seta pair I on abdominal tergite IX (the setal pair nearest the mid-line) —S1; seta pair II on abdominal tergite IX —S2.

Key to females *of Frankliniella* species recorded from Brazil
(excluding *fusca*, *difficilis* and *minor* q.v.)

1. Abdomen mainly yellow but with segments VIII–X sharply dark brown; abdominal tergites V–VII with brown markings medially (Fig. 78) . . . . . *bicolor*
-. Abdomen variable, either yellow, brown or with median tergites bicoloured, but never with segments VIII–X sharply darker than basal abdominal segments (Figs 1–6) 2
2. Head with ocellar setae pair I absent; pronotum with only 2 pairs of posteromarginal setae. . . . . *speciosa*
-. Head with ocellar setae I present; prono tum with 5 (rarely 3) pairs of posteromarginal setae (Figs 22–30) 3
3. Abdomen largely brown (Figs 13, 17–18) 4
-. Abdomen largely yellow, sometimes tergite X darker or tergites with brown areas medially (Figs 3, 8, 14) 29
4. Ocellar setae pair III short, scarcely 1.5 times as long as diameter of an ocellus; pronotal am and aa setae usually much less than 0.5 as long as pronotal pa setae (Figs 24, 27) 5
-. Ocellar setae pair III long, usually at least 2.5 times as long as diameter of an ocellus; pronotal am and aa setae usually about 0.7 as long as pa setae (Figs 36–38) 11
5. Mid and hind tibiae uniformly dark brown (Fig. 10) 6
-. Mid and hind tibiae with pale areas, never uniformly dark brown (Fig. 12) 7
6. Pronotal posteromarginal setae pair IV almost as long as pair II (Fig. 57); metanotal campaniform sensilla absent; ocellar setae pair III just outside ocellar triangle (Fig. 48) . . . . . *minuta*
-. Pronotal posteromarginal setae pair IV no longer than pairs III and V (Fig. 39); metanotal campaniform sensilla present; ocellar setae III between anterior margins of posterior ocelli. . . . . *serrata*
7. Tergite X 1.4–1.7 times as long as IX (Fig. 102) . . . . . *oxyura*
-. Tergites IX and X subequal in length, or X shorter than IX (Fig. 100). 8
8. Postocular setal pairs I and III both missing; ocellar setae pair III arise between posterior ocelli (Fig. 35); thorax paler than abdomen . . . . . *nakaharai*
-. Postocular setae pairs I and III usually both present (Fig. 27); ocellar setae pair III arise anterior to tangent between anterior margins of posterior ocelli; thorax not paler than abdomen 9
9. Metanotum with equiangular reticulation medially, campaniform sensilla absent (Fig. 69) . . . . . *konoi*
-. Metanotum with narrow linear reticulation medially, campaniform sensilla present (Fig. 62) 10
10. Pronotal am setae scarcely longer than discal setae; fore wings shaded. . . . . *curta*
-. Pronotal am setae almost twice as long as discal setae; fore wings pale (Fig. 159) . . . . . *fuscicornis*
11. Abdominal tergite VIII posterior margin with no comb or with only few short teeth laterally (Figs 93, 104) 12
-. Abdominal tergite VIII posterior margin with microtrichial comb, sometimes with 2 or 3 teeth missing medially (Figs 87–92) 13
12. Ocellar setae III arising on anterior margins of ocellar triangle (Fig. 45); hind tibiae almost clear yellow, contrasting with the dark brown hind femora (Fig. 113); metanotal campaniform sensilla present (Fig. 64). . . . . *fulvipes* [in part]
-. Ocellar setae pair III arising between posterior ocelli (Fig. 51); hind tibiae not sharply paler than femora; metanotal campaniform sensilla absent (Fig. 74) . . . . . *schultzei* [in part]
13. Compound eyes with 3 or 4 anterolateral facets much larger than surrounding facets (Fig. 46) 14
-. Compound eyes with all facets subequal in diameter, although some ventral ommatidia may be enlarged (Figs 50–54). 15
14. Fore wings uniformly brown; enlarged facets about 2.0 times longer than normal ones (Fig. 46); pm setae pair II more than 3.0 times as long as pair I (Fig. 30). . . . . *fulvipennis*
-. Fore wings largely brown but basal third sharply paler; enlarged facets about 3.0 times longer than normal ones; pm setae pair II scarcely longer than pair I . . . . . *longipennis*
15. Antennal segment III pedicel elongate, twice as long as sub-basal ring (Figs 138) . . . . . *parvula*
-. Antennal segment III pedicel short, less than 1.5 times the diameter of sub-basal ring (Figs 128, 150) 16
16. Antennal segment III with cup-shaped pedicel (Fig. 148) . . . . . *brevicaulis*
-. Antennal segment III pedicel different 17
17. Hind tibiae mainly yellow but with brown area medially ***and*** postocular setae pair I absent . . . . . *fulvipes* [in part]
-. Hind tibiae usually extensively brown, or sharply bicoloured with basal third sharply yellow (Figs 112, 114–115); if hind tibiae largelly yellow then postocular setae pair I present (Fig. 44) 18
18. Postocular setae pairs I and III absent (Fig. 38); frequently apterous; male with strongly curved pore plates on sternites III–VIII . . . . . *platensis*
-. Postocular setae pair III present, pair I usually present (Fig. 23); male pore plates different (Figs 83–86). 19
19. Abdominal sternite III with pair of small pore plates near antecostal ridge (occasionally one pore plate missing) (Fig. 77) antennal segment VIII unusually long, about 4 times as long as wide (Fig. 117). . . . . *australis*
-. Abdominal sternite III with no pore plates; antennal segment VIII less elongate (Fig. 118) 20
20. Fore wings almost uniform in colour, either dark or pale (Figs 161–164) 21
-. Fore wings extensively brown but sharply pale basal to the veinal fork (Figs 155–156). 25
21. Forewing almost uniformly pale or weakly shaded (Fig. 163) . . . . . *occidentalis* [in part]
-. Forewing almost uniformly brown (Fig. 164). 22
22. Pedicel of antennal segment III simple, without a distinct swelling but occasionally slightly dilated near apex (Figs 143–145). 23

-. Pedicel of antennal segment III with a distinct swelling (Figs 149–152) 24
23. Metanotum distinctly reticulate anteromedially (Fig. 75); antennal segment III distinctively paler than IV (Fig. 143); abdominal tergite IX setae S1 less than 0.7 as long as setae S2 . . . . . *simplex*
-. Metanotal sculpture weak or absent medially (Fig. 61); antennal segment III concolorous with IV (Fig. 120); abdominal tergite IX setae S1 sub-equal in length to setae S2 . . . . . *brunnea*
24. Antennal segment III pedicel with a sharp ring-like swelling (Fig. 149); pronotal posteromarginal setae pair II more than 0.5 as long as posteroangular setae (Fig. 55). . . . . *casearie*
-. Swollen pedicel not sharply ring-like (Fig. 139); pronotal posteromarginal setae pair II about 0.4 as long as posteroangular setae (Fig. 37) . . . . . *peruviana*
25. Hind tibiae sharply bicoloured, brown with basal third sharply yellow (Fig. 112). 26
-. Hind tibiae almost uniformly brown, scarcely paler at apex (Fig. 114) 27
26. Mid-tibiae brown with base briefly yellow (Fig. 110) . . . . . *annulipes*
-. Mid-tibiae almost clear yellow, sometimes with brown markings medially (Fig. 111) . . . . . *varipes*
27. Postocular setae pair IV small, no longer than the diameter of a posterior ocellus (Fig. 33); metanotal campaniform sensilla absent (Fig. 67) . . . . . *hemerocallis*
-. Postocular setae pair IV prominent, at least 1.5 times as long as diameter of an ocellus (Fig. 52); metanotal campaniform sensilla present (Fig. 68) 28
28. Abdominal tergite VIII with posteromarginal comb complete, all microtrichia equally long and slender; fore tibiae concolorous with fore femora; postocular setae pair I absent and pair IV as long as width of a compound eye; pronotal am setae 1.3 times as long as distance between compound eyes (Fig. 52) . . . . . *setipes*
-. Abdominal tergite VIII with posteromarginal comb often with 2 or 3 teeth missing medially, microtrichia irregular in form with broad bases (Fig. 98); fore tibiae sharply paler than fore femora (Fig. 34); postocular setae pair I present and pair IV shorter than width of a compound eye; pronotal am setae scarcely 1.0 times as long as distance between compound eyes . . . . *insularis*
29. Apterous or micropterous; abdominal tergites with 4 pairs of long and equidistant setae in addition to the posteroangular pair (Fig. 82). . . . . *trinidadensis*
-. Macropterous; median pairs of tergal setae much shorter than lateral pairs 30
30. Pedicel of antennal segment III with distinct swelling or disc (Fig. 154). 31
-. Pedicel of antennal segment III without a swelling 34
31. Tergite VIII with comb present only laterally . . . . . *tritici*
-. Tergite VIII with complete comb of long microtrichia (Fig. 94) 32
32. Abdomen mainly yellow but with segments X and posterior margin of IX dark brown; antennal segment II mostly dark brown (Fig. 122). . . . . *condei*
-. Abdomen uniformly yellow (Fig. 80); antennal segment II paler. 33
33. Antennal segment III pedicel with ring about 2.0 times as wide as basal stem; pedicel immediately above this ring smoothly concave (Fig. 152). . . . . *musaeperda*
-. Antennal segment III pedicel with ring scarcely 1.5 times as wide as basal stem; pedicel immediately above this ring irregularly concave with minute tubercle (Fig. 151). . . . . *gardeniae*
34. Pronotal aa (and usually am) setae scarcely longer than discal setae (Figs 24, 31) 35
-. Pronotal aa and am setae clearly distinct from discal setae, at least 0.3 as long as pa setae. 37
35. Abdomen largely yellow but tergite X brown in apical 2/3 (Fig. 96); ocellar setae III more than 2.5 times as long as width of an ocellus; metanotal campaniform sensilla absent . . . . . *graminis* **sp.n.**
-. Abdomen colour different, tergites usually uniformly yellow or with brown markings medially; ocellar setae III length less than 1.5 times width of an ocellus; metanotal campaniform sensilla present 36
36. Antennal segment VI pedicellate (Fig. 124); pronotal inner pa setae distinctively shorter than outer pair . . . . . *desantisi*
-. Antennal segment VI not pedicellate, base rounded; pronotal inner pa setae longer than outer pair . . . . . *bertelsi*
37. Ocellar setae pair III arising between posterior ocelli (Fig. 51); tergite VIII with no posteromarginal comb of microtrichia, sometimes with few scarcely developed teeth laterally (Fig. 104); . . . . . *schultzei* [in part]
-. Ocellar setae III usually further forward (Fig. 54); tergite VIII with posteromarginal comb well-developed, at least laterally (Fig. 95). 38
38. Posteromarginal comb on tergite VIII with only few weak lobes medially but with some lateral microtrichia; campaniform sensilla on metanotum absent; postocular setae pair I usually absent; head distinctly prolonged in front of eyes . . . . . *bondari*
-. Posteromarginal comb on tergite VIII fully developed; if postocular setae pair I absent then metanotal campaniform sensilla present; head sometimes weakly prolonged in front of eyes 39
39. Ocellar setae III about 1.5 times as long as width of an ocellus; pronotal am setae scarcely 0.5 times as long as aa setae. . . . . *distinguenda*
-. Ocellar setae III more than 2.0 times as long as width of an ocellus; pronotal am setae longer, usually more than 0.7 times as long as aa setae 40
40. Abdominal sternite II with 1 or 2 discal setae (Fig. 86) 41
-. Abdominal sternite II with no discal setae 42
41. Abdominal tergite IX setae S1 more than 110 microns long; S2 more than 130 microns long; usually associated with grasses . . . . . *williamsi*
-. Abdominal tergite IX S1 and S2 setae shorter, usually less than 100 microns long; associated with various dicotyledonous flowers. . . . . *gossypiana*
42. Abdominal tergites usually with brown area medially (Fig. 14); tergite VIII posteromarginal comb with microtrichia irregular,

arising from triangular bases (Fig. 101); po setae pair IV longer than distance between hind ocelli (Fig. 36) . . . . . *occidentalis* [in part]

-. Abdominal tergites clear yellow; tergite VIII posteromarginal comb with slender microtrichia of uniform length (Fig. 95); po setae pair IV shorter than distance between hind ocelli (Fig. 32) 43

43. Antennal segment VIII about 3.0 times as long as wide (Fig. 126); head slightly prolonged in front of eyes (Fig. 29); associated with grasses . . . . . *frumenti*

-. Antennal segment VIII not more than 2.5 times as long as wide; head not prolonged in front of eyes; associated with dicotyledonous plants 44

44. Postocular setae pair I present (Fig. 32) . . . . . *gemina*

-. Postocular setae pair I absent (Fig. 54) . . . . . *zucchini*

***annulipes* Hood, 1915**

(Figs 22, 59, 110, 112, 116, 155)

Described originally from Panama, with a synonym described from Mexico, this species is closely similar in structure, sculpture and chaetotaxy to *varipes*, with long pronotal setae, little pronotal sculpture, and fore wings that are bicoloured. The only difference found on the available specimens is that the mid tibiae of *annulipes* are brown but sharply yellow on the basal third, whereas those of *varipes* are more extensively, or even completely, yellow. *F. annulipes* was recorded from Brazil by Mound and Marullo (1996) from a single female taken from an orchid at Piracicaba (São Paulo).

***australis* Morgan, 1925**

(Figs 23, 77, 83, 87, 117, 156)

Abundant in Chile in the flowers of *Cestrum parqui* (Ripa *et al.* 2009), and also recorded from Argentina. The record of this species from Brazil (Paraná) is based on identification by R. zur Strassen of specimens deposited at the Senckenberg Museum, Frankfurt. The females of this species are unusual in having a pair of small circular pore plates on abdominal sternite III. Moreover, antennal segment VIII is longer than in other *Frankliniella* species apart from *frumenti*, more than 1.5 times longer than VII. The fore wings of males are not distinctively bicoloured.

***bertelsi* (De Santis, 1967)**

(Figs 24, 88)

Described originally as a species of *Isochaetothrips*, this species is known only from few specimens collected in southern Brazil. It is uniformly yellow in colour, with ocellar setae III minute, and pronotal setae am and aa no longer than the discal setae. Males have very small circular pore plates on abdominal sternites III–VII.

****bicolor* Moulton, 1948**

(Figs 43, 78, 118)

This is a very distinctive species, with abdominal segments I–IV yellow, V-VII with brown markings medially and VIII–X dark brown. As in *caseariae* and *gardeniae*, the margins of the pedicel on antennal segment III are produced into a small sharp-edged disc. The original female was described from Minas Gerais, but females have more recently been collected in Rio Grande do Sul, in low numbers from various plants. The male is uniformly yellow in colour and bears transverse pore plates on abdominal sternites III–VII.

***bondari* Hood, 1941**

Described from Brazil, this yellow species is recorded from Mexico, Cuba, and south eastern USA (Florida,

Georgia, Hawaii). Apparently specific to *Polianthes* (Agavaceae), the head is prolonged in front of the eyes as in other *Frankliniella* species that live on Poaceae (Nakahara 1992). The head also lacks postocular setae I and metanotal campaniform sensilla are absent. Two synonyms of this species, *alba* and *bratleyi*, were described based on macropterous and brachypterous forms in Mexico and USA.

***brevicaulis* Hood, 1937**
(Figs 1, 25, 60, 89, 119, 148, 157)

This is a widespread species in the Neotropics. It has a distinctive short and cup-shaped pedicel on antennal segment III. Females are brown in colour with forewings largely pale but weakly shaded brown basally, and tergite VIII has a posteromarginal comb of fine, well-spaced microtrichia. Males are yellow, with transverse pore plates on abdominal sternites III–VII.

***brunnea* Priesner, 1932**
(Figs 26, 61, 79, 120)

Described from Mexico, with two synonyms from that country and two further synonyms from Panama and Guatemala, this dark winged species appears to be widespread in the Neotropics. It has been found in flowers of *Bidens* (Asteraceae) in Minas Gerais. Postocular setae pair I is usually absent, antennal segment III has the pedicel weakly dilated, and the posteromarginal comb on tergite VIII is irregular and with short teeth. Males studied are distinctively paler and lack a posteromarginal comb on tergite VIII.

****caseariae* Moulton, 1933**
(Figs 2, 44, 55, 90, 121, 149, 158)

This is a poorly studied species, known previously only from the type series collected in Rio de Janeiro. However, a few females were collected recently in flowers of various plants in Minas Gerais, Rio Grande do Sul and São Paulo. The body is extensively brown, with head and thorax slightly paler and the fore wings uniformly brown. The pedicel on antennal segment III bears an expanded disc, and ocellar setae III are long and arise within the ocellar triangle just anterior to the tangent to the anterior margins of the posterior ocelli. The male is unknown.

****condei* John, 1928**
(Figs 122, 150)

Described from Brazil, this yellow species is similar to *gardeniae*: pronotum with only two minor setae on anterior margin between the am setae; anterior half of metanotum closely transversely striate but the type specimen is insufficiently cleared to decide if campaniform sensilla are present or absent; comb on tergite VIII long and slender. However, in contrast to *gardeniae*, abdominal segment X and the extreme posterior margin of IX of *condei* are sharply dark brown. Moreover, the antennae are more slender than in *gardeniae*, with segment V dark brown in the distal half rather than clear yellow, and the pedicel of segment III bears a disc that is smaller and less sharp-edged. The species appears to be known only from the original specimen (in BMNH, London), collected at São Paulo in a Bromeliaceae.

***curta* Hood, 1942**
(Figs 27, 62, 91, 123)

Described from Trinidad, this small species is apparently widespread, living in flowers of various Asteraceae. Adults seem to be variable in colour, but when mature the abdomen is extensively brown with the head and thorax

lighter (Mound & Marullo 1996). According to Sakimura and O'Neill (1979), *curta* is closely related to *oxyura*, from which it is only weakly distinguished by the brown abdomen. Currently, the name *curta* is applied to individuals in which the pronotal am and aa setae are scarcely distinguishable from the discal setae, and the pronotal pm II setae are much less than 0.5 as long as the pa setae. Males are yellow, with a slender transverse pore plate on abdominal sternites III–VII.

***desantisi* Sakimura & O'Neill, 1979**
(Fig. 124)

Known only from southern Brazil, this species is a member of the *minuta* group with particularly short pronotal am and aa setae. It has a characteristic pedicellate antennal segment VI, and the inner pair of pronotal posteroangular setae are shorter than the external pair. The male is unknown.

***difficilis* Hood, 1925**

The paralectotypes of this species from Martinique have a discal seta medially on sternite II, but the lectotype (Pitkin 1978) from Guadeloupe lacks this seta. The specimens recorded under the name *difficilis* from Brazil cannot at present be distinguished from *gardeniae*, but *difficilis* remains a valid name for a Caribbean species that is inadequately defined.

****distinguenda* Bagnall, 1919**
(Figs 28, 125)

Sakimura and O'Neill (1979) treated this species, under its synonymic name *verbesinae*, as a member of the *minuta* group because of the short ocellar setae pair III. However, the comb on tergite VIII has long and widely spaced teeth with the median pairs not converging at their tips, unlike the comb in most species of the *minuta* group. The lectotype was collected in Paraguay in 1905, and is a relatively large, pale yellow, individual with the following measurements in microns: body length about 1,100; ocellar setae pair III 20; postocular setae I present, IV 15; pronotal setae - am 25, aa 45, inner pa 57, outer pa 50. Although similar in appearance to members of the *rodeos*/*gemina* group, these setal lengths suggest these species may not be closely related. It must be mentioned that the step 39 in the key to species provided here applies only to the lectotype of *distinguenda*, and there is no information about intraspecific variation of the characters referred above. One female has been studied from Pernambuco, Brazil that is similar in colour and chaetotaxy to the lectotype, but with the body length scarcely 1,000 microns.

***frumenti* Moulton, 1948**
(Figs 3, 29, 63, 80, 126)

Placed in the *intonsa* group by Moulton (1948), this grass-living thrips was described from corn plants in Chile and subsequently recorded in Argentina by De Santis *et al*. (1980). As in *bondari*, the head projects in front of the eyes and the major setae on the head and thorax are more slender than in the other common yellow *Frankliniella* species. Males have large transverse and slightly curved pore plates on abdominal sternites III–VII. Based on comparisons with the original description and specimens in the collection at Canberra, Australia, this thrips is here recorded for the first time from Brazil. It has been found abundantly on *Paspalum* and *Eragrostis* flowers in southern areas, but one female has been studied from Pernambuco in the North East.

NEW RECORD. **Brazil**: **Pernambuco**, Petrolina, 1 female collected on grasses, 7.x.2007 (K. Minoura); **Rio Grande do Sul**, São Francisco de Paula, 30 females, 12 males collected in grasses, 6.xii.2009 (A. Cavalleri); **Santa Catarina**, Florianópolis, 8 females, 1 male collected in flowers of *Paspalum urvillei*, 16.ii.2010 (A. Cavalleri); same locality, 14 females collected in flowers of *Eragrostis ciliaris*, 16.ii.2010 (A. Cavalleri).

***fulvipennis* Moulton, 1933**
(Figs 30, 46, 92, 127)

Described from Brazil, this thrips has been recorded widely in Central America on several plant species (Mound & Marullo 1996). Because of its unusual eyes, with two ventral and three anterolateral ommatidia enlarged, this species was placed in *Exophthalmothrips* by Retana-Salazar (1998). That author stated that the posteromarginal comb on tergite VIII is incomplete medially, but on the holotype the comb is complete and with relatively short teeth. The fore wings and antennal segments are largely brown, except for the paler antennal segment III.

***fulvipes* Bagnall, 1919**
(Figs 7, 45, 64, 93, 111, 113, 128)

Described from Argentina, this species is also recorded from Brazil, Costa Rica, Panama and Peru. It seems to be particularly associated with flowers of Solanaceae, and resembles *varipes* in body colour and structure. However, *fulvipes* has no postocular setae I, and the hind tibiae are usually uniformly yellow, although some specimens from Central America and southern Brazil have these tibiae with faint brown markings medially. The posteromarginal comb of microtrichia is irregular and with relatively short and translucent teeth. On the lectotype these teeth are visible only with an oil-immersion X100 phase contrast objective, thus the posterior margin of tergite VIII effectively lacks a comb. The males are bicoloured, with large transverse pore plates on abdominal sternites III–VII.

***fusca* (Hinds, 1902)**

Almeida and Arruda (1962) recorded this North American species, the tobacco thrips, from São Paulo on the leaves of peanut plants. However, this is possibly a misidentification of *Enneothrips flavens*, an abundant species that causes severe damage to the leaves of this crop.

***fuscicornis* Moulton, 1948**
(Fig. 159)

This species is known only from one poorly mounted female, collected in São Paulo. It was described originally in 1933 as *fulvicornis* Moulton but, since that is a homonym of *fulvicornis* Uzel from Europe, the new name *fuscicornis* was later proposed. Ocellar setae pair III are minute, about 15 microns and no longer than the length of a posterior ocellus. However, the pronotal setae are relatively long when compared to those of other *minuta* group species; the am setae are about 25 microns, the aa setae are at least 45 microns, and pm setae II are about 0.5 as long as the 50 micron long pa setae. Abdominal tergite VIII bears a complete posteromarginal comb of long and fine teeth.

***gardeniae* Moulton, 1948**
(Figs 4, 47, 56, 65, 94, 129, 151)

Described from Mexico, this is currently interpreted as a common and widespread species in much of South America. Records of *difficilis* from Brazil, including the form *minor* Moulton that was listed by Nakahara (1997) as a valid species, are here considered misidentifications of *gardeniae*. Antennal segment II is also unusually long, about 2.0 times as long as wide, and segment III bears an expanded disc on the pedicel, but in contrast to *musaeperda* the concavity immediately above this disc bears a minute tubercle or tooth.

***gemina* Bagnall, 1919**
(Figs 5, 32, 66, 95, 130, 160)

***rodeos* Moulton, 1933: 113 syn. n.**

The lectotype of this pale yellow species is damaged, although the following measurements in microns are based on that specimen: ocellar setae pair III 40; postocular setae I present, IV 30; pronotal setae - am 50 microns, aa 55, inner pa 65, outer pa 50. In his 1948 key, Moulton distinguished *rodeos* from *gemina* on a minor difference he claimed in the distance between the bases of ocellar setae pair III. However, this seems likely to be due to differences in slide preparation, and as no observable differences could be found between these two taxa they are here considered synonyms. Types of both taxa have been compared, and they both have antennal segment II pale, with only the faintest shading at the apex, and segment V weakly shaded in the apical third. Populations in southern Brazil that are otherwise indistinguishable from *gemina* commonly comprise individuals with antennal segment II uniformly brown, and segment V largely brown with only the basal third yellow. Both forms have been found living in sympatry in the flowers of several plants in Brazil, and further studies are necessary to investigate the possible effects of seasonality and food source on the colouration of these thrips.

***gossypiana* (Hood, 1936)**

Described originally in *Euthrips*, this thrips is here newly recorded from Brazil, although it is found widely on various plants between USA and South America. As in *williamsi*, this yellow species is unusual in having discal setae on abdominal sternite II. However, the differences between these two species are small, and they are distinguished from each other only by the length of the setae on the ninth abdominal tergite (Mound & Marullo 1996). The specimens examined from Bahia have the setae S1 and S2 on abdominal tergite IX measuring 70 and 75 microns long, respectively.

NEW RECORD. **Brazil**: **Bahia**, Casa Nova, 7 females collected on grapes, 8.vi.2010 (A.N. Moreira).

***Frankliniella graminis* sp.n.**
(Figs 8, 31, 96, 109, 131)

Female macroptera. Body extensively yellow, including legs; antennal segments I–II yellow, III–IV yellowish brown and V–VIII brown, V distinctively yellowish in basal third; abdominal segment X extensively darkened, except for basal fifth; fore wings pale to weakly shaded.

Head about 1.1 times as wide as long and clearly prolonged anteriorly in front of eyes; posterior region with several transverse lines of sculpture; three pairs of ocellar setae present, pair III well-developed (33 microns) and arising close to anterior margin of ocellar triangle margin; six pairs of fine po setae, pair IV not distinctively longer than others. Antennae 8-segmented, segments III and IV each with a forked sensorium; pedicel on III simple. Pronotum about 1.2 times as wide as long, with weak lines of sculpture; two pairs of long posteroangular setae and about 18 small discal setae; posteromarginal setae pair II about 1.5 times as long as pair I; aa setae minute and am scarcely longer than discal setae. Mesonotum with transverse elongate reticles. Metanotum with transverse lines of sculpture anteriorly, irregularly reticulate posteromedially; paired campaniform sensilla absent; two pairs of setae arising at anterior margin; fore wings with two complete rows of setae.

Abdominal tergites IV–VIII with ctenidia laterally; II–VII with few lateral and irregular teeth on posterior margin; VIII with a complete posteromarginal comb of microtrichia arising from triangular bases; S1 setae on IX clearly shorter than S2. Sternites without discal setae and with three pairs of long posteromarginal setae; sternites II–VII with an irregular craspedum of short and broad teeth posteriorly; craspeda sometimes interrupted medially.
Measurements (holotype female in microns). Body length 1,080 (distended). Head, length 113; width 120; dorsal eye length 60; ocellar setae pair III interval between pores 22. Pronotum, length 108; width 135; pronotal outer and inner pa setae length 40, 58, respectively. Fore wing length 510; median width 48. Abdominal tergite IX setae S1

and S2 length 90, 105, respectively. Antennal segments I–VIII length (width), 22 (25), 32 (25), 37 (20), 32 (18), 30 (17), 45 (17), 10 (5), 15 (7).

Male macroptera. Smaller than female, body uniformly yellow without brown markings; posterior margin of abdominal tergites II–VII with well-developed craspedum of tooth like lobes; tergite VIII with a complete comb of microtrichia; abdominal sternites II–VIII with toothed craspedum posteriorly; sternites III–VII with large transverse pore plates.

Measurements (paratype male in microns). Body length 1,030 (distended). Head, length 105. Pronotum, length 105; width 130; pronotal outer and inner pa setae length 41, 48, respectively. Fore wing length 460; median width 45. Pore plate on abdominal segment VII median length 10; width 65.

Material examined. Holotype female, **Brazil:** Minas Gerais, Juiz de Fora, (21º46'47"S, 43º22'23"W), 900 m, 11.xii.2011, on *Cymbopogon citratus* (A. Cavalleri).

Paratypes: 1 male collected with holotype; 3 females with similar data but on *Setaria parviflora*; 4 females, 1 male with similar data but on *Melinis minutiflora*; **Goiás**, Santo Antônio de Goiás, 750 m, 3 females collected in rice crops, 17.iii.2008 (J.A. Barrigossi).

Comments. This species seems to be related to other yellow, grass-living *Frankliniella*, such as *bondari* and *frumenti*. All of these have the head prolonged anteriorly, and relatively slender major setae on the head and thorax. As in *bondari*, the metanotum lacks campaniform sensilla, and po setal pair I on the head is frequently absent. However, this new species is remarkable in having very short or even minute pronotal aa and am setae. In general, the length of such setae on other *Frankliniella* species is more or less constant, with exception of some species in the *minuta* group, which also exhibit weakly developed pronotal anteromarginals and anteroangulars. Moreover, the presence of strongly toothed tergal and sternal craspeda in males is unique in this genus. This structure is also present in females but is less clearly developed, usually with a few stout teeth posterolaterally on tergites and sternites. This new taxon seems to be particularly common in central and southeastern highlands, living in several Poaceae species.

***hemerocallis* Crawford, 1948**
(Figs 6, 33, 67, 97, 132)

Described from USA, this dark bodied thrips has been found in Central America and Japan in association with *Hemerocallis* lilies. In Brazil, Lima (1997) recorded several females on *Crotalaria indica* (Fabaceae) in São Paulo. This species has bicoloured fore wings and lacks metanotal campaniform sensilla. The posteromarginal comb on abdominal tergite VIII has short microtrichia arising from broad bases.

***insularis* (Franklin, 1908)**
(Figs 9, 34, 68, 84, 98, 114, 133)

Described in the genus *Euthrips*, this species is widespread from South and Central America into the southern USA. In Brazil, this thrips is commonly found breeding on *Hibiscus rosa-sinensis* (Malvaceae) flowers. Females have mid and hind tibiae uniformly brown, contrasting to the yellow tarsi. Antennal segments III–IV are long and constricted apically, forming a distinctive neck. The posteromarginal comb on tergite VIII is usually shortly interrupted medially, lacking a few teeth. Males have the mid and hind tibiae largely yellow, and abdominal sternites III–VII each bear a large transverse pore plate.

***konoi* Sakimura & O'Neill, 1979**
(Fig. 69)

Described from only one female collected from dead twigs in Santa Catarina, this brown species was referred as similar to *bertelsi* and *curta* in having minute pronotal aa and am setae. However, the metanotum in *konoi* lacks campaniform sensilla and bears equiangular reticulation medially.

***longipennis* (Moulton, 1933)**

Described originally in *Exophthalmothrips* and similar in structure to *fulvipennis*, this species is remarkable in having the eyes extending backward dorsally on the head, and with five or six very large anterolateral ommatidia. This large dark brown thrips is known only from a few females collected in Brazil and Peru.

***minor* Moulton, 1948**

This thrips was described by Moulton only in his key to species, and given the name *difficilis* f. *minor*, from "W.I., Brazil". According to the International Code of Zoological Nomenclature, this name is valid, and it was recognised as a distinct species by Nakahara (1997). No details of any specimens were given by either author, and no lectotype has been designated. Nakahara distinguished *minor* as a species with the statement: "The pedicel of antennal segment III of some of the types has a small but distinct angulation. However, one type has a similar angulation as those of *F. difficilis*." The identity of these specimens remains in some doubt, and they possibly represent small individuals of *gardeniae*.

***minuta* (Moulton, 1907)**
(Figs, 10, 48, 57, 134, 161)

Described in the genus *Euthrips*, this brown species is commonly collected from the flowers of several Asteraceae. It lacks po setae I, and it shares with *konoi* the unusual condition within the *minuta* group of lacking paired campaniform sensilla on the metanotum. It is widespread in Central America and also recorded from Brazil, Colombia, Peru and USA. In Brazil it is known only from early records from several crops in Rio Grande do Sul (Redaelli & Fernandes 1944, 1946) and its presence in this country requires further confirmation.

***musaeperda* Hood, 1952**
(Figs 11, 49, 70, 99, 135, 152)

This thrips is newly recorded from Brazil, although the identification is based on the original description and comments in Mound and Marullo (1996). Originally described from Haiti, the ring on the pedicel in this species is larger than in any other described *Frankliniellla*. Specimens identified as *musaeperda* have been studied from several sites from Paraná to Minas Gerais.

NEW RECORD. **Brazil**: **Minas Gerais**, Juiz de Fora, 5 females on *Lippia* sp. flowers, 11.xii.2011 (A. Cavalleri); Uberlândia, 2 females, 3 males on *Hancornia speciosa*, 2007 (E.A. Silva); **Paraná**, Marialva, 1 female on grapes, xi.2001 (A.M. Meneguim); São Paulo, Mogi-Guaçu, 2 females on *Byrsonima* flowers, 16.v.2010 (A. Cavalleri).

***nakaharai* Sakimura & O'Neill, 1979**
(Figs 12, 35, 71, 100, 136, 162)

Known only from a few females collected in Santa Catarina and Rio Grande do Sul, this small species lacks po setae I and III. The body is bicoloured, with the abdomen dark brown but the thorax distinctively paler. The short length and the posterior position of ocellar setae pair III on the head is characteristic.

***occidentalis* (Pergande, 1895)**
(Figs 13, 14, 36, 72, 81, 85, 101, 137, 163)

Described originally from western USA in the genus *Euthrips*, this species is a major economic pest and tospovirus vector that is now found worldwide (Kirk & Terry 2003). It varies in colour from almost uniformly brown to

yellow, possibly dependent to some extent on the temperature at which it pupates. However, the most common form on crops is largely yellow with distinctive light brown markings medially on each abdominal tergite. Large numbers of the dark form were studied from southern highlands in Rio Grande do Sul. This pest, the Western Flower Thrips, has been demonstrated recently to comprise at least two structurally identical sibling species (Rugman-Jones *et al.*, 2010).

***oxyura* Bagnall, 1919**
(Fig. 102)

Described from Paraguay, this brownish yellow thrips has been collected in several Asteraceae flowers in Argentina and Brazil. As in other members of the *minuta* group, this species has small ocellar setae III on the head, and short aa and am setae on the pronotum. It is similar in structure to *fuscicornis*, but *oxyura* has the fore wings shaded, and abdominal segment IX is remarkably shorter than X.

***parvula* Hood, 1925**
(Figs 15, 50, 138, 153)

This brown species is not yet recorded from Brazil, but is included here because as a widespread insect in Central America that is common in the flowers of *Musa* and *Theobroma cacao* (Mound & Marullo 1996) it is likely to be found in this country. It is very distinctive in having the pedicel of antennal segment III elongate, and the fore wings are dark although slightly paler at the base.

***peruviana* Hood, 1937**
(Figs 37, 103, 139, 164)

Described from a few females in Peru, this dark brown species has been collected from grasses at Piracicaba (Monteiro 1999) and a short series from Mato Grosso is deposited at Natural History Museum, London. The pedicel on antennal segment III is slightly swollen apically, but the disc is not as sharp-edged as that of *caseariae*, and ocellar setae pair III are placed slightly further forward. The few specimens available for study of these two species could equally well be interpreted as representing variation within a single species.

***platensis* De Santis, 1966**
(Figs 38, 73, 105, 140)

This species is here newly recorded from Brazil, based on a comparison of the apterae listed below with the original description. The species was described from Argentina on apterous and macropterous individuals. The male has pore plates on sternites III–VIII, and their presence on VIII as well as their strongly curved shape differ from the condition found in any other member of the genus.

NEW RECORD. **Brazil**: **Rio Grande do Sul**, Eldorado do Sul (30°5'31"S, 51°40'19"W), 3 females, 1 male collected in pitfall traps, 17.ix.2009 (L.R. Podgaiski).

***schultzei* (Trybom, 1910)**
(Figs 16, 17, 51, 74, 104, 141)

Described originally from Africa in the genus *Physopus*, this species has 17 synonyms from various tropical countries around the world. It is an unusual species because ocellar setal pair III arise close together between the anterior margins of the posterior ocelli, and abdominal tergite VIII of females has no posteromarginal comb. The body colour is variable, either brown, with pronotum, tibiae and tarsi paler, or yellow with faint shadings on the

tergites. This thrips is of economic importance because of its association with many crops, and its ability to transmit tospoviruses.

***serrata* Moulton, 1933**
(Figs 18, 39, 106, 142)

Placed in the *minuta* group, this species is known only from females collected in Brazil. It has uniformly dark brown mid and hind femora and tibiae, contrasting with the yellow tarsi. The head lacks postocular setal pair I and abdominal tergite VIII has a complete posteromarginal comb of small microtrichia arising from large triangular bases.

****setipes* Bagnall, 1919**
(Fig. 52)

Described from Argentina, the record from Brazil is based on an identification by R. zur Strassen of specimens in the Senckenberg Museum, Frankfurt. This record requires further confirmation, because *fulvipes* and *varipes* are also dark brown in colour with the fore wings sharply bicoloured and major pronotal setae exceptionally long. However, *setipes* is characterized by having uniformly dark brown mid and hind tibiae, po setal pair I absent, and pair IV slightly longer than the width of a compound eye. In the lectotype, antennal segments III–V are all pale yellow, as is the basal half of VI with the distal half only weakly shaded.

***simplex* Priesner, 1924**
(Figs 40, 75, 107, 143)

Originally described from Mexico, but recorded from Guatemala (Mound & Marullo 1996), one female of this dark brown thrips has been recorded from Orchidaceae flowers in São Paulo (Monteiro 1999). The fore wings are almost uniformly brown, scarcely paler at the base, and setae S1 on abdominal tergite IX are little more than half of S2 in length. Ocellar setae pair III are rather short, 25–35 microns long, and the pronotum has almost no sculpture medially apart from a weak longitudinal ridge.

***speciosa* Moulton, 1933**

This species is included in the key here based on the statement by Nakahara (1997: 359) that *speciosa* shares with *antennata* Hood from Peru the absence of ocellar setae pair I, whereas this pair of setae is present in all other members of the genus. Unfortunately, *speciosa* is known only from one damaged female, collected in Brazil at Rio de Janeiro, and the possibility that this is merely an aberrant specimen cannot at present be discounted.

***trinidadensis* Hood, 1941**
(Figs 19, 53, 58, 76, 82, 144)

Specimens studied from Trinidad are micropterous with very short wing lobes (Mound & Marullo, 1996), but specimens collected recently in Rio Grande do Sul are apterous. The abdominal tergites of this grass-living species lack the normal pairs of ctenidia, but the species remains known from few individuals.

***tritici* (Fitch, 1855)**
(Fig. 154)

Described in the genus *Thrips*, this is a common insect in northern temperate areas, recorded in Canada, USA and Mexico. It was reported in 1930 from Argentina by Blanchard (according to De Santis *et al.* 1980), but this record needs confirmation. In Brazil *tritici* was recorded on wheat in Rio Grande do Sul (Biezanko *et al.* 1949) but this is possibly a misidentification of some other *Frankliniella* species. However, Lima (2011) recorded several yellow adults of this thrips on many unrelated plants in northeastern Brazil. This species is readily identified by the swollen pedicel of antennal segment III, and the sparse posteromarginal comb on abdominal tergite VIII, which is absent medially with only a few slender teeth laterally.

****varipes* Moulton, 1933**
(Figs 20, 41, 108, 115, 145)
longispinosa* Moulton, 1933: 116 **syn. n.

Described originally from Espírito Santo, this dark brown species is widespread in Brazil, particularly in southern areas. The pronotal aa and am setae are longer than half the pronotum length. The hind tibiae are always bicoloured, but the mid-tibiae are variable, usually extensively yellow or shaded brown medially. The species synonymised here was described by Moulton based in two females that were also collected in Espírito Santo. The holotype of *longispinosa* has been studied, and the rather paler body colour is considered to be due to the individual being teneral and not having achieved the fully mature dark body colour. Small females of *varipes* have antennal segment III scarcely 2.2 times as long as wide, whereas larger females, and all available females of *annulipes*, have this segment 2.5 times as long as wide.

***williamsi* Hood, 1915**
(Figs 21, 42, 86, 146)

This grass-living species is widely distributed in South American countries, and also many States of the USA. It is also known from several Southeast Asian countries, as well as northern Australia. It is usually found breeding at the base of young green leaves of *Zea mays*. Most females have one or two discal setae on abdominal sternite II, but occasionally these are not developed.

****zucchini* Nakahara & Monteiro, 1999**
(Figs 54, 147)

This species was distinguished from *gemina* and *rodeos* because of the lack of postocular setal pair I, and a slight difference in position of ocellar setal pair III. Nakahara and Monteiro (1999) also referred to the presence of one longer pair of lateral submarginal setae on the pronotum as a diagnostic character of *zucchini*. However, examination of further specimens has suggested that these characters states are not entirely stable, and the significance of these cryptic yellow species remains unclear.

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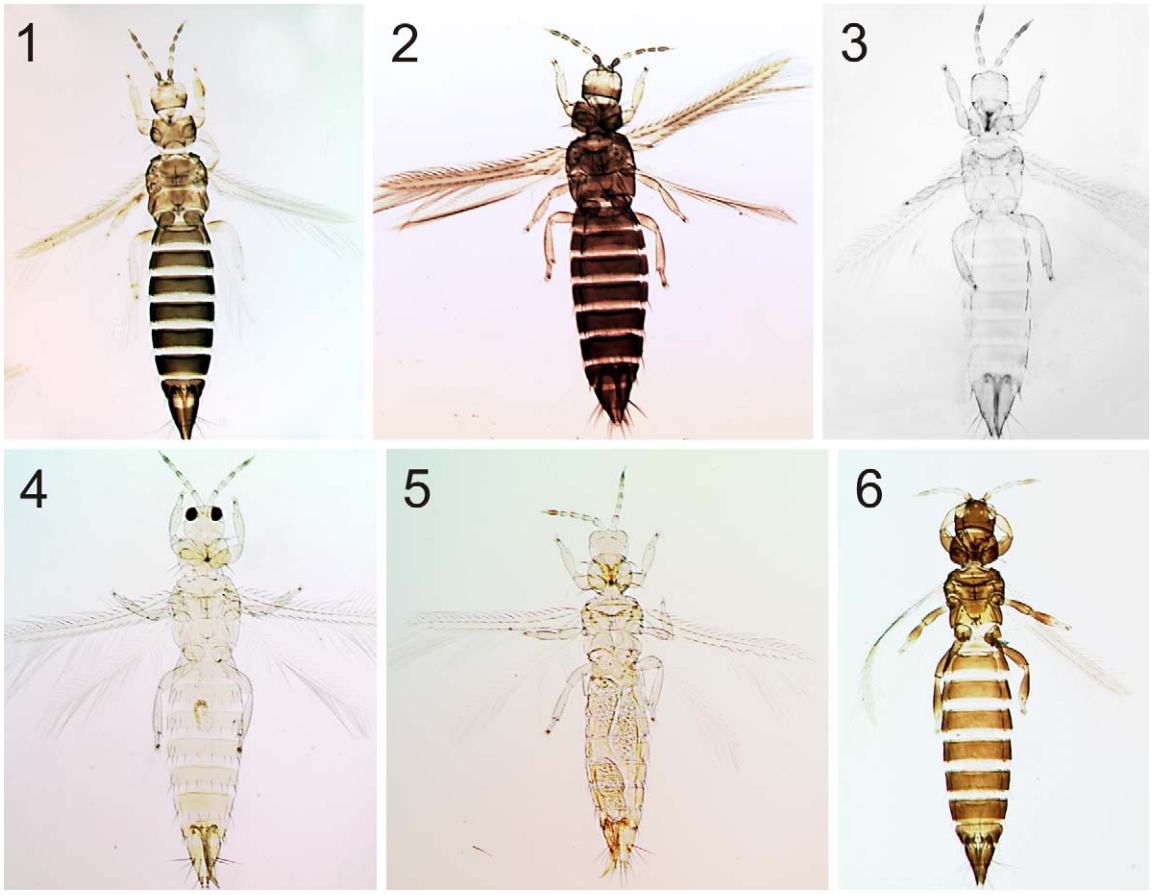
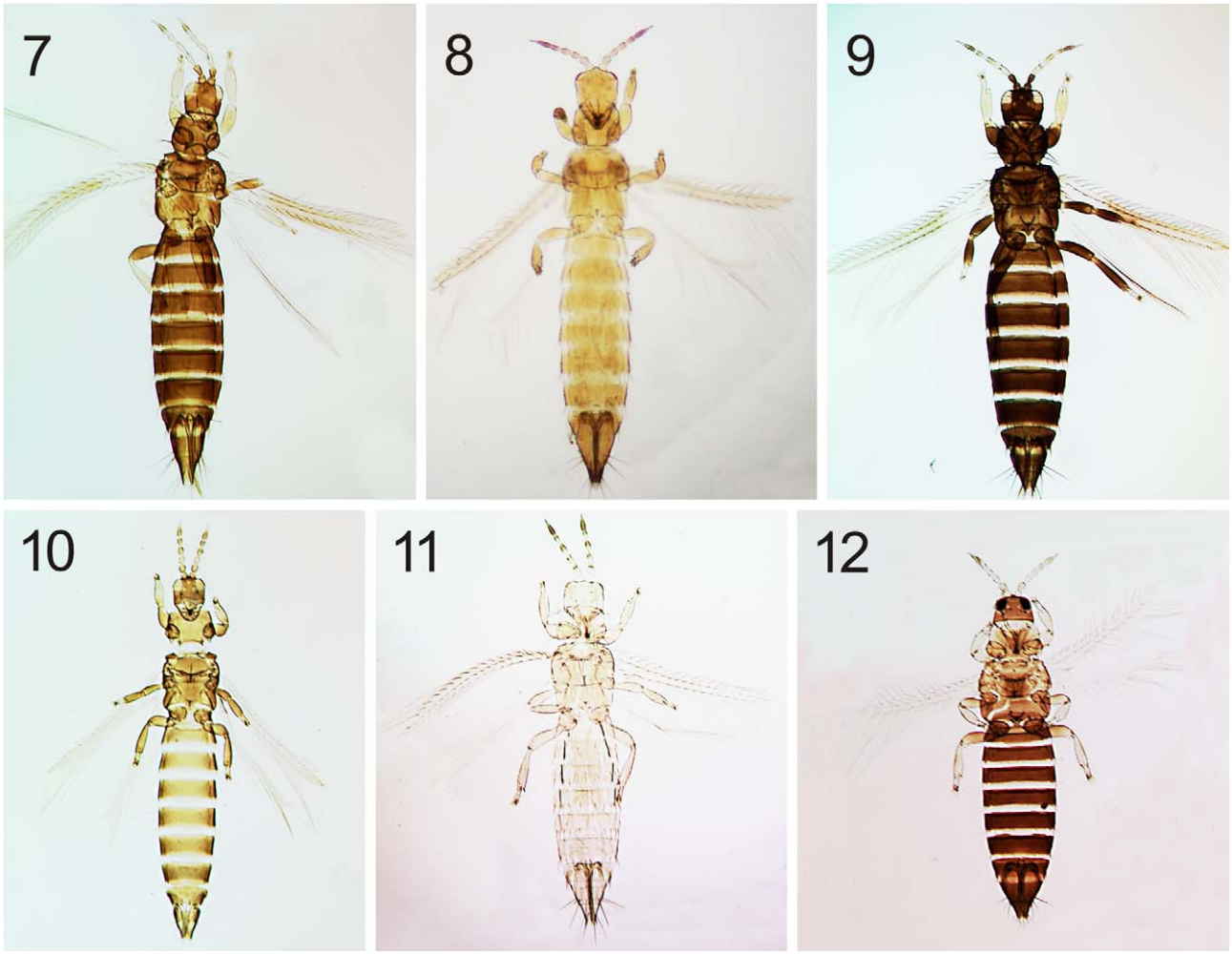
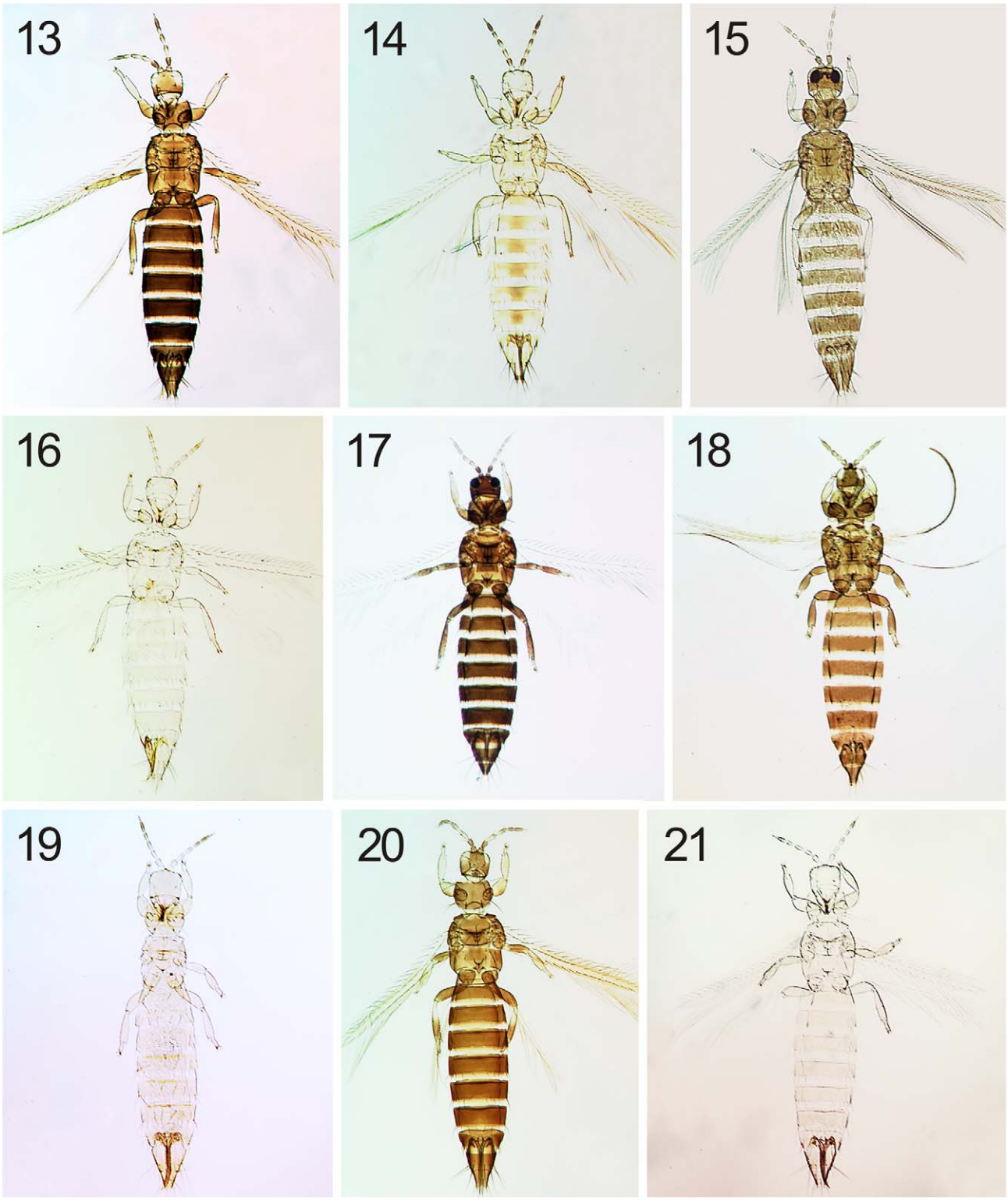


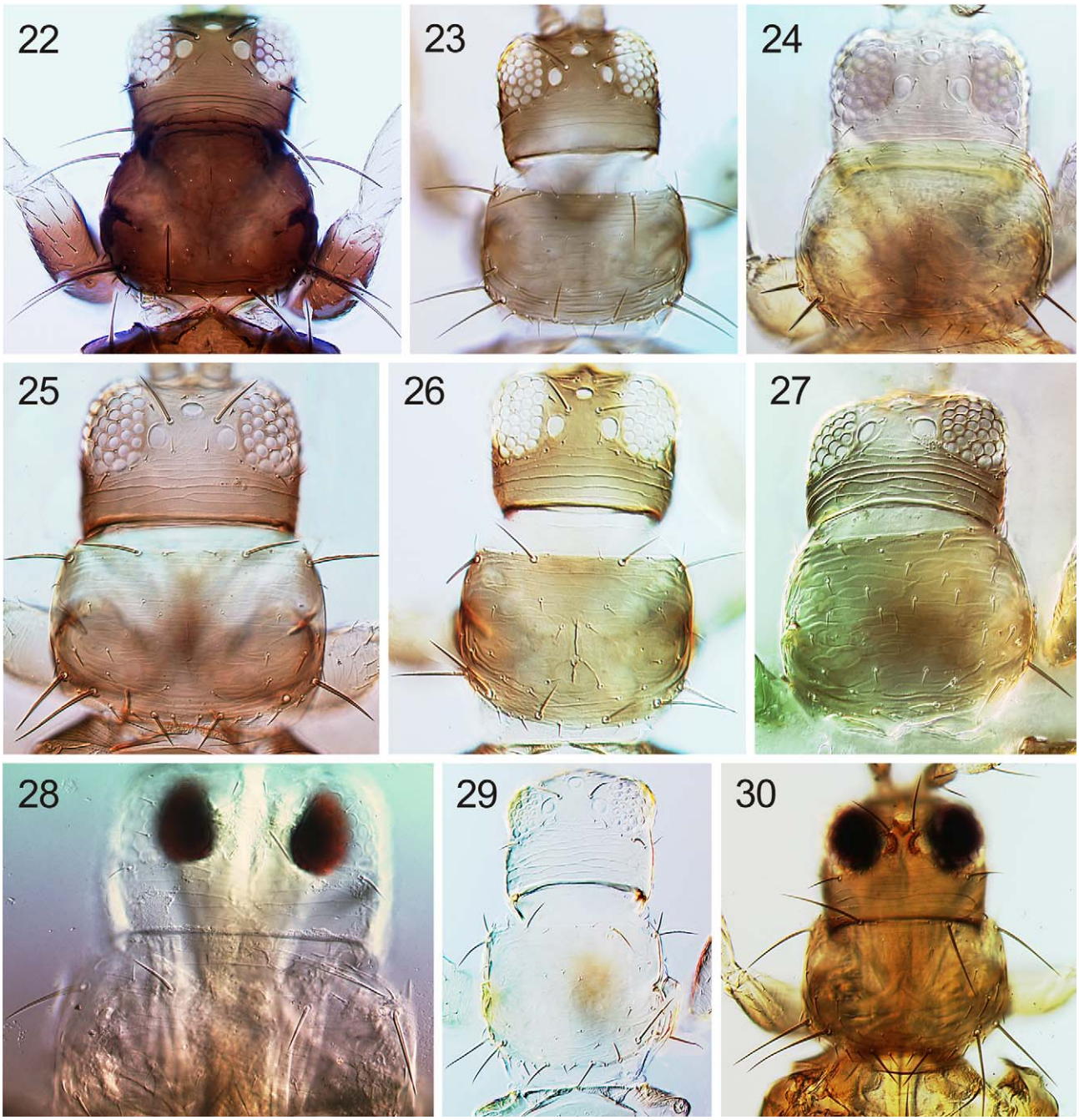
FIGURES 1–6. Females of *Frankliniella* spp. **(1)** *F. brevicaulis*; **(2)** *F. caseariae*; **(3)** *F. frumenti*; **(4)** *F. gardeniae*; **(5)** *F. gemina*; **(6)** *F. hemerocallis*.



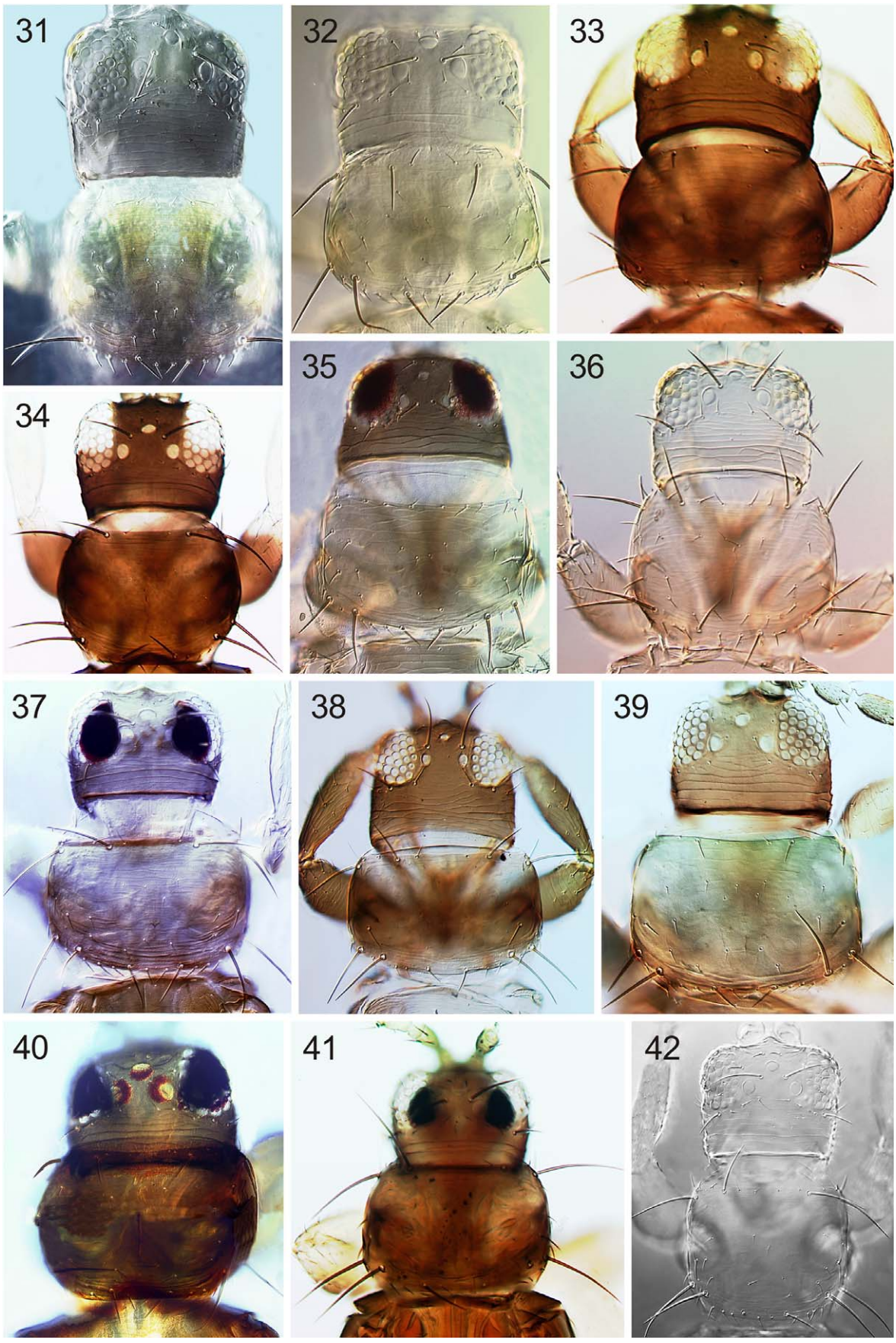
FIGURES 7–12. Females of *Frankliniella* spp. **(7)** *F. fulvipes*; **(8)** *F. graminis* **sp.n.**; **(9)** *F. insularis*; **(10)** *F. minuta*; **(11)** *F. musaeperda*; **(12)** *F. nakaharai*.



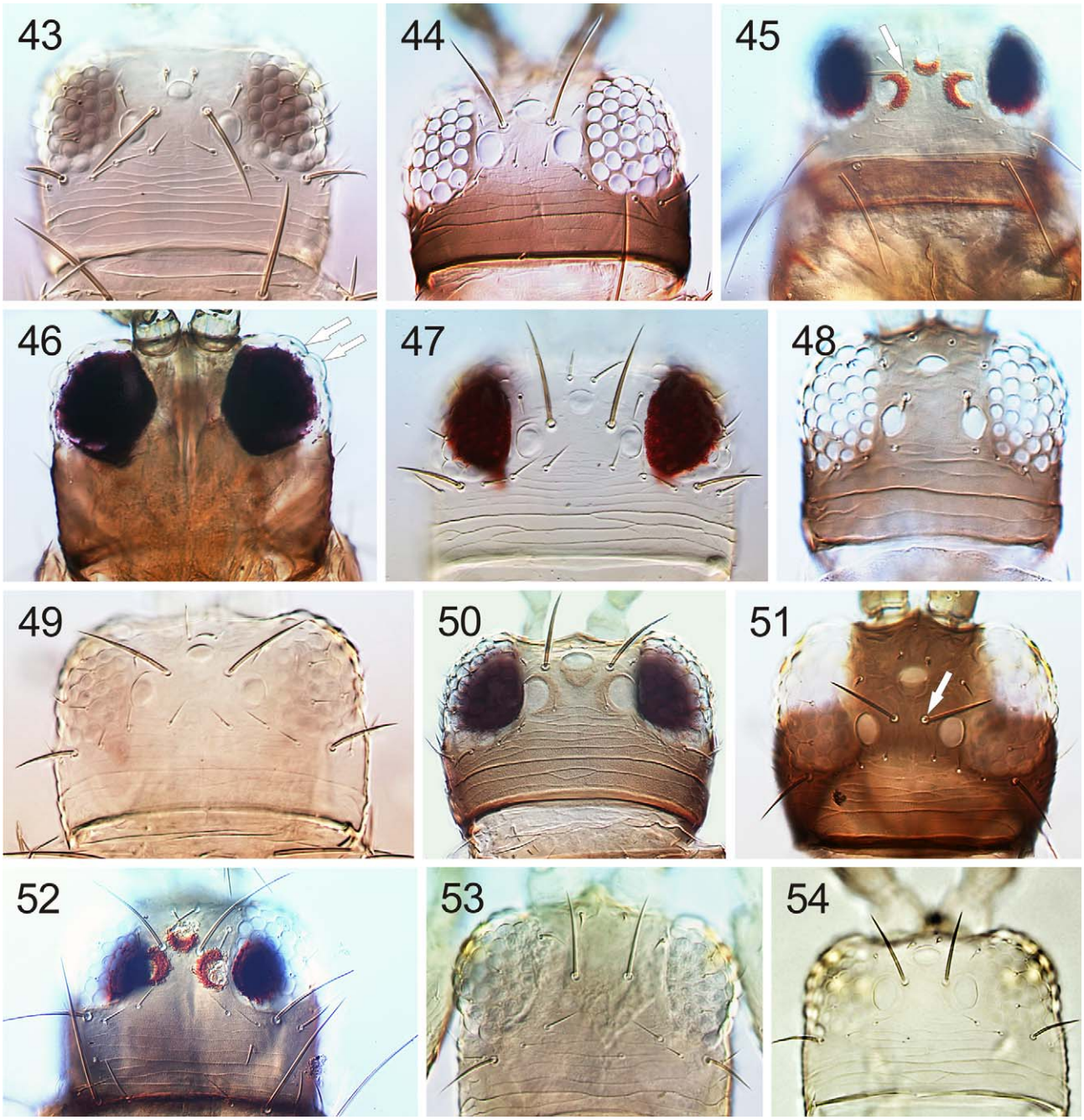
FIGURES 13–21. Females of *Frankliniella* spp. **(13)** *F. occidentalis* (dark form); **(14)** *F. occidentalis* (bicoloured form); **(15)** *F. parvula*; **(16)** *F. schultzei* (yellow form); **(17)** *F. schultzei* (dark form); **(18)** *F. serrata*; **(19)** *F. trinidadensis*; **(20)** *F. varipes*; **(21)** *F. williamsi*.



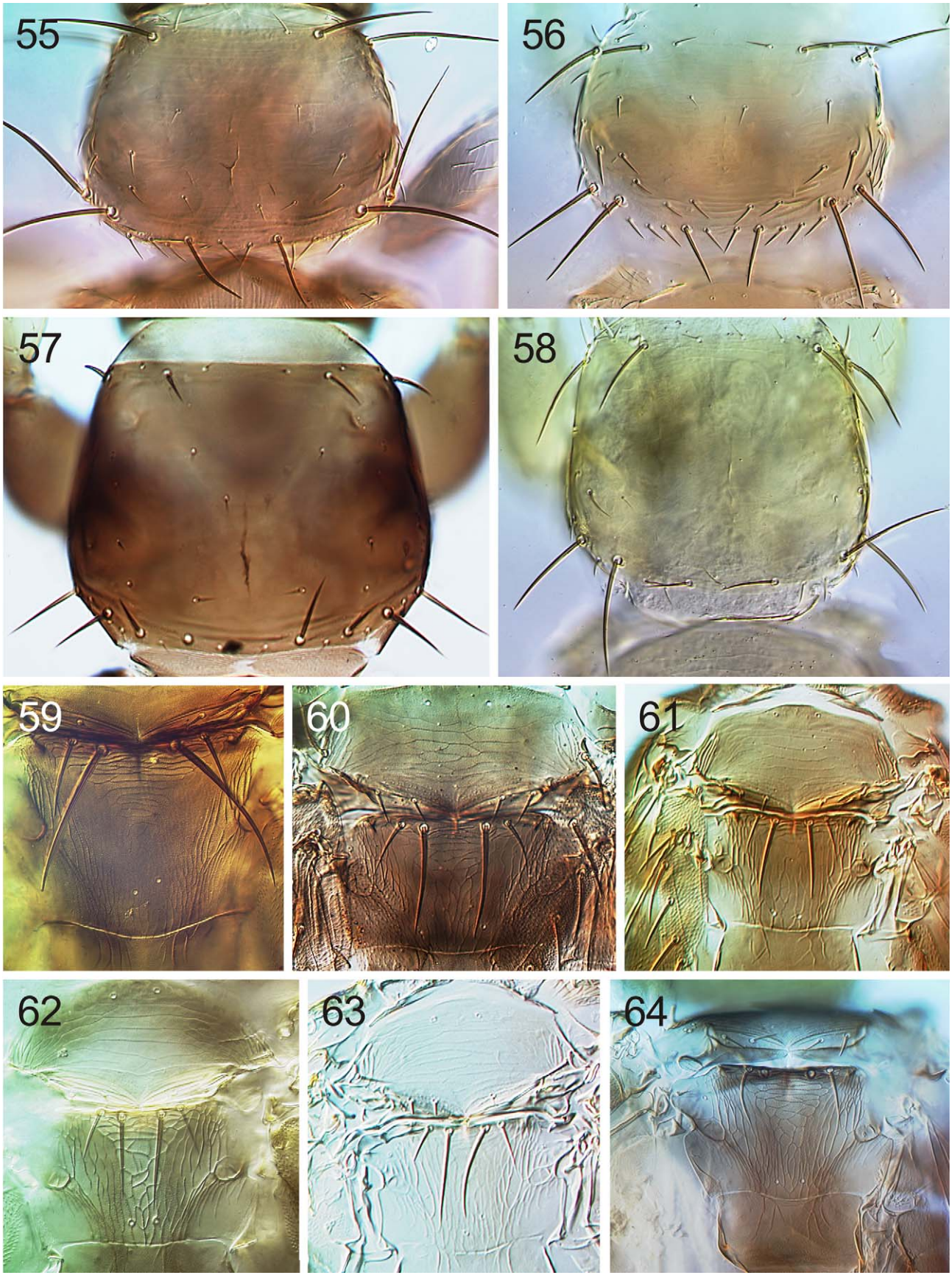
FIGURES 22–30. Head and pronotum of *Frankliniella* spp. **(22)** *F. annulipes*; **(23)** *F. australis*; **(24)** *F. bertelsi*; **(25)** *F. brevicaulis*; **(26)** *F. brunnea*; **(27)** *F. curta*; **(28)** *F. distinguenda*; **(29)** *F. frumenti*; **(30)** *F. fulvipennis.*



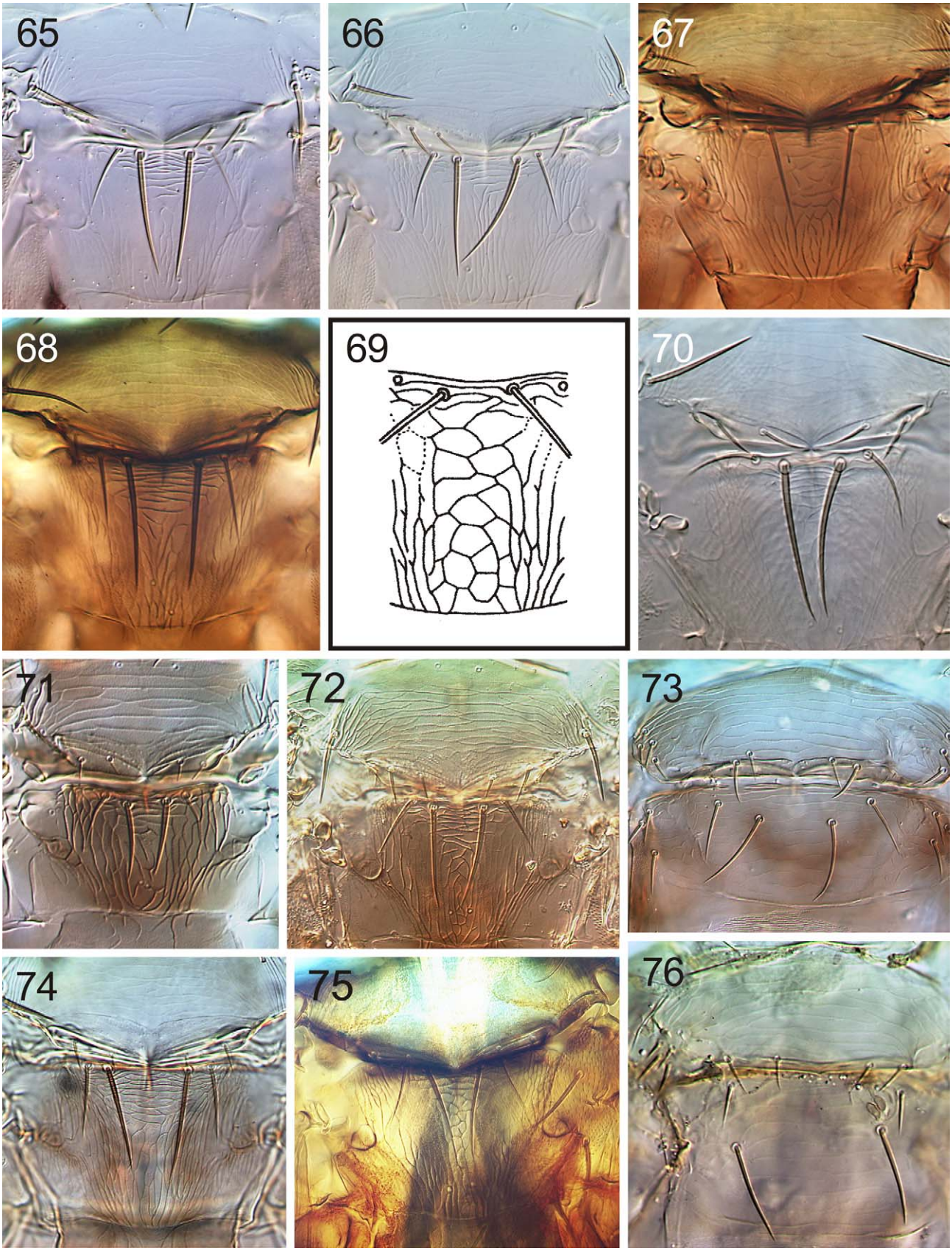
FIGURES 31–42. Head and pronotum of *Frankliniella* spp. **(31)** *F. graminis* **sp.n.**; **(32)** *F. gemina*; **(33)** *F. hemerocallis*; **(34)** *F. insularis*; **(35)** *F. nakaharai*; **(36)** *F. occidentalis*; **(37)** *F. peruviana*; **(38)** *F. platensis*; **(39)** *F. serrata*; **(40)** *F. simplex*; **(41)** *F. varipes*; **(42)** *F. williamsi*.



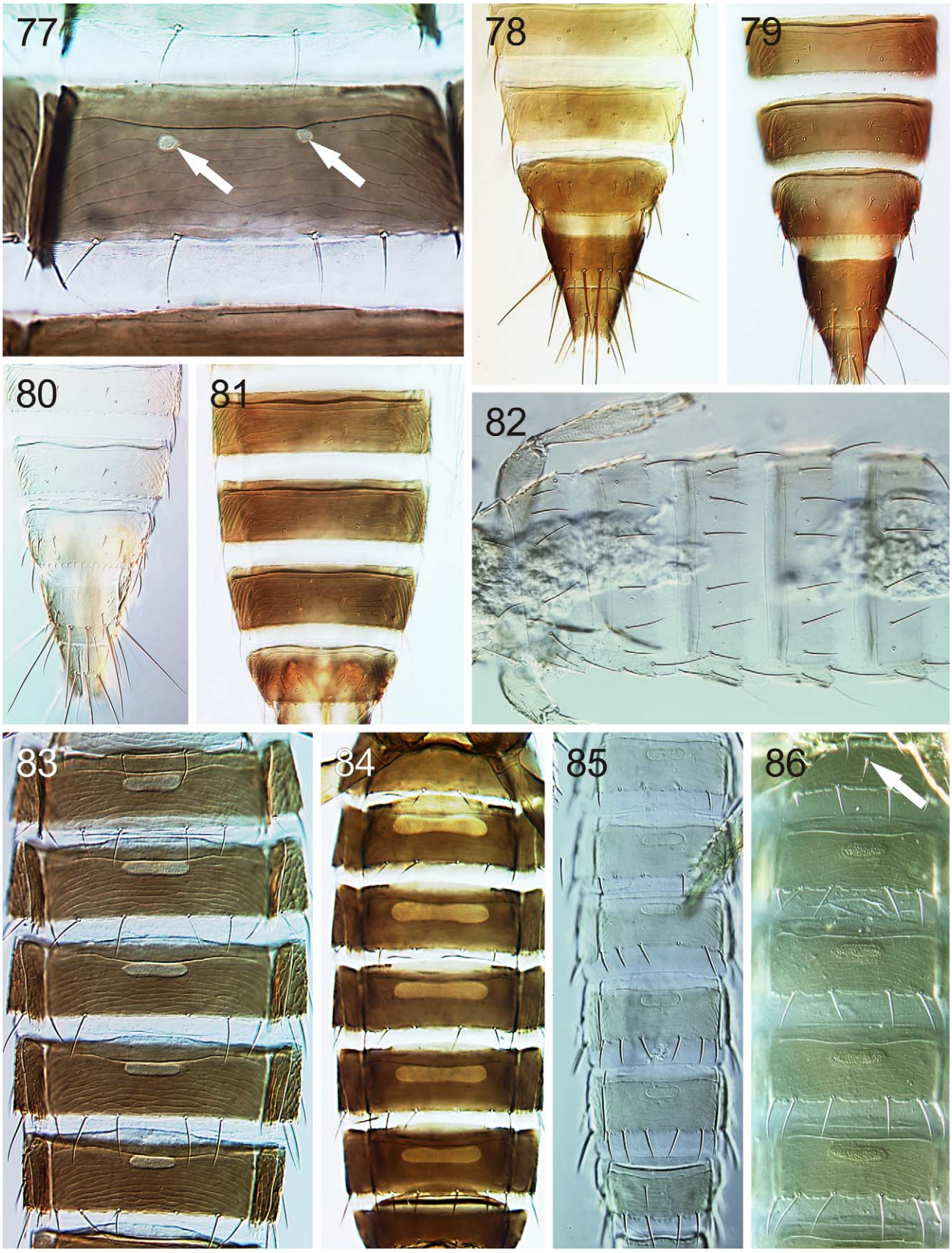
FIGURES 43–54. Head of *Frankliniella* spp. **(43)** *F. bicolor*; **(44)** *F. caseariae*; **(45)** *F. fulvipes* (arrow indicates the ocellar setae pair III position); **(46)** *F. fulvipennis* (arrows indicate enlarged ommatidia); **(47)** *F. gardeniae*; **(48)** *F. minuta*; **(49)** *F. musaeperda*; **(50)** *F. parvula*; **(51)** *F. schultzei* (arrow indicates the ocellar setae pair III position); **(52)** *F. setipes*; **(53)** *F. trinidadensis*; **(54)** *F. zucchini*.



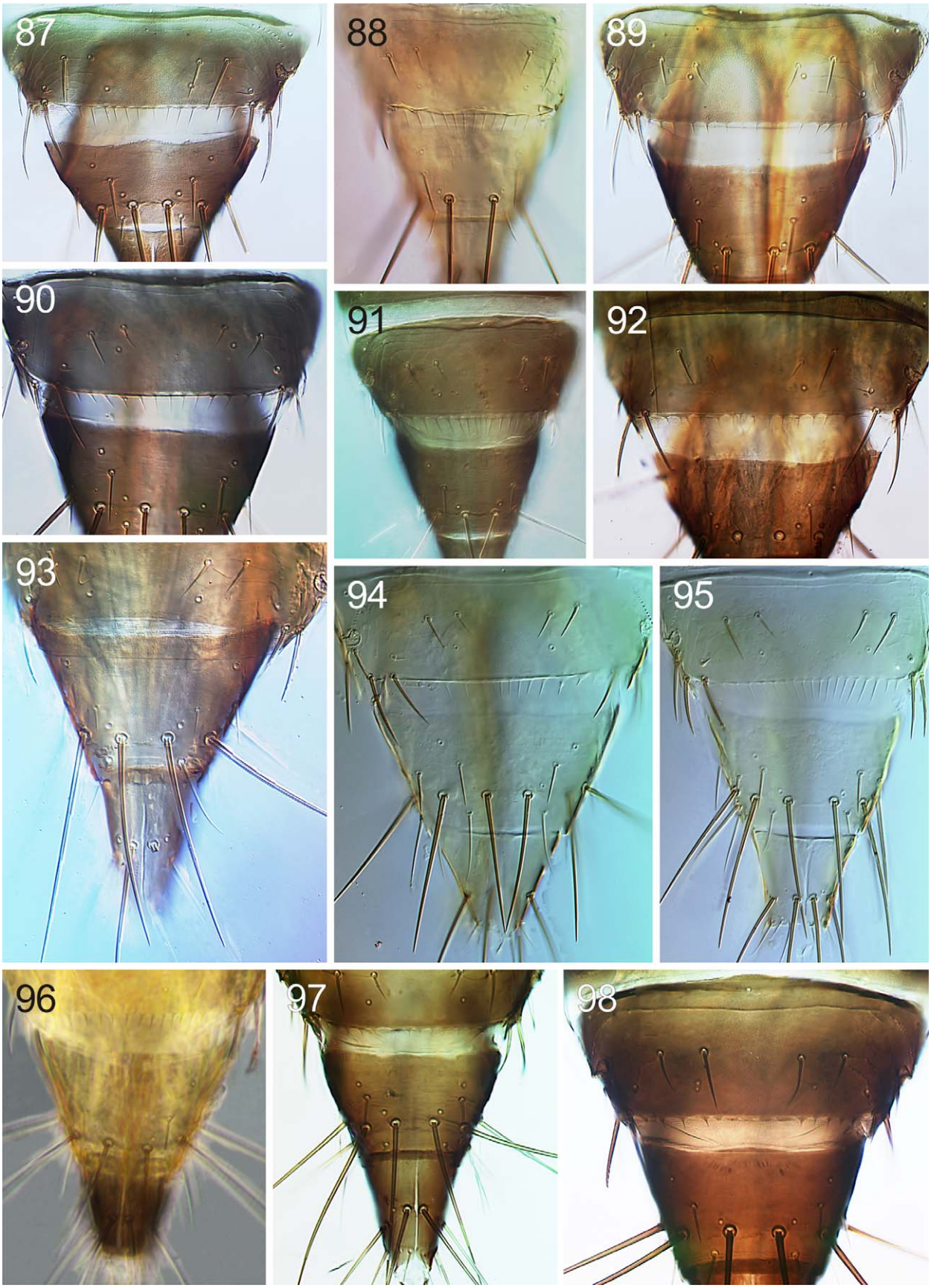
FIGURES 55–64. *Frankliniella* spp. Pronotum 55–58: **(55)** *F. caseariae*; **(56)** *F. gardeniae*; **(57)** *F. minuta*; **(58)** *F. trinidadensis*; meso & metanotum 59–64: **(59)** *F. annulipes*; **(60)** *F. brevicaulis*; **(61)** *F. brunnea*; **(62)** *F. curta*; **(63)** *F. frumenti*; **(64)** *F. fulvipes*.



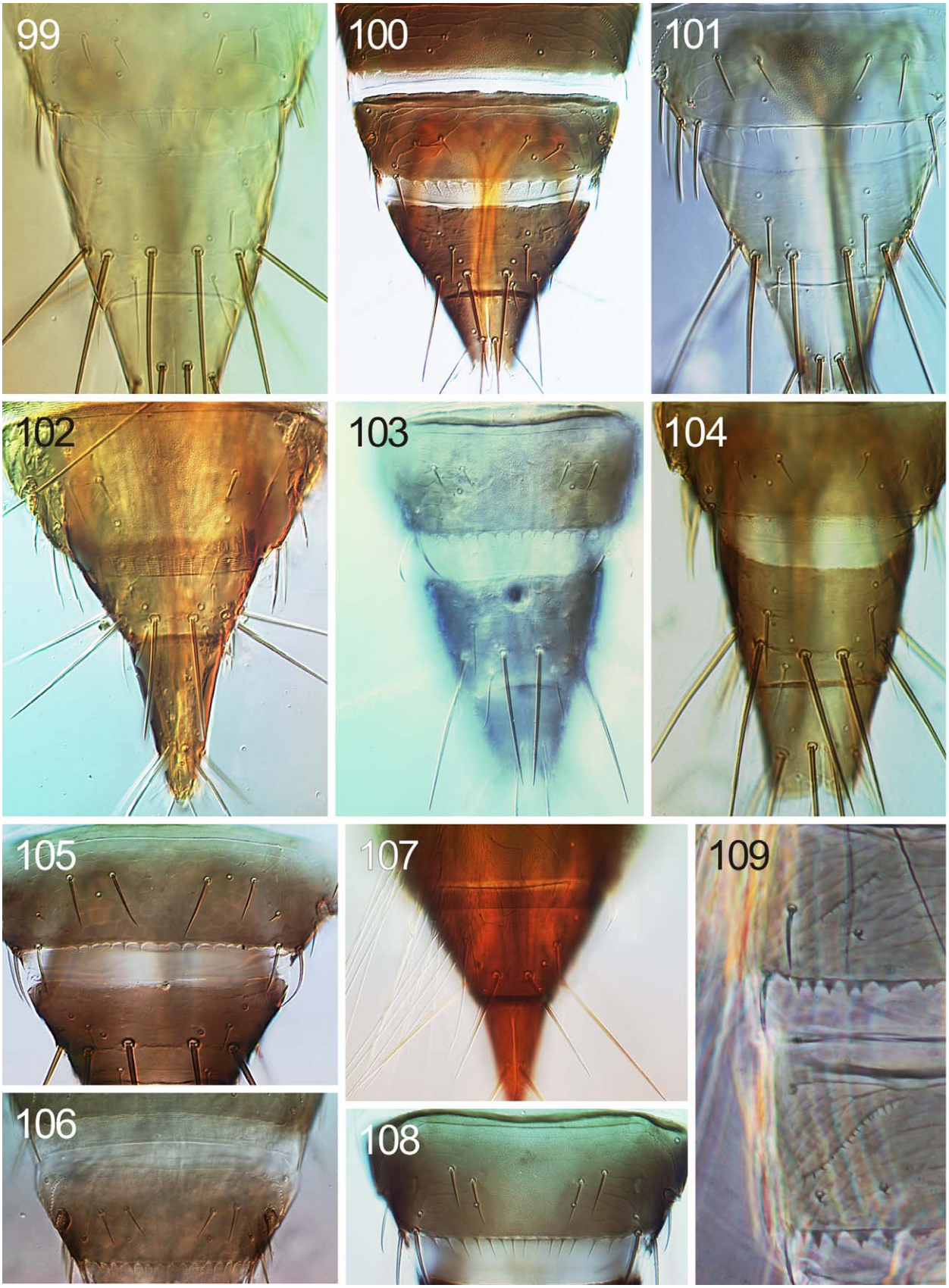
FIGURES 65–76. Meso & metanotum of *Frankliniella* spp. **(65)** *F. gardeniae*; **(66)** *F. gemina*; **(67)** *F. hemerocallis*; **(68)** *F. insularis*; **(69)** *F. konoi*; **(70)** *F. musaeperda*; **(71)** *F. nakaharai*; **(72)** *F. occidentalis*; **(73)** *F. platensis*; **(74)** *F. schultzei*; **(75)** *F. simplex*; **(76)** *F. trinidadensis*.



FIGURES 77–86. Abdomen of *Frankliniella* spp. **(77)** female sternite II of *F. australis* (arrows indicate pore plates); female abdominal tergites 78–82: **(78)** *F. bicolor*; **(79)** *F. brunnea*; **(80)** *F. frumenti*; **(81)** *F. occidentalis*; **(82)** *F. trinidadensis*; male abdominal sternites 83–86: **(83)** *F. australis*; **(84)** *F. insularis*; **(85)** *F. occidentalis*; **(86)** *F. williamsi* (arrow indicates discal setae on sternite II).

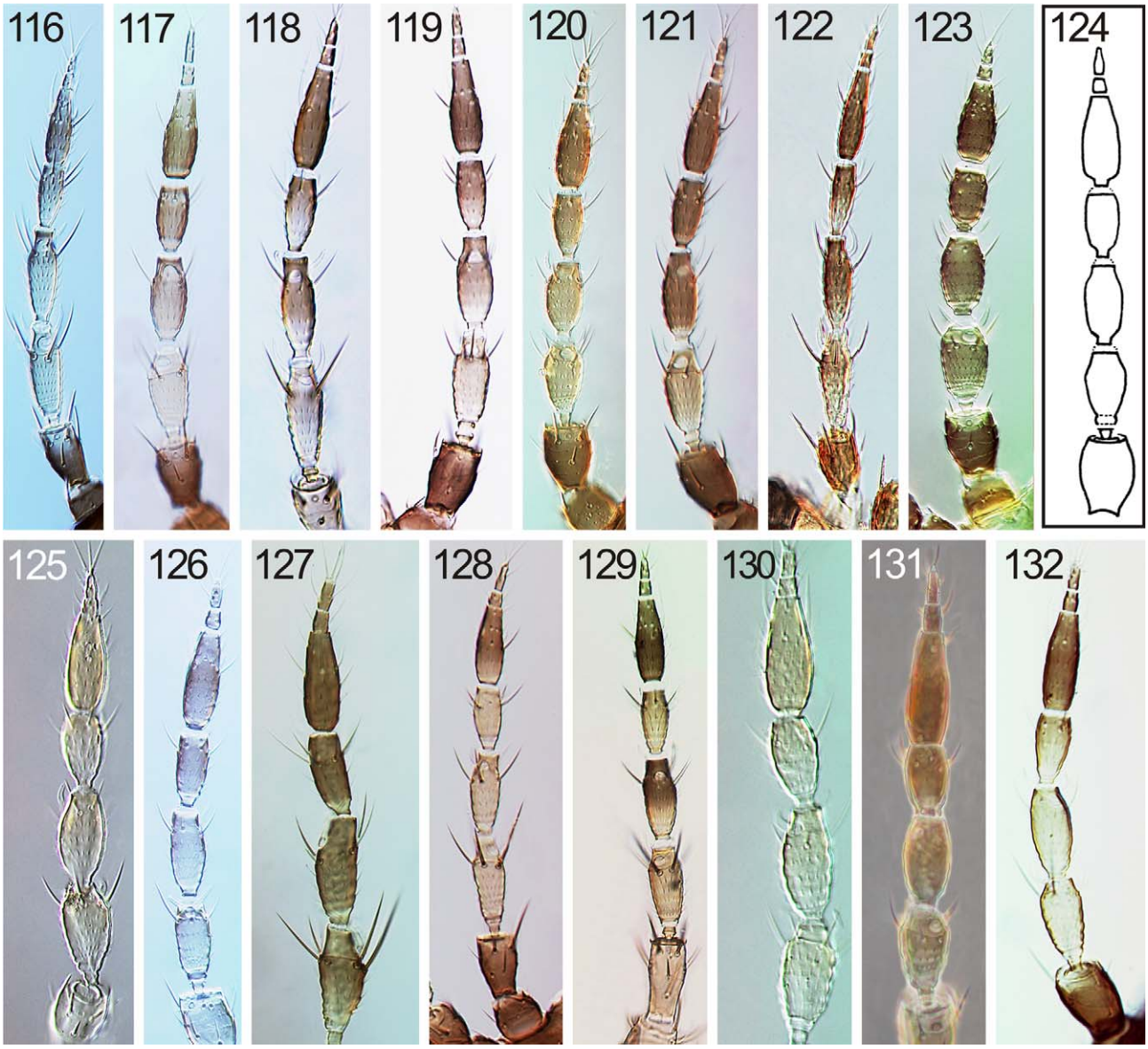


FIGURES 87–98. Abdominal tergites of *Frankliniella* spp. **(87)** *F. australis*; **(88)** *F. bertelsi*; **(89)** *F. brevicaulis*; **(90)** *F. caseariae*; **(91)** *F. curta*; **(92)** *F. fulvipennis*; **(93)** *F. fulvipes*; **(94)** *F. gardeniae*; **(95)** *F. gemina*; **(96)** *F. graminis* **sp.n.**; **(97)** *F. hemerocallis*; **(98)** *F. insularis*.

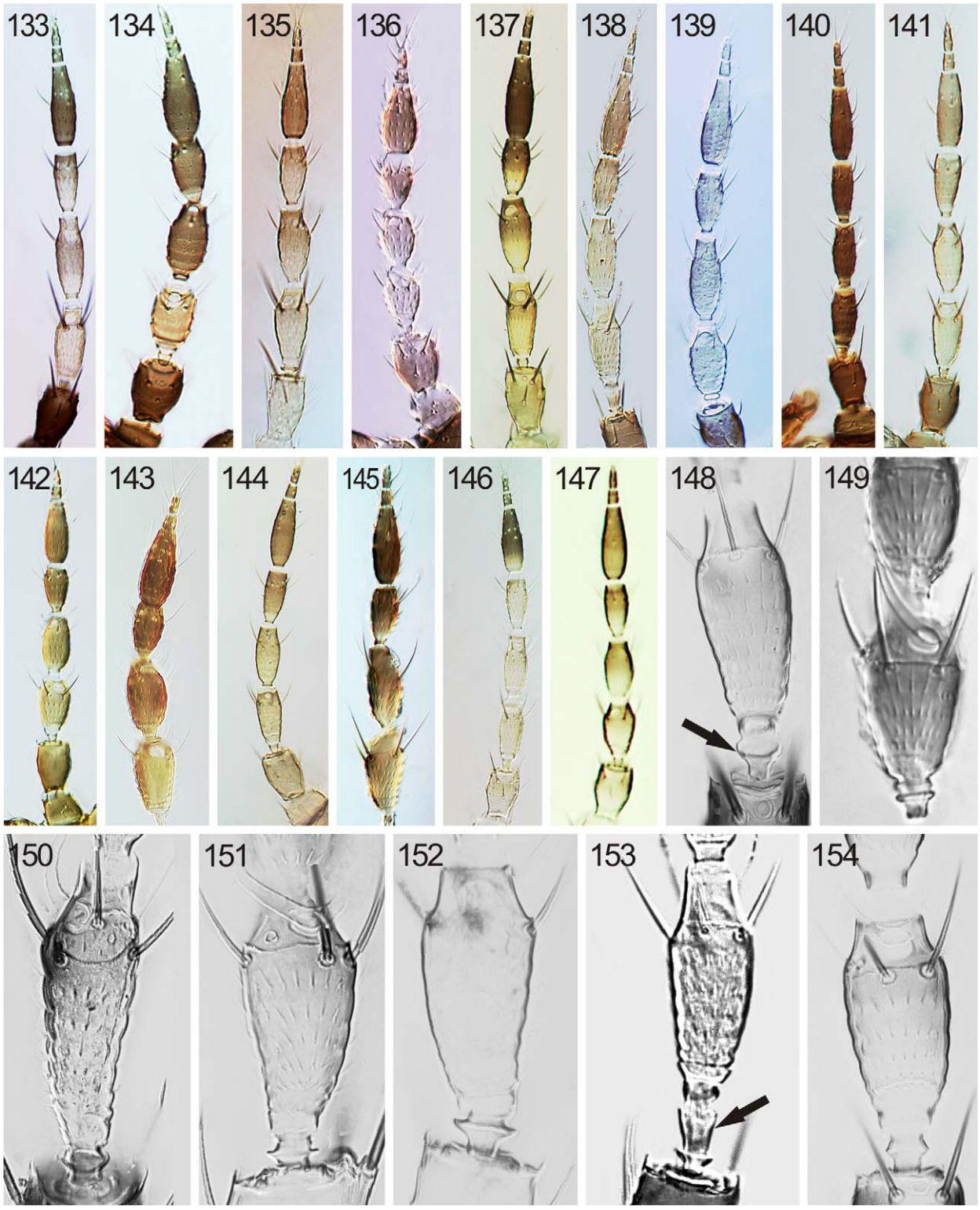


FIGURES 99–109. Abdominal tergites of *Frankliniella* spp. **(99)** *F. musaeperda*; **(100)** *F. nakaharai*; **(101)** *F. occidentalis*; **(102)** *F. oxyura*; **(103)** *F. peruviana*; **(104)** *F. schultzei*; **(105)** *F. platensis*; **(106)** *F. serrata*; **(107)** *F. simplex*; **(108)** *F. varipes*; **(109)** *F. graminis* **sp.n. (**lateral view of tergites IV–V).

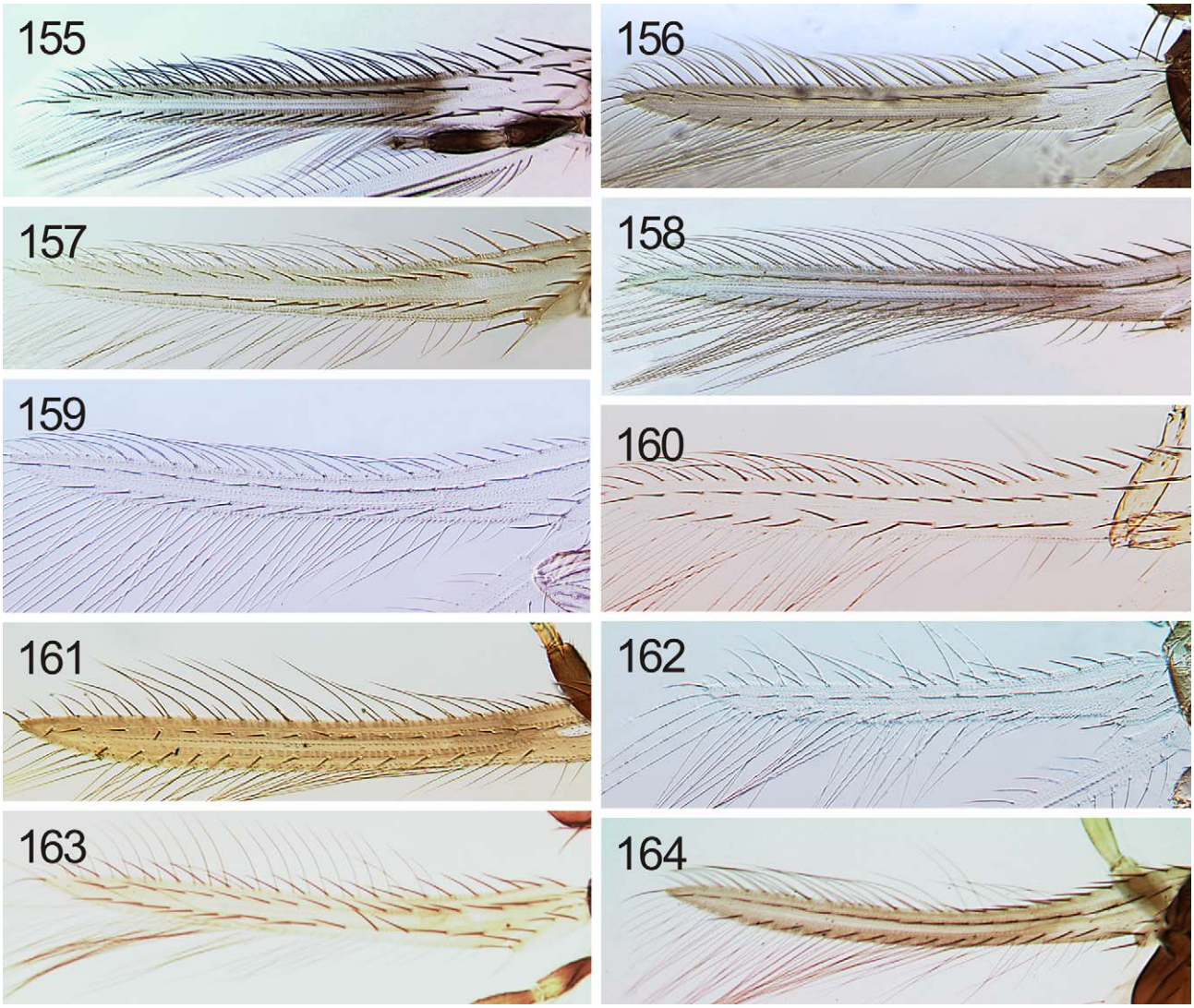
FIGURES 110–115. Legs of *Frankliniella* spp. mid leg 110–111: **(110)** *F. annulipes*; **(111)** *F. fulvipes*; hind leg 112–115: **(112)** *F. annulipes*; **(113)** *F. fulvipes*; **(114)** *F. insularis*; **(115)** *F. varipes*.



FIGURES 116–132. Antenna of *Frankliniella* spp. **(116)** *F. annulipes*; **(117)** *F. australis*; **(118)** *F. bicolor*; **(119)** *F. brevicaulis*; **(120)** *F. brunnea*; **(121)** *F. caseariae*; **(122)** *F. condei*; **(123)** *F. curta*; **(124)** *F. desantisi*; **(125)** *F. distinguenda*; **(126)** *F. frumenti*; **(127)** *F. fulvipennis*; **(128)** *F. fulvipes*; **(129)** *F. gardeniae*; **(130)** *F. gemina*; **(131)** *F. graminis* **sp.n.**; **(132)** *F. hemerocallis*.



FIGURES 133–154. Antenna of *Frankliniella* spp. **(133)** *F. insularis*; **(134)** *F. minuta*; **(135)** *F. musaeperda*; **(136)** *F. nakaharai*; **(137)** *F. occidentalis*; **(138)** *F. parvula*; **(139)** *F. peruviana*; **(140)** *F. platensis*; **(141)** *F. schultzei*; **(142)** *F. serrata*; **(143)** *F. simplex*; **(144)** *F. trinidadensis*; **(145)** *F. varipes*; **(146)** *F. williamsi*; **(147)** *F. zucchini*; antennal segment III (arrow indicate pedicel) 148–154: **(148)** F. *brevicaulis* (arrow indicates the cup-shaped pedicel); **(149)** *F. caseariae*; **(150)** *F. condei*; **(151)** *F. gardeniae*; **(152)** *F. musaeperda*; **(153)** *F. parvula* (arrow indicates the elongated pedicel); **(154)** *F. tritici*.



FIGURES 155–164. Fore wings of *Frankliniella* spp. **(155)** *F. annulipes*; **(156)** *F. australis*; **(157)** *F. brevicaulis*; **(158)** *F. caseariae*; **(159)** *F. fuscicornis*; **(160)** *F. gemina*; **(161)** *F. minuta*; **(162)** *F. nakaharai*; **(163)** *F. occidentalis*; **(164)** *F. peruviana*.